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Fifth Semester First Degree Programme (CBCSS)
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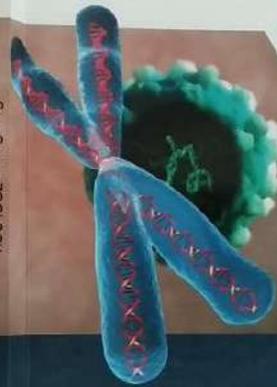


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Genetics and Biotechnology
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Alternate Energy Sources involves all those things that do not consume fossil fuel. They are widely available and environment friendly. They cause little or almost no pollution. There have been several alternative energy projects running round the globe to reduce our dependency on traditional fossil fuels. There are many impressive options that we can take into consideration. Here in the reader will learn more about nonconventional energy sources that one can take into consideration.



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DR. VINOY THOMAS

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Humour

Texts, Contexts



Editors

P.P.Ajayakumar, Lal C.A
Kalyani Vallath, Babitha Justin, Sanchita J
Chitra V.R

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Transgressing Patriarchal Codes: Humour in Arundhati Roy's *The God of Small Things*

SHALINI RACHEL VARGHESE

Laughter, its meaning and propriety have continuously occupied the mind of philosophers, moralists and dramatists since antiquity. Moving up in history, in a more modern context, laughter is typically associated with humour and joy and yet, not all laughter is the fruit of humour and even less so, that of joy. On the contrary, it may be noted that in a long historical tradition, laughter has been associated with ridicule, degradation and the vulgarity of the lower classes. The object of ridicule, in addition to the 'follies' of the lower classes has often been that of the woman. Jokes, puns and anecdotes from the earliest historical moments of urbanisation have posited women as entities of ridicule. A great deal of English literary humour emanates from satirising female ignorance, habits, speech, ideas of beauty and dressing and parental and marital relationship, the instance of Sheridan's Mrs. Malaprop being the quintessential example and source of laughter in the age of Restoration. As a portrayal of ludicrousness, Mrs. Malaprop has been immortalized, not only as a word in the language but as a commemoration of female stereotypes in the

*Dessin Humoristique: Cartoons beyond the
Column*

Edited by

Gem Cherian

Neethu Mary Tomy

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PROCEEDINGS



In Tintumon jokes, we see him lamenting the plight of his poor father who married just once and 'suffers' for it. This is partly due to the financial dependence of women upon their husbands in the domestic sphere. Often, women are either not educated or even if they are educated, they are not allowed to go to work, thanks to the existing stereotypes about financially independent women. Thus, in cartoons produced in both the 1970s and the 2000s, women remain as ridiculous burdens for the male figures in the house.

Thus, "Bobanum Mollyum" and Tintumon jokes are exemplary texts where the domestic sphere becomes the laughter-inducing factor. The multifarious aspects of the Kerala domestic sphere get unveiled here and the tracing of an alternate history of Kerala in the postcolonial era, becomes possible through a study of the supposedly 'trivial' language of humour.

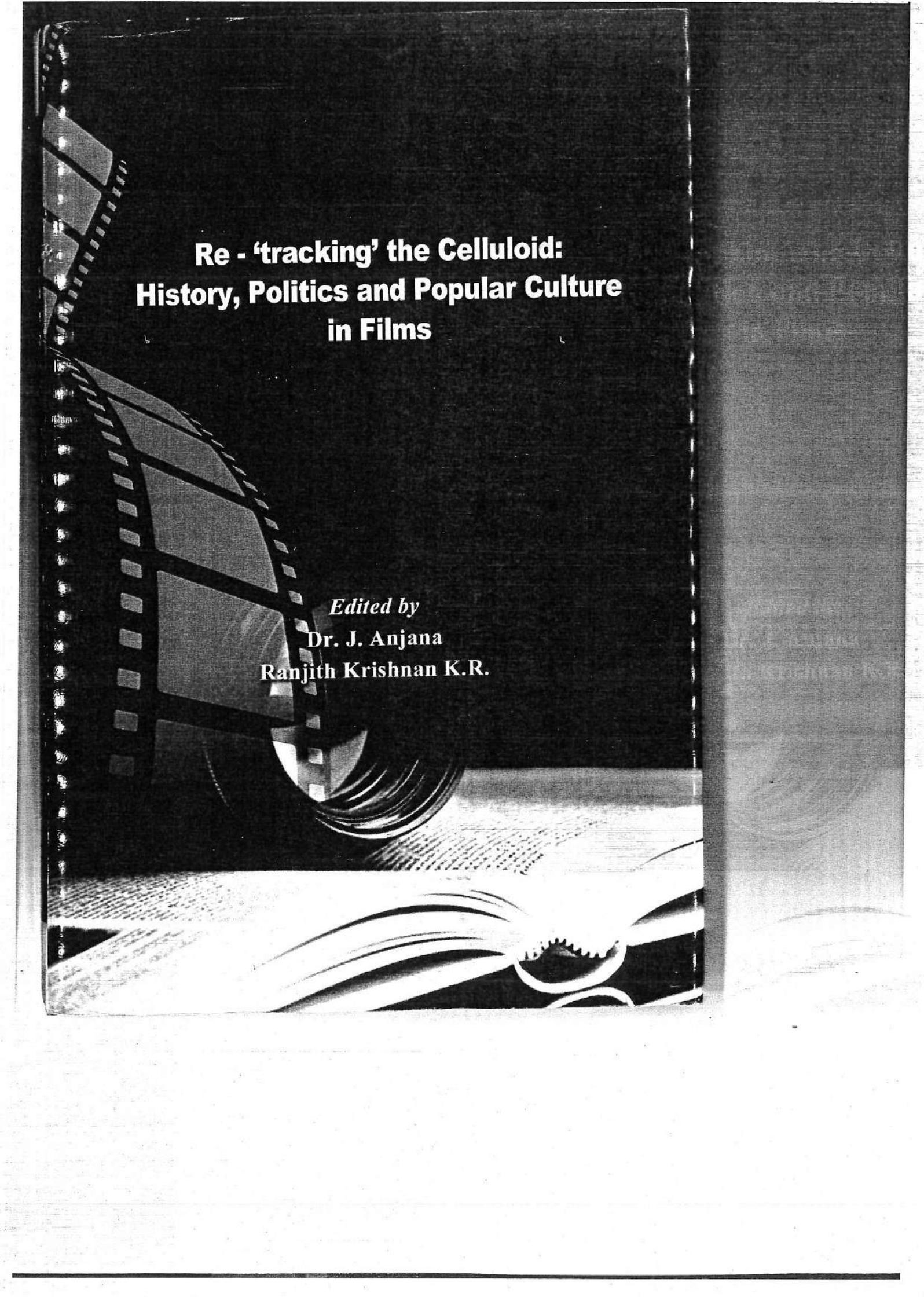
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"Humouratix": The Creation of 'New' Narratives of Reality: An Analysis of Select Asterix Comics

ANEJ SOMARAJ

The paper attempts to analyse a fascinating aspect of Asterix comics, created by Rene Goscinny (the writer) and Albert Uderzo (the illustrator). Starting with the premise that comics as artefacts of popular culture, the paper seeks to examine how Asterix comics manage to 'subvert' paradigms. The attempt is to problematise the issue of how comics as artefacts of popular culture can be seen as cartographers' attempt to map the changing/unchanging nature of that society and in this respect, the society's growth/decay is largely mediated by the role of politics, economics, customs, science and technology and other factors of human discourse. This modest attempt, which is more in the nature of ruminate musings, is on a set of comics that narrate the Asterixian saga of the Gallo-Roman world. What defends this proposition is the way in which literature becomes a chronicle of how various seemingly mundane aspects of human discourse like technology affects and effects change. The singular striking aspect of change is its pervasive extent in society which are all mirrored through the cast of characters, as



**Re - 'tracking' the Celluloid:
History, Politics and Popular Culture
in Films**

Edited by
Dr. J. Anjana
Ranjith Krishnan K.R.

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Subversive Dismantling of Patriarchal Structures in *Ratatouille*

A c
Filr

Jolly Alex

Ratatouille is an ode to an outsider, to an alienated, marginalized creature yearning for recognition and acceptance; deciphering the struggles of an artist who literally rises from a sewer. This movie is a plea for artistic liberty, which when curbed or strangulated, leads to a dismantling of the restrictive patriarchal structures, decentering of power equations and certain major ideological shifts. Remy, the protagonist, struggles indefatigably against the prejudice of the extant power structures—daring to swim against the tide, all the while challenging stereotypical social structures. The movie on a whole is a subversive collage consisting of Remy, the country rat who dreams of being a chef, Linguini the illegitimate son of a chef yearning for acceptance, Collete, the female chef who dared to storm the male bastion and Anton Ego, a notorious food critic, a representative of the arrogant English archetypes. The movie thus celebrates the passionate, aggressive and relentless pursuit of excellence overcoming the moral tug of war between family obligation and individual ambition, submission and subversion, conforming and upsetting the apple cart. This study aims to show how animation movies like *Ratatouille* caricature the society and offer the harshest social commentary on contemporary society.

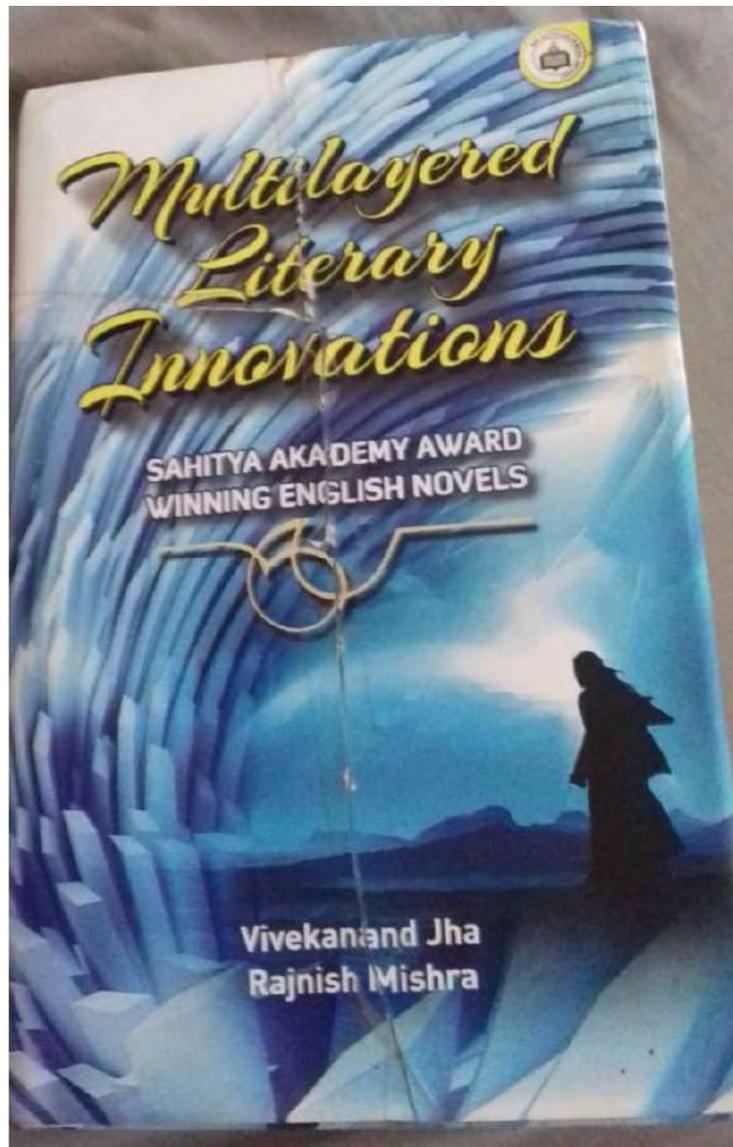
The hero Remy is garbage-scavenging rat, not by a choice of his own but because of his nativity, for unlike his family members he is blessed with an astute sense of taste and smell. Hence he loathes these garbage-hunting missions and when he broaches this subject with his father who also happens to be the leader of the rat gang, Django's no nonsense reply is, "Food is fuel. You get picky about what you put in the tank, your engine gonna die. Now shut up and eat your garbage". His father repeatedly warns him to avoid the kitchen and of the humans, the two things he cannot do away with. He does confess, "I know I'm supposed to hate the humans, but there is something about them. They don't just survive. They discover, they create....Good food is like music, you can taste, colour, you can smell it".

*Jolly Alex, Assistant Professor,
Department of English, Christian College, Chengannur*

His dad, the patriot
poison-detector for the g
him. In his essay "Invis
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the ideology that subver
process of socialization i
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a potential for contradictio
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albeit a handful who beg to c



13

*Political Struggle and Communal Violence:
The Shadow Lines as a Partition Novel*

Nirmala Varghese

Literature is not a disinterested bystander and writing on the partition, whether the partition is a focal point or appears as a side issue suggests the ideological make up of the writer and his / her milieu. What is the image of the partition that emerges from novels? The most obvious is that of violence and horror. The Literature that engages the history of decolonisation, partition and independence in India marked by ethnic difference is the literal and symbolic site of national violence. This literature as a part of postcolonial public spheres that become increasingly transnational, articulates a critique of nationalism through the representation of violence. There are a number of novels by South Asian and British writers on the theme of partition, a blatant reality in the global history. Partition was the most traumatic experience of division of hearts and communities. It was partition only that became the cause of the biggest bloodshed and brutal holocaust in annals of mankind.

Amitav Ghosh's writing deals with the epic themes of travel and diaspora, history and memory, political struggle and communal violence, love and loss, while all the time crossing the generic boundaries between anthropology and artwork. The Shadow Lines is a novel that lays strong emphasis on the history



Dr. Vivekanand Jha is a translator, editor and award-winning poet from India. He has a Diploma in Electronics and Communication Engineering, Certificate in Computer Hardware and Networking, MA and PhD in English. He is a contributing poet to *WaveLengths - 2011 Invariant Anthology of Poetry (USA)* which has won first place in the 2011 London Book Festival. He has been Poetry Contest Winner - Third Place Winner - for the poem "Hounds Heave to Horn and Hamper" conducted by *RegisterUK*, a documentary, graphic, translation book series (USA). His poem, "Song of Wines" was featured in the 10 Selected Poems for Performance & 10 Selected Poems for Award in 2nd Korea-Nigeria Poetry Fest on 21 March 2012 organized by the Korean Cultural Centre Nigeria. He is the author of five books of poetry. He has also authored a critical book on the poetry of Jayanta Mahapatra and edited six critical anthologies on Indian English Writing. His poems have been published in numerous magazines and 20 poetry anthologies around the world. He has more than 25 research and critical articles published in various national and international anthologies and refereed journals. He is currently engaged in editing *Indo-English Poetry Anthology* to be published by Hidden Brook Press, Canada. He is the son of the noted professor, poet and award-winning translator, Dr. Rajanand Jha (Crowned with Sahitya Akademi Award, New Delhi). Website: <http://poetryjha.wordpress.com>



Dr. Rajnish Mishra is Assistant Professor, Department of Applied Science and Humanities, IIS Engineering College, Ghazabad, Uttar Pradesh, India. His areas of specialization are ELT methodologies, literary theory and criticism, and creative writing. He has B.Sc. & M.Sc. in Agriculture and Diploma in Spanish and French from Banarus Hindu University (BHU). He has MA in English Literature and was awarded PhD on the topic *A Critical Analysis of Villains in Shakespeare's Tragedies*. He has competence in teaching French, English, Communication and Soft Skills. He has more than 12 years of teaching experience, and more than 20 critical articles and research papers of his are published in various national and international publications and journals. He has co-edited six critical anthologies on Indian English Literature. He is presently working on the psycho-geographical effect of his city, Varanasi, in both creative and critical media.
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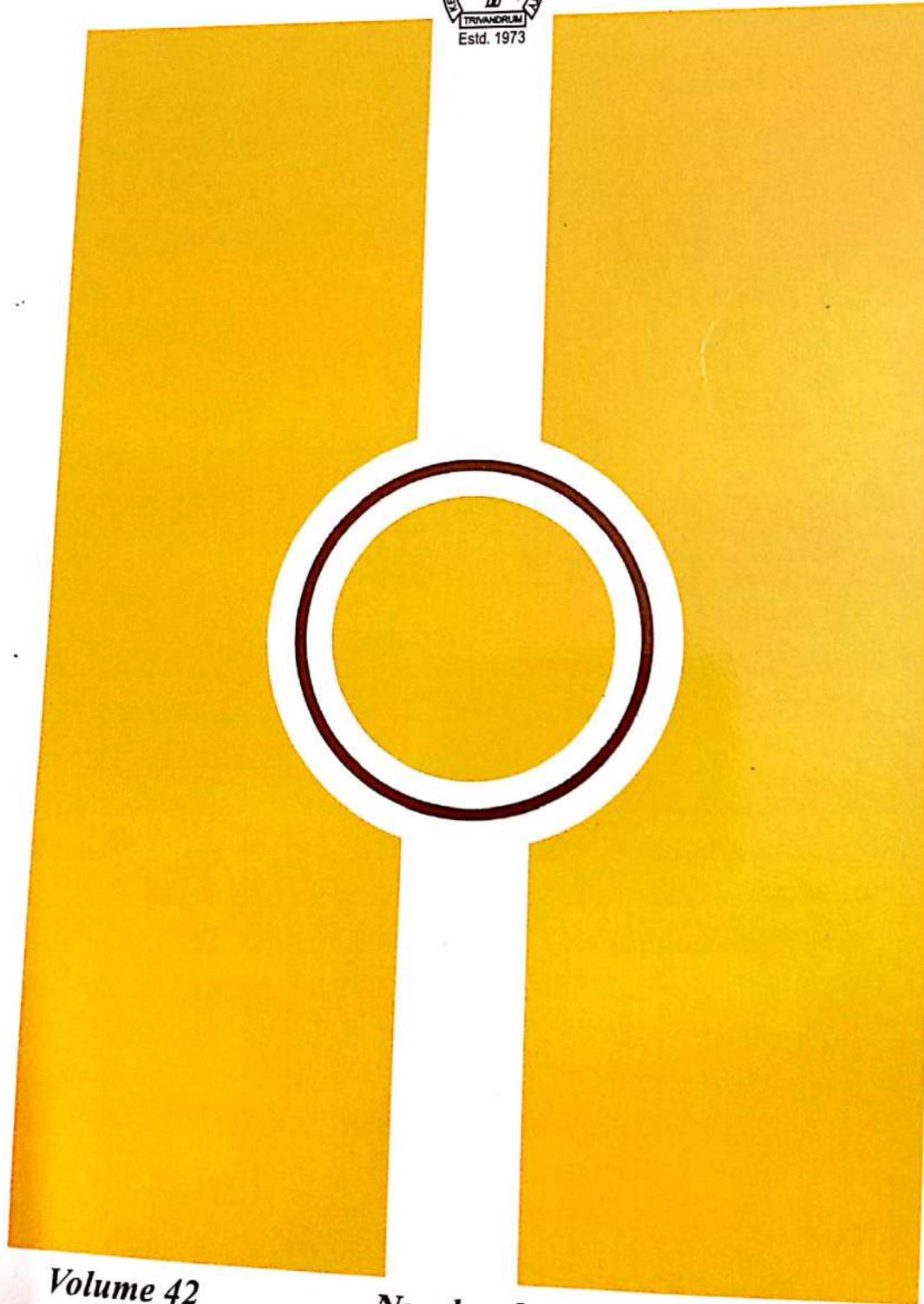


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Ambivalent Selfhood: Locating the Space of the Woman in Indian Television Advertisements

Shalini Rachel Varghese

This paper examines the portrayal of the woman in Indian television advertisements over three decades in terms of a broad spatial progression, wherein the woman within the four walls of domesticity evolves into a multifaceted subject with greater freedom and choices. However progressive the socio-psychological implications of this process may be, there is also the persistence of a continuing sense of oppression and objectification in the representation of the woman's body, particularly in advertisements meant for male consumption. The state of cultural ambivalence implied in the concurrent representations of woman is examined from the perspectives of feminist theories and the theory of "male gaze" as explicated by Laura Mulvey. The persuasive role of TV commercials in the discourse of gender construction is thereby seen as a mutable rubric which keeps the gender debate alive in India.

Keywords: Television, Selfhood, Objectification, Gender-construction, Advertisements

Introduction

This paper purports to examine the state of Indian women in television advertising today in terms of the significant transformation in the manner of their portrayal over three decades. The way women are depicted in

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This book addresses some of the burning issues of Kerala Economy. They include agrarian crisis, globalization and agricultural transformation, energy crisis, environment and climate change, demographic transition and ageing, migration, construction boom, health crisis and fiscal crisis. As Kerala Economy is a fond area of study to scholars and economic policy makers alike all over the world, the contents of this book would be of great use to all its potential users including students, teachers, researchers, administrators and the general public.

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9. Technological Modernisation and its Impact on Environment and Livelihood: A Study on the Fishing Community of Kerala

Jisha John and V. Mathew Kurian

Technology has been accepted as an engine for economic growth and development. The availability and application of new technology is of great importance as a determinant of the nature and structure of the society and as a contributor to changes in environmental quality. Since before the industrial revolution economies and societies have relied on resources like wind, water, animal power and wood then on coal and finally on natural gas and petroleum. The 'scientific temper' of humanity is behind all scientific and technologic achievement of society. Thus technology was brought into the main stream of development.

But economists differ on the role of technology in developmental processes. Some stress the prosperity, other points to damaged ecosystem and endangered sustainability. Technological growth is invention, innovation, transfer, penteration or diffusion. The productivity of an economy consisting of its natural endowments and technology is conditioned by culture and institutions in a society. Institutions as well as technology are part of culture. Accumulation of resources and progress in technology has an impact on culture and vice versa. The goal of this paper is to have a look at the technology side of debate and analyse to what extent modern harvesting technology helped the sustainability of the fisheries and livelihood of the fishers in the marine fisheries of Kerala. The paper is divided into three parts: First part critically reviews the role of technological change and economic growth in different perspectives. The second part discusses the technological congruence that has occurred in the fisheries sector of Kerala. Third part analyses the impact

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The Twilight Enigma

Thankam K. Abraham

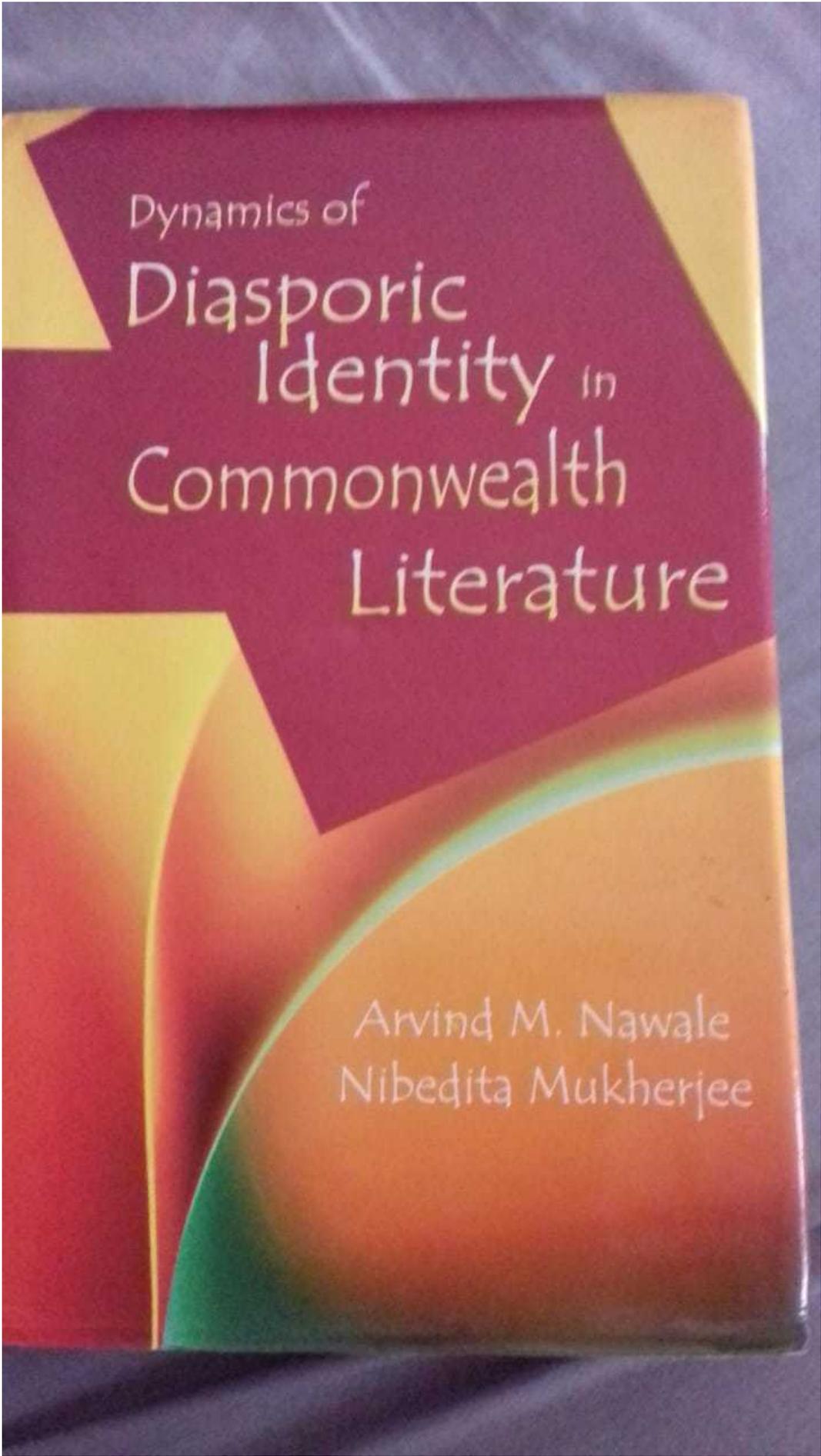
(Assistant Professor, Christian College, Chengannur)

Popular fascination for monsters and disasters that wreak havoc upon the 'normal' world has grossed many a million for producers of movies like *Jurassic Park*, *Godzilla*, *X-Men*, and quite recently *Avatar* and 2012. One can almost sense a mass hysteria in the way crowds rave about these movies. There seems to be more in the mass appeal of these productions than just technological gimmicks and animation feats. On the whole it can be said that a craving or appetite for the phantasmagoric world or dystopia is on the increase. According to P.N. Gangadharan Nair in his *The Treatment of Political Ethos In Jeffrey Archer's Novels: A Critical Study*, "Popular fiction like all other cultural creations reflects social meanings and more and more importantly intervenes in the life of society by organizing and interpreting experiences. Thus to understand popular fiction is to examine it as a form of cultural production. This offers a particular way of thinking and feeling about one's relationship to oneself, to others and to society as whole" (29). The effort of this paper is to go deep into the socio-political and cultural significances of the immense popularity of the *Twilight* series by Stephenie Meyer.

Gangadharan Nair in his dissertation titled *Treatment of Political Ethos In Jeffrey Archer's Novels: A Critical Study* cites Leslie Fiedler's remarks in *What was Class Culture? And Mass Society*, "Literature which transgresses social taboos, teaches that the impulse of lawlessness exists deep in human psyche. Once these taboos are translated into popular fiction, the fear of the unconscious and its tyranny over our bodies and dreams, and by the same token, of the art which simultaneously releases and neutralizes its dark aspects" (29). Replete with vampires and were wolves, the *Twilight* series articulate this preoccupation with the unknown. They might come under the category of gothic fiction even though the settings and locales are quite modern and urbane. The sexual tensions that exist between the protagonists come across as the crux of the storyline. Edward Cullen represents a superior species that is genetically inclined to be 'bloodsuckers' and Bella stands as a symbol for the American fascination for the 'terrible beauty'. Bella epitomizes the human greed for wealth, beauty, a crowing victory over death coupled with everlasting youth. Even when she denies the expensive gifts given to her by Edward, she is enthralled by the purchasing power of the Cullens, a power that puts all discomfiting and mundane little economising out of countenance.

In *Beyond Twilight Explore the World of Vampires*, N. Mascetti describes a vampire as "psychologically repulsive: he of any moral code; he stands outside and therefore threatens society; he drinks blood; he kills without mercy; and still worse of the final and most inhuman of acts transforming his victim into horrific creatures, a unilateral decision that no mere human will is strong enough to prevent" (13). However Meyer attempts to challenge the hitherto held notions regarding vampires and reintroduces the undead in her own terms, a defamiliarising of the vampire description holds true for all the vampires that figure in the series the Cullens and their allies. If we examine all the vampire victims found in fiction, we can identify a hegemonic supremacy established by the oppressor over the oppressed. The victim is mesmerised and dominated by his/her malefactor to end in an irrevocable destiny. "I couldn't have this level of influence over me. It was pathetic. More than perhaps I am unhealthy" (*Twilight*, 63). Bella is alive to such wisdoms only if she considers him an ordinary human. All such insignificant little details are soon forgotten once she realises that she is receiving the attention of a supernatural being. J. Jenks, the procurer of false papers in *Breakfast at Tiffany's*, is painfully aware of strangeness of his customers from Cullen and is terrorized into complying with the demands of his clients.

To apply a Marxist reading to the text does not seem to be as we can clearly perceive the workings of ideology in the relationship between a human Bella and her vampire friends. She considers the inequality in status between herself and Edward as natural. In the novels do we see any recognition of oppression in Bella's position to identify as a potential victim or prey but regards the situation as an unfortunate circumstance brought about by the natural inclination of the vampires. She has an easy solution to annihilate any threat to her existence, that is, to become one of the privileged herself. "What could happen?" She meant it as a rhetorical question. "Get it answered anyway, and my voice was not as steady as I wanted" (*New Moon*, 9). The first chapter of *New Moon* reveals succinctly Bella's fear of ageing which breaks out into a positive rage in the later volume when she learns that Jacob Black, her macho werewolf friend, is abominably by her, also incidentally did not get any older. The end and withering away of the Cumeacn Sibyl is simply not her cup of tea. Her initiation into the vampire world meant exquisite beauty, power, and extra perks like special gifts, the price to be paid for it seemed so little. Musings on beauty and success seem to be dancing in tune to the strategies of multinational giants in cosmetic industry. 'Pale is beautiful' is a notion that targets colonizing impressionable young minds of both



Dynamics of
Diasporic
Identity ⁱⁿ
Commonwealth
Literature

Arvind M. Nawale
Nibedita Mukherjee

A homeland can be a nation, a region, a linguistic area located in South Asia or language, ethnic, or religious group originally from south Asia or a combination of both (1).

18

Diaspora and Homeland in Amitav Ghosh's *Sea of Poppies*

Nirmala Varghese

Diaspora literature involves an idea of a homeland, a place from where the displacement occurs and narratives of harsh journeys undertaken on account of economic compulsions. Basically Diaspora is a minority community living in exile.

According to Robin Cohen in *Global Diasporas – An Introduction*:

What is common in all Diasporas is that there are people who live outside their natal (or imagined natal) territories" (IX) and recognize that their traditional home lands are reflected deeply in the languages they speak, religion they adopt and cultures they produce. Earliest immigrants of the Indian Diaspora consisted of disprivileged and subaltern classes forced into alienation to a distant diasporic settlement. As in the days of yore, the return to homeland was next to impossible due to lack of proper means of transportation, economic deficiency and vast distances so the physical distance became a psychological alienation and the homeland became the sacred icon in the diasporic imagination. Makarand Paranjape in *One foot in and a Couple of toes in India*.

Diasporas and Homelands in South Asian Canadian Experience says:

For Amitav Ghosh, the homeland is central to the crafting of his fictional world. His *Sea of Poppies* (2008) evokes the India of the colonial period. It is a fascinating story that unfolds in the 1830's the impact of rule of the colonial regime in India and the Indian social system – disinherited nobility, disempowered peasantry, caste, community and kin- that led to the dispersal of people from their homelands to unknown destinies.

Colonialism often creates a setting which results in the migration of large number of people, either within the colonies or from them to the imperial centre. Colonialism usually works through the use of brutal force employed by one country to exploit another community and obtain economic wealth. Colonialism most commonly was the abuse of native people. *Sea of Poppies* is based on the cultivation of poppy along the Ganga in the Bhojpur region to feed East India Company's opium factories and sustain Britain's illicit opium factories with China that left the imperial coffers in London overflowing with wealth. "Come the cold weather, the English Sahibs would allow little else to be planted; their agents would go from home to home, forcing cash advances on the farmers, making them sign asami contracts. It was impossible to say no to them" (29-30). The fertile farms of the Ganges plains are blooming only with poppies-beautiful, deadly denying the peasants the crops to sustain them and indebting them to moneylenders and landowners, themselves indebted to the buccaneers of the East India Company.

The novel outlines the consciousness of a Diaspora writer brining back the picture of a homeland at one particular episode of history. The East India Company was engaged in the

repute, she has contributed a number
international Journals. She has also
and is at present on the editorial board
ed journal. She is also on the advisory
s prepared course material for the
is associated with the university as
ian Theatre in English and Literature
Dynamics of Diasporic Identity
mitav Ghosh.

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REFLECTIONS ON SWAMI VIVEKANANDA

**PERSPECTIVES ON RELIGIOUS
AND MORAL PHILOSOPHY**

Editor : Daisy Mathew

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SWAMI VIVEKANANDA AND HIS PHILOSOPHY ON HINDUISM

ANEESH. S

*(Assistant Professor, Department of History
Christian College, Chengannur)*

Swami Vivekananda was born on January 12, 1863. His earlier name was Narendernath Datta, popularly called as Bileh. His mother was Bhuwaneshwari Devi and father Bishwanath Datta. He got traditional sanskaras from the family. Vivekananda received English education and had sharp intellect. Before coming to Ramakrishna Paramhansa, he was a member of Brahma Samaj. He was of firm belief that God cannot be seen or realized in human form. During his short life of less than 40 years, Swami Vivekananda travelled to many places in India and outside. Many of these places have now become sites of pilgrimage. All of the places he visited and stayed in are even today filled with his holy presence and inspiration. His philosophy of Hinduism is the following.

The concept of Universalization:

One of the pertinent contributions of Swami Vivekananda was to build a bridge between Indian culture and Western culture (Vivekananda, Idea of Universal Religion(Selected Works)). He did it by interpreting Hindu scriptures and philosophy and the Hindu way of life and institutions to the Western people in an idiom which they could understand (Bhajananda). He made the Western people realize that they had to learn much from Indian spirituality for their own well-being. He showed that, in spite of her poverty and backwardness, India had a great contribution to make to world culture. In this way he was instrumental in ending India's cultural isolation from the rest of the world (Swami Vivekananda: A Reassessment).

He was India's first great cultural ambassador to the West. On the other hand, Vivekananda's interpretation of ancient Hindu scriptures, philosophy, institutions, etc prepared the mind of Indians to accept and apply in practical life two best elements of Western culture, namely



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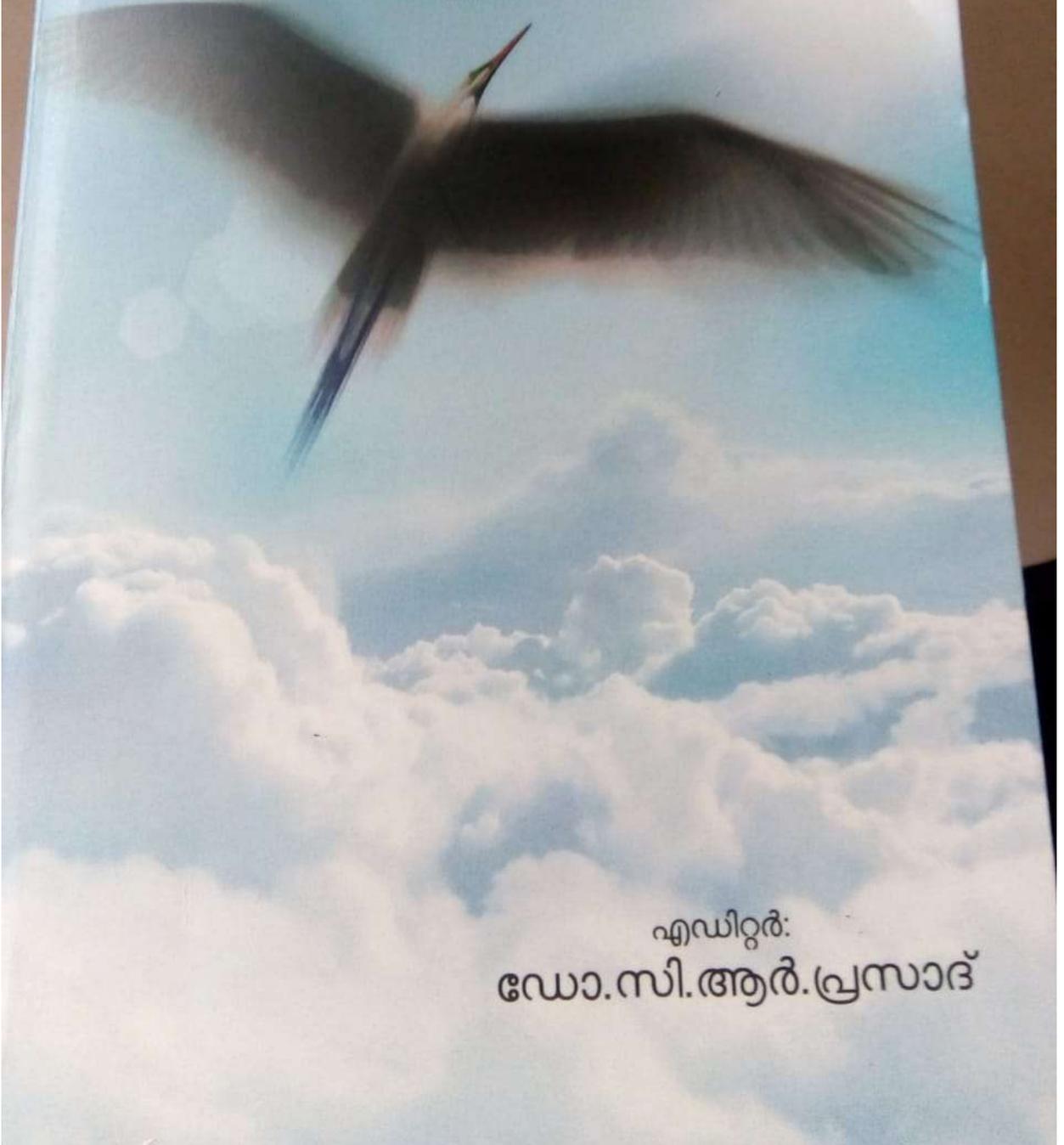
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വിനയം

വിജ്ഞാനവികരണയത്നം



എഡിറ്റർ:
ഡോ.സി.ആർ.പ്രസാദ്



വിനയം
ജനുവരി 2018

എഡിറ്റർ
ഡോ. സി. ആർ. പ്രസാദ്

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Dalit Christians In Kerala: Victims Of Discrimination

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CASTE AND THE RIGHT TO LAND OWNERSHIP IN KERALA

*Aneesh S. Assistant Professor, Department of History Christian College,
Chengannur & Arya P, Research Scholar, University of Kerala*

The most important achievements of the Communist governments in Kerala were the implementation of the land reforms and the legislation of the Agricultural Workers' Act. The Communists were elected to power in 1957 to the legislation of the two landmark Acts. These are the Kerala Land Reform Amendment Act ([KLRAA] 1969) and the Kerala Agricultural Worker's Act ([KAWA] 1974). The land reform bill was initiated in 1957, and its main features were: the fixing of a ceiling for the extent of holdings, the fixation of maximum rates of fair rent in respect of various classes of land, the surrender of land in excess of the ceiling, compulsory purchase of the rights of the landlord by permanent tenants on payment of a purchase price, rights of tenants to fixity of tenure, and so on. In effect, the Act of 1969 abolished landlordism. It also allowed the agricultural labours who were attached to the landlords known as kudikidappukar the right to ten cents of land including the hutments that they lived in. KAWA, on the other hand, legalized regular working hours, minimum wages, and various other welfare measures for agricultural labor. The Agrarian Relations Bill introduced in 1958 was passed with minor amendments. The legislature passed subsequent land reform bills in 1960, 1963, 1964, and 1969. But the historical land reform act, which put an end to the feudal system and ensured the rights of the tenants on land, came into force on 1 January 1970.

This paper will argue that the land reforms implemented by the Communist Party quenched the outcry of the landless agricultural labourer for the ownership of land. But it did not solve the bonded economic dependency of the Kudikidappukars, since they were given only 10 cents of land even though the landlords possessed many acres of land. This created two types of citizens in Kerala, the upper caste landlords and the lower castes with less land. Thus the amended land reforms introduced by the Communist government shattered the dreams of economic equality of the downtrodden community. Only receiving 10 cents of land, the Kudikidappukar got the title 'free Peasants'. But it is the naked truth that it was quite impossible for them to depend completely on their small portion of land for their livelihood. So again they need the mercy of rich landlords for using the latter's land for their livelihood. Spontaneously, it led to the economic dependence of backward communities in Kerala.

The majority of the people, who were socially and religiously being looked down upon, lost a chance to get economic equality in the society. The Dalits, who were once 'the real owner' of the land, are now in a situation to struggle for a piece of land for their survival. This became a vital cause for the continuation of backwardness of the Dalit communities in Kerala. In order to build a classless, casteless society in Kerala, equal distribution of wealth is inevitable. To attain such a big dream, the role of

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Evaluation of enzymatic antioxidants on the gill of freshwater fish, *Oreochromis mossambicus* as biomarkers of Paraquat exposure

*R. Abhilash

Abstract

The level of activity of antioxidant enzymes like Superoxide Dismutase (SOD), Catalase (CAT) and Glutathione Peroxidase (GPx) as biomarkers of oxidative stress in the gill of freshwater fish *Oreochromis mossambicus* exposed to paraquat was evaluated. The 96h LC₅₀ value for paraquat was found to be 12.60 mg/L. The fish were subjected to three sublethal concentrations viz. 1/20th, 1/15th and 1/10th of LC₅₀ concentration for a period of 10, 20 and 30 days. In the case of the lowest and intermediate sublethal concentrations, all the enzymes showed a minor escalation in activity on the 10th day followed by inhibition in the gill tissue. A duration and dose dependent inhibition of these enzymes was observed in the exposed fish towards the end of the experiment. Among these enzymes, GPx showed maximum diminution, making it a suitable biomarker of paraquat exposure. The present investigation unequivocally establishes the oxidative stress inducing effect of paraquat in fish. Also, the findings provide a rational use of oxidative stress biomarkers in aquatic ecosystem for paraquat pollution biomonitoring.

Keywords: Antioxidant enzymes, biomarker, paraquat, *Oreochromis mossambicus*

Introduction

The contamination of aquatic ecosystem by herbicides has gained increasing attention in recent years. The acute and chronic exposure and accumulation of these chemicals can result in tissue burdens that produce adverse effects not only in the exposed organisms, but also organisms including human beings. Many of them are capable of inducing oxidative stress in fish. Organisms have evolved a variety of responses that help compensate for the physiological impact of environmental contaminants. The antioxidant defense mechanism forms the crux of the whole system (Slaninova et al. 2009).

Paraquat is the trade name for 1, 1-dimethyl-4, 4-dipyridinium dichloride, a broad-spectrum herbicide of widespread use for crop desiccation and weed control

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(Dinis-Oliveira et al. 2007). Paraquat is highly toxic, especially fish, thus, vulnerable to several discernible effects (Gabryelak & Klekot 1985). It has been reported to increase peroxidase activity, inhibit acetylcholinesterase activity and alter dehydrogenase levels in carp (Asztalos & Nemcsok 1985; Gabryelak & Klekot 1985). Paraquat toxicity is widely accepted as a model of oxidant injury (Combs 1983).

The response to oxidative stress has also an ecological significance, especially in aquatic environments. Antioxidant defenses, present in all aerobic organisms, are antioxidant enzymes and free-radical scavengers whose function is to remove reactive oxygen species, thus protecting organisms from oxidative stress (Regoli et al. 1995). Among these enzymes, Superoxide Dismutase (SOD) catalyses dismutates superoxide anion radicals, whereas catalase (CAT) eliminates hydrogen peroxide. Glutathione Peroxidases (GPx), through reduction of both hydrogen peroxide and organic hydroperoxides, provide an efficient protection against oxidative free radicals in the presence of reduced glutathione. Thus, antioxidant enzymes play a crucial role in maintaining cell homeostasis (Otitofu & Onwurah 2011).

There has been a constant effort in the last decade for the validation of antioxidant enzymes as biomarkers of exposure. The ecotoxicological approach of biomarkers measured in individuals relies on the fact that changes occur in biological organization before the community is affected. Biomarkers are parameters measuring behaviors, physiology, biochemistry, cell integrity, structure and expression (Vasseur & Cossu-Leguille 2003). They are indicators of a normal status, or changes in individual of the population studied. The oxidative stress defense system has been increasingly studied because of the potential of oxidative-mediated responses to provide biochemical biomarkers (Vasseur et al. 2005).

A review of the literature reveals that there is a paucity of information on oxidative stress and its effect on fish. The present study was undertaken to investigate paraquat induced oxidative stress and its effect on enzymatic antioxidants namely superoxide dismutase, catalase and glutathione peroxidase in the gill tissue of the fish, *Oreochromis mossambicus*. An attempt has been made to assess usefulness of these parameters as biomarkers of paraquat.

Materials and Methods

The commercial grade paraquat, supplied by Syngenta India Ltd., Mumbai, was used in the present study. The required concentration of the pesticide was prepared in free tap water. Studies were conducted on the freshwater fish, *Oreochromis mossambicus*. They were obtained from a local water body which has no previous history of pollution. The acclimation and maintenance of fish was done using standard procedures as described earlier (Abhilash 2013). Fresh water acclimated fish having a mean body length of 14 cm and 15-20 g wet weight were used. The 96 h LC₅₀ value was calculated using probit analysis with SPSS/Windows (SPSS, Version 16.0.2). The fish were divided into four, each consisting of ten individuals. First group served as control and remaining as experimental. The fish were exposed to different sublethal concentrations (1/20th, 1/15th and 1/10th LC₅₀) of the toxicant. Controls received similar treatment.



INCLUSIVE GROWTH: THE UNFINISHED AGENDA

- Dr. Shyni T. Alexander -



About the Department



The Department of Economics, one of the oldest departments of Catholicate College, was established in 1955 even before the formation of the state of Kerala. It has created around 3000 graduates through 57 batches. Centre for women studies of the institution is attached to the Department. The vision of the department is an egalitarian society having holistic and sustainable development. The mission is to mould posterity who would wipe tears from every eye and lead India in the steady state growth path towards sustainable and equitable development horizon.

About the Professor



Dr. Shyni T. Alexander is the Head of the Department in Economics & Centre for Women Studies of Catholicate College at Pathanamthitta in the state of Kerala. She is a faculty member in the department of Economics since 2000. She was awarded Ph. D degree in Economics from Mahatma Gandhi University in 2014 and has more than 15 years of teaching and research experience. She is a life member of the Indian Economic Association and Reviewer of International Centre for Economics, Humanities and Management (ICEHM). Her areas of interest include gender and development economics. She was in the editorial board of Catholicate Journal of Studies and Research and has published papers in various national and international peer-reviewed journals.

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15. Social and Economic Inclusion of the Differently Abled: An Unfinished Agenda

Linchu Elizabeth Samuel

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ABSTRACT

Disabled people are among the most socially and economically excluded people. They are often excluded due to the ignorance of the public as well as lack of proper policies for integrating them. An attempt is made in this article to look into the social and economic exclusion faced by the differently abled people.

Key words: Disability, Social model, Economic model, Inclusion

Introduction

As defined by the World Health Organisation disability is an umbrella term, covering impairments, activity limitations and participation restrictions.

In the medical model of disability, individuals with certain physical, intellectual, psychological and mental impairments are taken as disabled. According to this, disability lies in the individual as it is equated with restrictions of activity, with the burden of adjusting with environment through cures, treatment and rehabilitation. The medical model tends to view disabled people as having physical problems to be cured. It perceives disability as a problem located in the disabled individual and assumes that working on the individual can solve it.

In contrast, in the social model the focus is on the society, which imposes undue restrictions on the behaviour of persons with impairment. In this, disability does not lie in individuals, but in the interaction between individuals and society. This model implies that the physical, attitudinal, institutional and social environment must change to enable people living with impairments to participate in society on an equal basis with others. People with disabilities do not often have equal access to health care, education and workforce participation. The discrimination faced by the disabled can be classified into three types: (i) Attitudinal (ii) Environmental (iii) Institutional. (Harris and Enfield 2001)

Attitudinal discrimination occurs when people may be socially excluded by attitudes of fear and ignorance on part of the disabled people. They may often be excluded from society because of generally low expectations of what disabled can achieve.

Institutional discrimination occurs where the law discriminates against the rights of disabled people by making them second class citizens, by denying them the right to vote, to own land, to attend school, to marry, or to have children etc. Several legislation and Acts have been passed to enable them to enjoy equal rights and opportunities on par with other fellow men in the country. Persons with disability are often not aware of the various provisions made under these acts and concessions that are made available to them.

Environmental discrimination occurs where public services including building and transports services are not designed with proper access for disabled. School buildings are built with stairs making inaccessible for those with disability and impairments. Problems of the disabled school children gets further compounded with lack of trained teachers, inappropriate teaching materials, and unwillingness to include the disabled children. Parents of the disabled feel that they lack educational skill and therefore, do not need education.

The differential treatments and the artificial barriers created always keep them away from achieving a full or equal participation and integration into their own society. To address the various problems faced by them, the governments have come out with several measures to bring them in to the mainstream society and lead a decent life by enabling them to participate in all the societal activities and to realise their rights.

Disability in India

According to Census 2011, in India, people with disabilities constitute 2.21% of total population i.e., 26.8 million. However estimates vary across sources. The Planning Commission recognizes this figure as 5%. The World Bank Report has observed that people with disabilities comprise between 5% and 8% of Indian population, that is around 55 to 90 million people. Compared to the population of many European countries, we can say that the disabled form the largest minority group in India. India has 12 to 30 million children living with disabilities. According to UNESCO, 90% of children with

disabilities in developing countries do not attend school. Research indicates that violence against children with disabilities occurs at least 1.7 times greater than for their peers without disabilities. Only 34% of the working age persons with disabilities are working.

Table 1 Disability in India by Gender and types of disability

Type of Disability	Person	Male		Female	
		Number	Percentage	Number	Percentage
Seeing	5,032,463	2,638,516	17.6	2,393,947	20.2
Speech	1,998,535	1,122,896	7.5	875,639	7.4
Hearing	5,071,007	2,677,544	17.9	2,393,463	20.2
Movement	5,436,604	3,370,374	22.5	2,066,230	17.5
Mental Retardation	1,505,624	870,708	5.8	634,916	5.4
Mental Illness	722,826	415,730	2.8	307,094	2.6
Any Other	4,927,011	2,727,828	18.2	2,199,183	18.6
Multiple disabilities	2,116,487	1,162,604	7.7	953,883	8.1
Total	26,810,557	14,986,202	100	11,824,355	100

Source: Census of India, 2011

As seen from Table 1, the percentage of disabled in India is 2.21% of the total population. The proportion of disabled is higher among the male population (55.9%). Disability in movement is the highest type of disability in India followed by hearing and seeing.

Table 2 Decadal change in disability in India by Gender, 2001 -2011

	2001	2011	Decadal Growth (%)
Total	21,906,769	26,810,557	22.4
Male	12,605,635	14,986,202	18.9
Female	9,301,134	11,824,355	27.1

Source: Census of India, 2001, 2011.

As seen from Table 2, there is a decadal increase in disability in India by 22.4%. The decadal increase is higher among female than male population.

- In public sector, employment of persons with disability is only 0.54% of the total work force.
- Employment of persons with disabilities among large private firms was only 0.3% of their workforce.
- Among multi-national companies, it is 0.05% of their workforce.
- 87% of persons with disabilities are employed in the informal sector, hence receiving no protection or benefits from the government.
- Employment of persons with disability fell from 43% in 1991 to 34% in 2006, despite the country's economic growth.

Economic growth in the past years has failed to include the disabled in to the mainstream; in fact they have been excluded economically and socially.

Inclusion Strategies

A multi-dimensional approach is required to include the disabled in the growth process of the country. In India where disability is still considered as a social stigma, a change in the attitudes of the people towards disability is required. A holistic approach which includes attitudinal, environmental and institutional changes is required along with steps to rehabilitate the disabled. This could bring a proper balance between the medical and social aspects of disability.

1. Creating a Disabled friendly Environment

Work places, schools, colleges, public transport etc are to be made accessible to the disabled. This can be done only by initiatives at the governmental level and by sensitising the public towards the needs of the disabled.

2. Increasing the employability of disabled.

In spite of the reservation provided by the Government for employment it is found that a very minute population of disabled are employed especially in the formal sector. It is necessary to increase their educational attainment, provide vocational and skill training to include them in the workforce.

3. Private Initiatives through Corporate Social Responsibility

There is a need to sensitize the corporate sector about the need for employing persons with disabilities.

Employing people with disabilities should become part of corporate regular HR policy.

Encourage and facilitate corporate sector in developing disabled friendly policies thus creating inclusive organizations. ITC, WIPRO, KFC etc are the leaders in this regard.

4. Employer Incentives:

Employer incentives in the form of tax incentives, government funding for employer accommodation, support for work place modification etc.

Conclusion

Even though the disabled people form around 3-5% of the population, growth models by and far have excluded them from the development process. In spite of the coercion by the government there are a number of limiting factors that prevent employment of the disabled persons. Our growth models need to identify these issues and take corrective measures for the social and economic inclusion of the disabled people.

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B. PUBLIC SPEAKING

(Resource person: Mr. John George Athyal, Asst. Prof. in English, Christian College, Chenganoor)

Public speaking is an inevitable skill that allows teachers to instruct, inspire, and induct their learners effectively. It is one of the major skills in the global market that is keenly sort after. What transpires during public speaking is a communication pattern that attracts the listeners almost immediately and moves them to respond without much coaxing or through force. Early training in public speaking took place in ancient Egypt. Aristotle discussed oratory, and the subject with definitive rules and models.

Before we delve into the reasons as to why public speaking is important and why teachers need to master the skill, it would be beneficial to revisit some defining moments in history to display the importance of public speaking.

- Martin Luther King gave his “I have a dream speech” which inspired a nation and broke down racial barriers. Without his leadership and his inspirational speech it may have taken an extra 10 years to bring equality to all races.
- Presidents Nixon’s speech united a nation and put a man on the moon
- Abraham Lincoln’s Gettysburg address put him on the map for president. Without this speech he may never have been the icon he is today.

**Voices from Borderlands:
Emerging Literatures, Ignored Voices,
Silenced Uproars and Evolving
Theoretical Perspectives**

Jolly Malayam
Nithya G.R



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**The Marginalized Majority: Voicing the Angst of the
Linguistically Challenged in
Chetan Bhagat's *Half Girlfriend*.**

Ms. Jolly Alex
Assistant Professor
Department of English
Christian College, Chengannur

Abstract

English, a language which came from nowhere is set to conquer the world. However, this has led to the genesis of a hegemonic wall between the users and non-users of this language. Hegemony of an English speaker is always felt by a non-English speaker. This hegemony is sometimes described as linguistic globalization. The problem of hegemony of English is the English divide. English divide takes place as a result of the formation of the English language based class system. Chetan Bhagat's latest novel *Half Girlfriend* which is dedicated to "rural India", "non-English-types", is a novel which explores class-divide in the society and how English has become the new class system. Varying degrees of English puts one into various classes in the society and impacts relationships, work, career everything.

This paper aims to create consciousness in the minds of the English speakers, who have an extremely exalted opinion about their linguistic skills and at the same time create a platform to vocalize the angst of those non-English speaking people who find themselves isolated from the mainstream- residing in a No-man's land, trying to break the divide between "us" and "them". Thus the majority residing in the borderlands, who are linguistically-challenged are brought to the forefront.

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Theoretical Perspectives

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**Meena Alexander's Fault Lines:
The Anguish of a Lost and Traumatized Self**

Ms. Leena Liz Mathew
Assistant Professor
Department of English
Christian College
Chengannur

Abstract

Large-scale immigration in recent years has led to unprecedented anxieties of adjustment and a hypersensitive aspect like individual identity has come into conflict with the demands of the immigrant's adopted homeland. Such conflicts are not exclusive to immigrants of Indian origin. They apply to settlers from other countries or cultures as well. When the seeds of tradition sprout and goes on its lifecycle, life is beautiful for the immigrant writers. But once the saplings of tradition start to wither, they are lost in a trauma of rootlessness and insecurity. This trauma gets intensified in the case of woman immigrant writers.

Leaving places and returning to them in memory is the theme of Alexander's memoir *Fault Lines* which was published in 1993. Journeying back and forth in time, surfaces as the essence of this memoir. It epitomizes a search wherein the author consciously plants herself in her early days and begins her account in a more or less chronological arrangement. In *Fault Lines*, there is a marked and conspicuous focus on identity. The numerous situations the author encounters, the people she meets, the events she steps into, are brought around as indicators to what she is, has been, and becomes. The more she moves within herself, the more poignant becomes the contemplation and self-examination.

Fault Lines is a work that relates to the seismic discontinuities of Alexander's existence, linking them through the operation of her poetic gift. *Fault Lines* revolves around the theme of establishing one's self, and forming an identity independent of one's surroundings. In coming to terms with ethnicity and femaleness in America, Alexander feels the need to create a wholeness of being that resists the numerous fractures of migration but is left wondering, as she does in *Fault Lines*. *Fault*

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From Struggle to Survival: The Empowered Female Protagonist in *Rudaali*

Nirmala Issak
Associate Professor of English
Christian College
Chengannur

Many writers and activists have written and expressed the condition and oppression of women in society. Simone De Beauvoir wrote the *Second Sex* in 1949, which argued against inequality and enforced "otherness" or the marginalization of women in society. Feminist Criticism seeks to challenge the traditional notions of society and establish the perspectives and experiences of women which had been marginalized for ages. It's goal is to widen our understanding of women's experiences of the world and their value in the world. Literature and especially the representation of women in literature was felt to one of the most important forms of socialization since it provided the role models

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THE POSTGRADUATE DEPARTMENT OF ENGLISH
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UGC SPONSORED NATIONAL SEMINAR

**RE- INVENTING AND RECASTING THE PRAXIS OF
GLOBALISATION**

4-6 DECEMBER 2014

Re-inventing and Recasting the Praxis of Globalization

Edited by

Anej Somaraj & Shalini Rachel Varghese

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John George Athyal University of Kerala

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Globalization and The Diasporic Culture : A Study Of Novels By Rohinton Mistry

Nirmala Varghese
Assistant Professor
Christian College
Chengannur

Globalization involves the movement of people, capital, commodities across national boundaries. The movement of people, capital and commodities has a strong cultural dimension. Globalization can be seen as a mechanism that also results in the merging of cultural practices, the assimilation of the foreign into the native and the encounter of different cultures. Metropolises across the world have become cosmopolitan, multicultural and hybridized with globalization. In the context of globalised cultural regimes, new challenges to culture and literature and new forms of writing and cultural practices emerge.

Post-colonial theory studies immigrant and diasporic identities as celebrations of difference. Blake Bohmer describes the immigrant and diasporic people thus: "ex-colonial subjects, third world in cultural interest, cosmopolitan in almost every other way, these people work within the precincts of the western metropolis while at the same time maintaining thematic and political connections with a national background." (233) Migrant people also demonstrate a nostalgia and longing for the mythic and homeland.

My paper intends to examine how diasporic cultures are understood in the context of globalization. It also shows a circulation of ethnicity/ ethnic culture in the works of Rohinton Mistry. The mobility of the native is a consequence of globalization. A global view of the world is also visible. According to Roland Robertson, "Glocalization is the localization and incorporation of locality processes which themselves largely shape the global compression of the world as a whole." (40) Texts which invest in a cultural identity are meant to be shared. Rohinton Mistry, a diasporic writer in Canada, shares his Parsi Indian background in his works. The idea of the local finds place in his diasporic writings as part of his attempts to share with the global world his identity and culture that is facing extinction. He grounds his ethnicity in a transnational context. In the words of Kariyn Koh, "A celebration of community then, is also an unstated act that publicly marks the place of the dead as in a tomb so as to create a link between the present and future community." (162) Diasporic cultures are ethnic cultures that are tied to the cultural practices of the community to which they belong. They are also hybrid/ glocal cultures that are tied to a local time, though deterritorialized.

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Matsyaganddhi, A Feminist Perspective On Globalisation

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Christian College
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Matsyaganddhi a one woman play was scripted by Sajitha Madathil. The author is a prominent theatre activist from Kerala who displays distinct feminist leanings in her plays. *Matsyaganddhi* is about the marginalised fishing community beaten down by the heavy blows of globalisation. The entire play is narrated by a fisherwoman who smells of fish ('*Matsyaganddhi*'). It presents a woman's perspective on life and reality. The play was first staged in South Africa, during the Earth Summit in 2002. The play also makes a strong statement on the marginalization of women.

The solo play begins with the narrator identifying herself with the soul of the sea.

At first the growling came from within my chest. And then there were several ships growling, growling. Shattering my eardrums. Little babyfishes, terrified, scurried for shelter under my clothes. All of a sudden a huge net fell down upon us from the sky... The little baby fishes, now dead, kissed me on my eyes and lips. (42)

She speaks of 'Kadamma' the Sea-Mother, a feminine entity, an object of worship, as per the traditional beliefs of the fisherfolk of coastal Kerala. Jane Freedman in *Feminism* cites the ecofeminist stands of activists like Vandana Shiva. Shiva's ecofeminism

argues that before the rise of Western colonialism and Western science, indigenous peoples throughout the world had close and relatively harmonious relations with the natural world. Natural forces were typically seen as feminine because they represented the generative powers of fertility and birth... This relationship to nature and natural resources was seriously damaged by the rise of Western colonialism,... and by Western science which transformed the global view of nature, seeing it as merely a resource for men's benefit and not something to be revered and respected as it had been. (Freedman, 56)

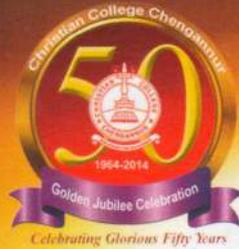
All these led to ecological destruction, overuse of resources and technologisation of life in general which are the main concerns in the play under study.

Cecilia Busby in *The Performance of Gender* speaks of the role of women in a fishing community :

Women among the Mukkuvar, are excluded from the world of fishing and the sea, disbarred from the major productive enterprise of the fishing economy. Yet without women's contribution the economy would rapidly collapse, for it is their work on the shore, their essential contribution to the movement of fish and money and resources throughout the community; they are the links which connect the village to the outside world, they bind household to household through networks of debt, exchange and relationship. (Busby, 53)

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Human Lives Going Glocal: A Chaotic Reading of Manjula Padmanabhan's *Harvest*

Leena Liz Mathew
Assistant Professor Dept. Of English
Christian College Chengannur.

Since time immemorial humans have complained that life is becoming more complex. The increase in complexity is directly related to sweeping changes in the structure and dynamics of human civilization, the increasing interdependence of the global economic and social system and the instabilities of dictatorships, communism and cooperate hierarchies. Our complex social environment is consistent with identifying global human civilization as an organism capable of responding effectively to complex environmental demands. Today, global connections are manifest in the financial system, in transportation and communication systems, and in responses to political, social and environmental crises. A transition to global conflict, and hence to global cooperation, took place. Along the way, the conditions of life changed, driven by technological, medical, communication, education and governmental changes, which themselves involved global cooperation and collective actions. The number of stressors in everyday life has multiplied exponentially: traffic, money, success, work or life balance, the economy, the environment, parenting, family conflict, relationships, disease. As the nature of human life has become far more complicated, our ancient stress response hasn't been able to keep up. Human civilization continues to face internal and environmental challenges. In this context it is important to recognize that the complexity of a system's behaviour is fundamentally related to the complexity of challenges it can effectively overcome. The collective complexity of human civilization is directly relevant to its ability to effectively respond to large scale environmental changes.

We are living in an age of surprises and shocks. We live in the times of the nonlinear and the unpredictable. But under the wave of unpredictable elements, there is a current of predictability because of which we deliberately expect the unexpected. Beyond the unpredictable systems which appear to be random and uncertain, there are deterministic and predictable systems. There is an underlying order in what appears to be random events or data.

Glocalization has gained increasing significance in the everyday lives of common people. Glocalization means an integration of global and local forces which lead people and processes to cross borders to interact. It creates structures that are essentially "local in spirit but global in character". This metamorphosis of the global and the local, which would otherwise be polar extremes, is now a hybrid of the global and the local. A permanent intertwining of the global and the local dimensions has occurred. Glocalization is a process whereby localities develop direct economic and cultural relationships to the global system through information technologies, bypassing and subverting traditional power hierarchies like national governments and markets. It is marked by the development of diverse, overlapping fields of global-local linkages. There is always the need for institutional change and social adaptation. Strong pressures to preserve local identity and customs have become prominent. Trade barriers have

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Emotional Trauma in the Selected Works of Timothy Findley

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Abstract

Mental illness is a traumatic problem that occurs in some families. Everyone in the family is affected by mental sickness and the behaviour that results from it. The society views the issue of mental illness in a derogatory manner. A social taboo is placed on the family of a mentally ill person. No one offers a helping hand or pays heed to the problems of the family members of these people. The overall societal attitude towards mental illness makes the caregiver's burden much heavier. The problems that caregivers of people with mental illness face today are complex and profound. Mental illness is one of the recurring themes as seen in many works of Timothy Findley. This paper is a study on how different family members respond to the issue of the mental illness of their dear ones as seen in some of Findley's works.

Keywords

Mental illness, emotional trauma, family.

Mental illness, a harrowing crisis in some families, affects everyone in the family. The behaviour that results from it ruins the whole family. The subject of mental illness is a deprecating matter as far as the society is concerned. A social taboo placed on the family of a mentally ill person makes the caregiver's burden much heavier. The multifaceted and deep problems that caregivers of people with mental illness face today arise from inside the family as well as from outside. Caregivers face a broad array of problems and experience many emotional responses to them. Early onset of mental illness has a catastrophic impact on all members of the family. Before the family members can become even remotely effective at coping with their own feelings, they

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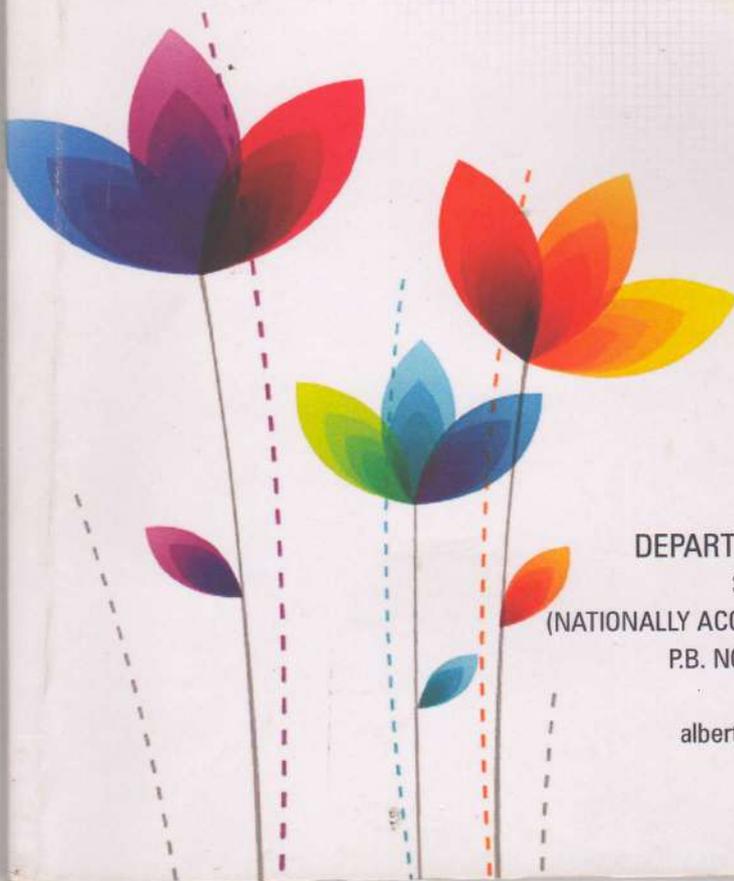
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The Trauma of The Family Members of Mentally Ill People: A Study on Selected Works of Timothy Findley

Leena Liz Mathew

Mental illness is a traumatic problem that occurs in some families. Everyone in the family are affected by the ill person's sickness and the behaviour that results from it. The society views the issue of mental illness in a derogatory manner. A social taboo is placed on the family of a mentally ill person. No one offers a helping hand or pays heed to the problems of the family members of these ill people. The overall societal attitude towards mental illness makes the caregiver's burden much heavier. The problems that caregivers of people with mental illness face today are complex and profound. These problems arise from inside the family as well as from outside. Caregivers face a broad array of problems and experience many emotional responses to them. Early onset of mental illness has a catastrophic impact on all members of the family. Before the family members can become even remotely effective at coping with their own feelings, they need to start by recognizing and accepting that their relative is mentally ill. This is inevitably a painful experience for the family. Although not all caregivers react in the same way, common reactions include self-blame, grief, feeling overloaded and guilt. Many families deny for a long time that there is a problem at all, because it is too painful to believe. They may also suffer physical reactions such as headaches, stomach aches and other medical problems. Parents, siblings, spouses and children struggle to make sense out of the tragedy by searching for the plausible reason for the illness of their loved one.

Timothy Findley, in full Timothy Irving Frederick Findley, a Canadian author, is known for his intelligent writing and storytelling. His subject matter is often the lives of troubled individuals. Mental illness is one of his recurring themes as seen in many of his works. His characters often carry dark personal

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Voices from Borderlands:
Emerging Literatures, Ignored Voices,
Silenced Uproars and Evolving
Theoretical Perspectives

Jolly Malayam
Nithya G.R



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**Meena Alexander's Fault Lines:
The Anguish of a Lost and Traumatized Self**

Ms. Leena Liz Mathew
Assistant Professor
Department of English
Christian College
Chengannur

Abstract

Large-scale immigration in recent years has led to unprecedented anxieties of adjustment and a hypersensitive aspect like individual identity has come into conflict with the demands of the immigrant's adopted homeland. Such conflicts are not exclusive to immigrants of Indian origin. They apply to settlers from other countries or cultures as well. When the seeds of tradition sprout and goes on its lifecycle, life is beautiful for the immigrant writers. But once the saplings of tradition start to wither, they are lost in a trauma of rootlessness and insecurity. This trauma gets intensified in the case of woman immigrant writers.

Leaving places and returning to them in memory is the theme of Alexander's memoir *Fault Lines* which was published in 1993. Journeying back and forth in time, surfaces as the essence of this memoir. It epitomizes a search wherein the author consciously plants herself in her early days and begins her account in a more or less chronological arrangement. In *Fault Lines*, there is a marked and conspicuous focus on identity. The numerous situations the author encounters, the people she meets, the events she steps into, are brought around as indicators to what she is, has been, and becomes. The more she moves within herself, the more poignant becomes the contemplation and self-examination.

Fault Lines is a work that relates to the seismic discontinuities of Alexander's existence, linking them through the operation of her poetic gift. *Fault Lines* revolves around the theme of establishing one's self, and forming an identity independent of one's surroundings. In coming to terms with ethnicity and femaleness in America, Alexander feels the need to create a wholeness of being that resists the numerous fractures of migration but is left wondering, as she does in *Fault Lines*. *Fault*

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This book is an edited collection of the research papers presented in the UGC sponsored National Seminar (15 -16 October 2015), **Voices from Borderlands: Emerging Literatures, Ignored Voices, Silenced Uproars and Evolving Perspectives**, organized by the Department of English, St. Stephen's College, Pathanapuram.

The prime focus of the seminar was to lend voice to perspectives on and from literal and figurative borderlands. The seminar, divided into five sessions, brought into focus the following sub-themes:

- Exploring the Borderlands
- Borderline Literatures
- Voices Lost in the Mainstream Mayhem
- In Seek of the Silence of the Silenced
- Emerging Theoretical Perspectives:
New Visions on Borderlands

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UGC SPONSORED NATIONAL SEMINAR

RE-INVENTING AND RECASTING THE PRAXIS OF
GLOBALISATION



4-6 DECEMBER 2014

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23. And a Glocalized Malayalee Emerges... Ms. Sneha S.

Greens' Blues: An Ecocritical Reading of *Over the Hedge*

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Chengannur.

Long neglected as an object of serious study, animated films have in the recent years attracted a great deal of attention bringing along with it a commentary on wide range of matters that engage with history, society, and politics. Rather than a light entertainment for children, animation now presents itself to the public as a mature visual genre that is able to address issues ranging from war and discrimination to technological innovation and environmental crisis. In the last few years, a number of animation movies, have begun to employ anthropomorphized characters, to throw a light on contemporary environmental concerns. Some of these films juxtapose conflicting pressures about conservation and large scale habitat destruction, while still, bring about a happy end just to please the viewers, without a resolution of the crisis. Many animation movies employ non-human protagonists, to view from their lens, issues threatening their existence, like habitat destruction and extinction.

Dreamworks' *Over the Hedge* released in 2006, purports to highlight the kind of relationship that a human being should have with his environment and other living beings knowing that any attempt at encroaching on the "others" space can trigger off conflicts with far-reaching consequences. The movie throws light on an environment groaning under encroachment of humans, destruction of the natural habitat of the animals, and the ensuing reduction in their hunting grounds consequently effecting their food supply. *Over the Hedge* is about a group of animals who awaken from their hibernation, just to find that their forest home has been converted into a suburban sprawl. Its a metaphorical film that illustrates the uncertainties of globalization and the bane of greed and consumerism. RJ is a scheming racoon, who finds a group of foraging animals coming out of their hibernation and discovering a formidable object near their habitat, which they name Steve, completely clueless as to what it is and what lies beyond it. RJ introduces himself to the family, which is more of a community than a family, including possums, porcupines, skunk, a hyperactive squirrel, all led by a cautious and sagacious turtle, Verne. RJ enlightens them that the massive divider is a "hedge". The hedge blocks their tried and accustomed path to gather grains, nuts and berries. A naturally tentative Verne, goes exploring and is shell-shocked by what he sees- 54 acres of manmade, manicured, air-conditioned paradise stands in place of their home. He is flabbergasted and exclaims, "Half the forest is gone! The berry bushes. Trees. They're just gone! What will we do for food?" While Verne is distraught, RJ is jubilant and proclaims, "It's called a hedge, and it's not to be feared! Its the gateway to the good life."

RJ convinces them that the greedy, lazy human beings, dwelling on the other side of the hedge, have more than enough food and he cajoles the timid animals to move over the hedge and raid the human suburb. This attempt by the hitherto human-shy creatures to sneak into their habitation, was simply a matter of self-preservation because they had little choice. Their hunting grounds had dwindled and their habitat was rapidly losing ground to urban development schemes. *Over the Hedge* brings such issues to the fore and portrays the animals struggle for

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Monopoly and Hegemony in New Attire: An Analysis of the Newly Designed Syllabus of Film Studies of University of Kerala

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Globalization, “the process of going to a more interconnected world”, is also “the process of world economy dominated by capitalist models”, as stated by I. Wallerstein in his *World System Theory*. These two aspects can be consummately juxtaposed for a close scrutiny of the target word -globalization- in terms of films and film studies. Digital colonialism had been emerged even before the advent of the so called era of globalization. The thinking mass has nothing to do other than the process of *mimesis*. A blind adherence to the so called standards is visible even in the formulation of academic syllabus. This paper is forwarded as a part of the UGC Minor Research Project: *The Transfiguration and Metamorphosis from Print to Screen: Analysing the Relevance of Newly Designed Syllabus of Film Studies of University of Kerala*

As part of the new CBCSS (Choice Based Credit and Semester System), University of Kerala has launched film studies as one of the core course (main paper) in the fifth semester of B.A. English Language and Literature. The formulation or design of this paper as core subject might be because of demand for the visual presentation and visual representation of the real world and the ideal world through the medium of cinema and the evergreen relevance of the silver screen in the mind of the common man. When compared to other genres, films are rated the favourite medium of common mass who are the majority. Hence this screen medium can be used as an effective tool to enhance language, culture, tradition, creative thinking critical analysis etc. and thereby extend a virtual hegemony by the so-called developed states against the developing countries. This paper, prepared as part of a Minor Project under the aid of UGC, intends to study the competence and relevance of the current syllabus of University of Kerala for Film studies by comparing the syllabus to the national and international parameters of the same in association with the prescribed syllabus, around the globe, particularly for movies and there by analyzing the status and rank of oriental cinema and film studies amidst the monopoly of occidental films and film schools.

Film Studies is comparatively a new branch of study as it was evolved in the beginning of the twentieth century. It is branded as an academic discipline encompassing both the aesthetic and the technical aspects of films. The angle of importance is shifted from production to the prediction of the elements of a film like narrative, artistic, cultural, economic, and political

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Neethu Mary Tomy

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Thamarah and One Night's story of "Aladdin and the Wonderful Lamp" which was given to the Arabs by an unknown author during the Islamic Golden age (14th to 16th century). The date of the original tale's publication is also unknown.

Paul Martin Lester in his book *Images That Injure: Pictorial Stereotypes in the Media* points out that "Challenging Stereotypes, rejecting victimization . . . are positive messages". (135) Through these tales, Disney shows that though stereotyping cannot be essentially removed from the animation industry, it can be narrowed down and reduced without getting rid of the fun and entertainment provided by age old Disney films. Even today, *Beauty and the Beast* (1991) and *Aladdin* (1992) presents its audience with the same kind of enjoyment that *Snow White* (1937) and *Cinderella* (1950) give its audiences. Marion Gymnic, Kathrin Ruhl and Claus scheunemann have noted in *Gender (Re)visions: Constructions of Gender in Audiovisual Media*: ". . . Disney heroine has undergone (at least as far as her behaviour is concerned), evolving from an entirely passive and naive into a more active character . . ." (66). Both Belle in *Beauty and the Beast* and Jasmine in *Aladdin* are feisty, adventurous and defiant. Through the character of Belle, Disney deviates from the notion of 'love at first sight'. It takes time for Belle to fall in love with the Beast. Though Jasmine falls for Aladdin at first sight, she does not fall for 'prince charming. Ali of Ababwa'. Through these tales Disney shows that stories might have changed, stereotypes reduced, magic increased but still audiences feel nothing has changed.

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Unveiling the Unpredictable: A Chaotic Reading of 'Noddy and the Dancing Spell'

Leena Liz Mathew,
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We are living in an age of surprises and shocks. We live in the times of the nonlinear and the unpredictable. But under the wave of unpredictable elements, there is a current of predictability because of which we deliberately expect the unexpected. Beyond the unpredictable systems which appear to be random and uncertain, there are deterministic and predictable systems. There is an underlying order in what appears to be random events or data.

Chaos is the science of surprises, of the nonlinear and the unpredictable. While most traditional science deals with supposedly predictable phenomena like gravity, electricity, or chemical reactions, Chaos Theory deals with nonlinear things that are effectively impossible to predict or control, like turbulence, weather, the stock market, our brain states, and so on. These phenomena are often described by fractal mathematics, which captures the infinite complexity of nature. Many natural objects exhibit fractal properties, including landscapes, clouds, trees, organs, rivers etc, and many of the systems in which we live exhibit complex, chaotic behaviour. Recognizing the chaotic, fractal nature of our world can give us new insight, power, and wisdom.

The amazing unpredictability of nature is what Chaos Theory looks at. Chaos Theory has captured the beauty of the unpredictable and displayed it in the most awesome patterns. Chaos Theory is a mathematical sub-discipline that studies complex systems. Examples of these complex systems that Chaos Theory helped fathom are earth's weather system, the behaviour of water boiling on a stove, migratory patterns of birds, or the spread of vegetation across a continent. Chaos is everywhere. As per Chaos Theory, nature often works in patterns, which are caused by the sum of many tiny pulses. In a scientific context, the word 'chaos' has a slightly different meaning than it does in its general usage as 'a state of confusion', 'lacking any order'. Chaos, with reference to Chaos Theory, refers to an apparent lack of order in a system that nevertheless obeys particular laws or rules. The two main components of Chaos Theory are the ideas that systems—no matter how complex they may be—rely upon an underlying order, and that very simple or small systems and events can cause very complex behaviours or events. Long-range predictions are not possible. Although chaos is often thought to refer to randomness and lack of order, it is more accurate to think of it as an apparent randomness that results from complex systems and interactions among systems. Chaos Theory is a revolution, not of technology, like the laser revolution or the computer revolution, but a revolution of ideas. This revolution began with a set of ideas having to do with

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Chitra Bhoom - The Brand Ambassador of Indian Culture

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Animated cartoons have become the most popular form of entertainment for children. The disintegration of the joint families and the emergence of the nuclear families have catapulted television to the centre stage in the life of most children. Many a times, the busy schedule of the parents who struggle to juggle their time between the professional and personal life are themselves responsible for introducing their children to the alluring world of cartoons. Though it serves to keep the children entertained and engaged while the parents are busy attending to their chores, it also slowly enslaves having serious implications in future. "Television has control on the children's meta-cognitive, shared, expressive and other behaviour" (Mares and Woodard, 2001). It might have an adverse impact on their character and behaviour. Those children who are addicted to cartoons may refuse to go to school, exhibit violent temper tantrums and might even refuse to take food if denied access to their favorite programmes.

As with everything else, cartoon viewing also has its pros and cons. According to the report titled "The Effects of Cartoon Characters as Motivators of Pre-School Disadvantaged Children," "Cartoon characters stimulate interpersonal behavior, learning and social growth. Children associate with cartoon characters more readily than adults in many cases and tend to retain the lessons imparted more readily." (ehow.com). In some cases the cartoons leave a long lasting impression on the behaviour of children resulting in the formation of flawed personalities. It is again very common these days to see children who demand the kind of dresses and accessories used by their favorite cartoon characters.

The origin of the term 'Cartoon' dates back to the middle Ages. "It was first used to describe a preparatory drawing, fresco, tapestry, or stained glass window." (Wikipedia). By the 19th century, it came to refer to humorous illustrations in magazines and newspapers, and films. From the early 20th century onwards it was used to refer to comic strips and animated films. Since there was a stylistic similarity between comic strips and early animated movies, "Cartoon" came to denote animation, and the word cartoon is currently used to refer to both animated and gag cartoons. "Animation" designated any style of illustrated images seen in rapid succession to give the impression of movement. "Nowadays it is most often used in reference to television programmes and short films for children featuring anthropomorphized animals, superheroes, the adventures of child protagonist and related genres". (Wikipedia)

Department of English

St. Aloysius College, Edathua



UGC Sponsored National Seminar

Dessin Humoristique: Cartoons beyond the Column

PROCEEDINGS



Dessin Humoristique: Cartoons beyond the Column

Edited by

Gem Cherian

Neethu Mary Tomy

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The Indian Hippie from Central Travancore: Juxtaposing the Orient and Occident in *Bobanum Mollyum*

Basil Thomas,

Assistant Professor,

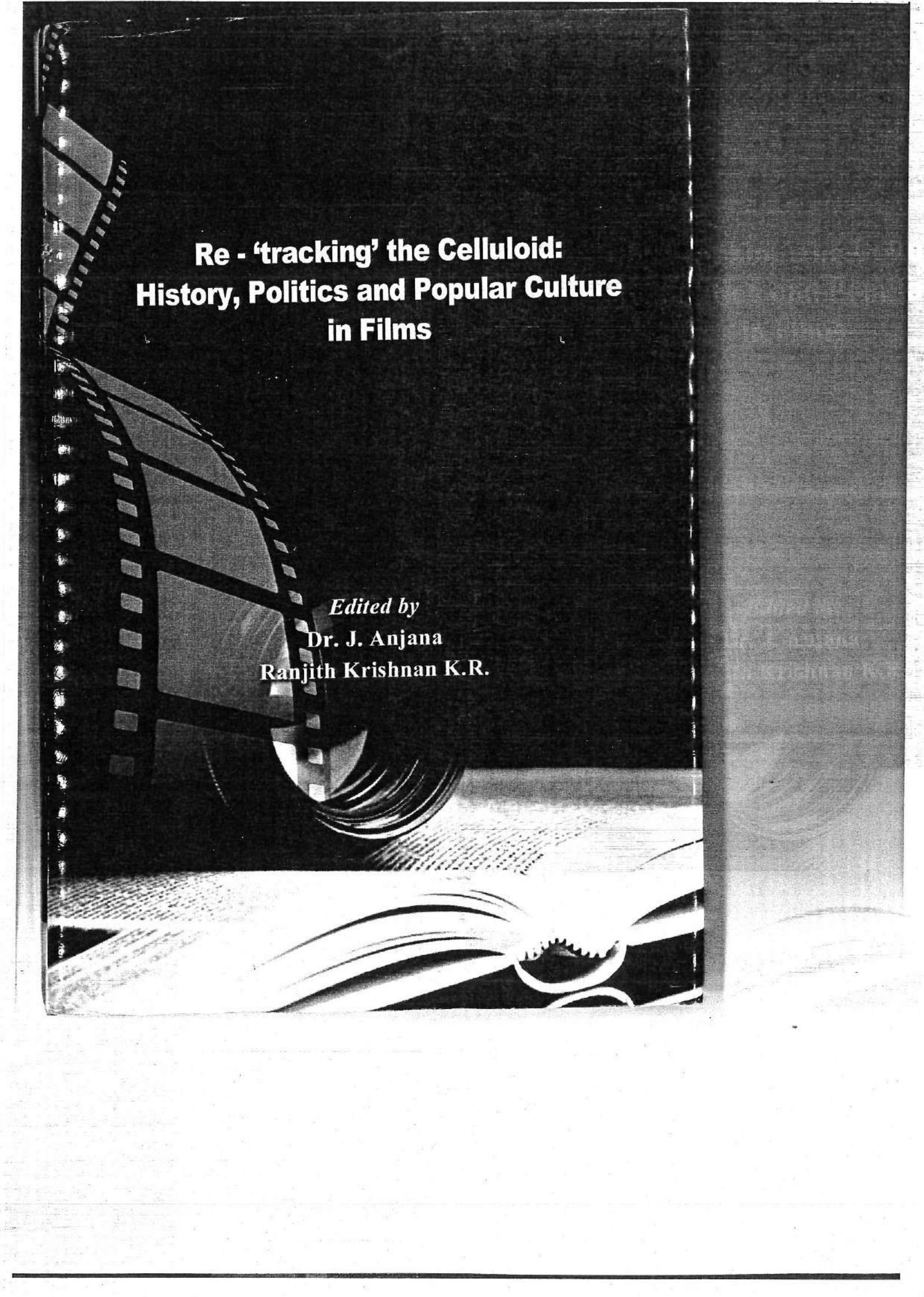
Department of English,

Christian College, Chengannur

Emerged in the 50s and 60s of the 20th century, the Hippie culture found its takeover like 'a west wind' in the world. This made the cartoonist V. T. Thomas, the renowned Toms, frame one character in the background of Central Travancore amidst the evergreen characters like Boban, Molly, Ittunna Chettan, Mariamma Chettathi, Aashan, Pothan Vakkeel, the dog which can be seen with the kids in almost every panel, Unnikuttan et al and baptized him with the local name Appi, which we call Appi Hippie.

Chiefly through the pages of the *Malayala Manorama* weekly, Toms' mischievous cartoon characters Boban and Molly became two domestic names in Kerala for over 40 years. He named the cartoon characters after two children in his neighbourhood, Boban and Molly, who asked him one day to draw their picture. "This took place after these two naughty children thwarted every attempt of mine to prevent them from jumping the fence around my house and walking through the kitchen, on their way to school", explained Toms. When he left *Malayala Manorama*, Toms commenced publishing *Bobanum Mollyum* in *Kalakaumudi*, to which move *Malayala Manorama* objected legally. After a controversial legal battle between *Malayala Manorama* and Thomas, *Boban and Molly* began to appear as a comic magazine called "Tom's Magazine".

Appi Hippie is a village hippie portrayed as a jobless youth who is very much interested in the 'company of women'. The portrayal, however, consummately euphemizes the nature of a typical womanizer. His hippiness apparently happens to be a license to lead a bohemian life free from all sorts of worldly bondages. One is sorry to tell the Income Tax Department that his source of income is unknown because to lead a life of *Carpe Diem*, the skinny hippie needs physical money. Our character, who is 'twice removed' from real hippie, brings to light the idea of original Hippie culture.



**Re - 'tracking' the Celluloid:
History, Politics and Popular Culture
in Films**

Edited by
Dr. J. Anjana
Ranjith Krishnan K.R.

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Bha

Subversive Dismantling of Patriarchal Structures in *Ratatouille*

Jolly Alex

Ratatouille is an ode to an outsider, to an alienated, marginalized creature yearning for recognition and acceptance; deciphering the struggles of an artist who literally rises from a sewer. This movie is a plea for artistic liberty, which when curbed or strangulated, leads to a dismantling of the restrictive patriarchal structures, decentering of power equations and certain major ideological shifts. Remy, the protagonist, struggles indefatigably against the prejudice of the extant power structures—daring to swim against the tide, all the while challenging stereotypical social structures. The movie on a whole is a subversive collage consisting of Remy, the country rat who dreams of being a chef, Linguini the illegitimate son of a chef yearning for acceptance, Collete, the female chef who dared to storm the male bastion and Anton Ego, a notorious food critic, a representative of the arrogant English archetypes. The movie thus celebrates the passionate, aggressive and relentless pursuit of excellence overcoming the moral tug of war between family obligation and individual ambition, submission and subversion, conforming and upsetting the apple cart. This study aims to show how animation movies like *Ratatouille* caricature the society and offer the harshest social commentary on contemporary society.

The hero Remy is garbage-scavenging rat, not by a choice of his own but because of his nativity, for unlike his family members he is blessed with an astute sense of taste and smell. Hence he loathes these garbage-hunting missions and when he broaches this subject with his father who also happens to be the leader of the rat gang, Django's no nonsense reply is, "Food is fuel. You get picky about what you put in the tank, your engine gonna die. Now shut up and eat your garbage". His father repeatedly warns him to avoid the kitchen and of the humans, the two things he cannot do away with. He does confess, "I know I'm supposed to hate the humans, but there is something about them. They don't just survive. They discover, they create....Good food is like music, you can taste, colour, you can smell it".

*Jolly Alex, Assistant Professor,
Department of English, Christian College, Chengannur*

His dad, the patriot poison-detector for the government. In his essay "Invisible subversion and containment: the ideology that subverts the process of socialization in positive feedback to those a potential for contradicting rebels by ostracising them independent saying, "Even at once rubbishes his rebellion are rats. We don't leave out through which the eruption Even in literary and culture of reversal of established them. Remy is a sagacious waters and debates in his mind conforming or subverting one who knows about it is wanting to walk on the safe warns him, "If Dad sees you He rubbishes Emile's disap

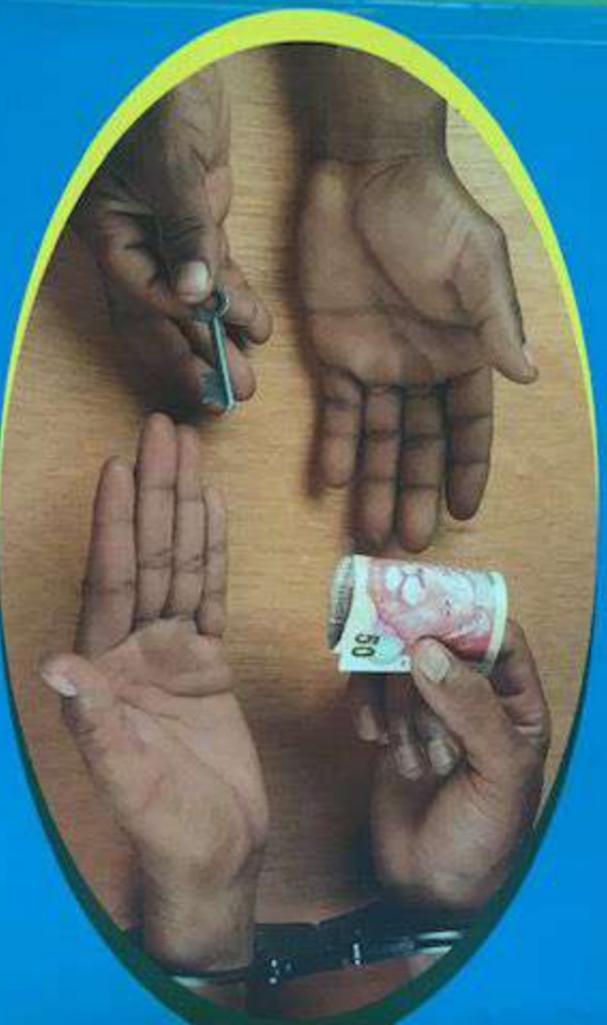
"You could fill a bucket know. You must be imagining may not work out. And you of where you came from. Y

Remy, probably an individual who threatens the dominant authority and hierarchy. These movies challenge and question the perpetuation of oppression, the so-called conformity in its members. A vast majority of the individuals albeit a handful who beg to c

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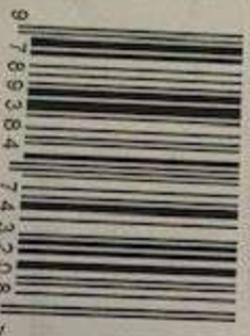
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Perceptions on Corruption

Dr. Biju Thomas

I. INTRODUCTION

Corruption is a behavior that is deviant from normal behavior. It is not expected from civilized persons. There is no ground to justify corruption. There is no religion which supports corruption. No constitution in the world supports corruption. The social and ethical principles of hardly any society support it. That is why, corruption is considered as abnormal behavior. It doesn't mean that such persons are mentally challenged. It is a choice made by the persons involved in it. Corruption benefits the persons indulging in it. But it destroys society. It distorts everything and leads to bad decisions affecting governance and administration.

Every day we hear about corruption all over the world. Corruption related issues have resulted in change of governments; politicians and officials have landed up in jails. Still, the phenomenon is continuing. Globalisation and information technology has not reduced corruption as expected. Every country is now part of the globalised world and uses information technology to the maximum possible extent. Corruption still continues without any obstacles.

• Understanding Different Perceptions on Corruption

Even though corruption is a worldwide large scale phenomenon, academic investigation on this theme is much less. If global warming is an environmental issue affecting the world, corruption is a more severe problem affecting society and governance. As one starts studying on corruption, he is confronted with multitude of definitions on corruption. A review of literature shows that corruption means different things to different persons indulging in corruption. Scholars who study about corruption also have varying views. What is meant by corruption for one person is determined by his perceptions on what constitutes corruption. So, one person's 'deal' is another person's 'corrupt act'. For one person it may be a 'gift', but for another person, it may be 'bribe' (Hough, 2013). This paper is an attempt to bring together the diverse perceptions on corruption and to identify the elements that are common in corruption if any. In particular, it will see how various scholars, authors and the intelligentsia view corruption.

According to Joseph Nye, corruption is a "behavior which deviates from the formal duties of a public role because of private regarding (personal, close family, private clique) pecuniary or status gains (Hough, 2013)." The World Bank defines corruption as "the abuse of public power for private benefit (Hough, 2013)." For the Transparency International corruption is the misuse of entrusted power for private gains. It is the active or passive misuse of the powers of public officials (elected or appointed) for private financial or other benefit according to Organization for Economic Cooperation and Development (Hough, 2013). Although *misuse of official position is the central element of corruption in all definitions* it is difficult to define the scope of official position. For example, bestowing benefits to relatives is part of loyalty in the Arab Middle East and so not corruption. So substituting violation of rules instead of misuse of official position would be helpful.

Edmund Burke has defined corruption in the context of laws of the state. The state exists in society for the benefit of people. Corruption for Burke is the *use of political authority to extent social and economic power beyond the limits set by the constitutional principles for the authoritative distribution of resources and the resolution of societal conflicts.* For Burke, corruption includes neglect of duties or not changing the laws when it is required. Whether or not such neglect is driven by self interest or wish to promote the interest of supporters, it is commission of corruption according to Burke. Whatever be the form, corruption starts at the surface and spreads wider and deeper shaking the very foundation of the system.

For Thucydides, Plato, Aristotle, Machiavelli and Rousseau, corruption was not a particular behavior, but a situation that grew out of permanent inequalities of wealth or political power that erode common moral commitment and institutions which benefit common welfare (Jonathan Mendilow, 2014). In other words, *corruption is replacement of normally acceptable methods of distribution of resources by arbitrary power.*

Corruption is not only private gains made by public officials. Daniel Kaufmann of Brookings institution is of the opinion that the traditional definitions neglect the role of private section in shaping public laws, regulations and agendas or *own interest* (Hough, 2013). That is, 'privatization of public policy.' In modern times, the private sectors lobby



PERSPECTIVES ON BIODIVERSITY OF INDIA



Editors

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and Peethambaran, C.K.**



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r q t p q i r x d x r s r s j t s p g 2 V l i v i n v d p v s d r i i h x s m g p y h i q s v i d v i d w d w
t v s i g i h dr h t p d r i j j i g x r z i g s r w v z d x r s r x l v s y k l t i s t p w t d v x r g r h d x r s r
F r p n k k d t w m s y v o r s 0 p h k i dr h f y n h m k s r w y g g i w w x l v s y k l v g d p n k y t dr h
j y v l i v m z i w q i r x m t d v x r g r h d x s v 2 g s r w v z d x r s r t d v d h r k q w d v i g v n r g d p m
q d r d k m k f rshzai wnx2 jsv p s r k x i v q

Vl i v i n v d r y k i r x r i i h j s v r q t p q i r x d x r s r s j C B D w t v s t s w i h
U v d x i k r g P d r dr h j s v y t h d x m k s j r d x r s r d p w v d x i k r i n w d r h d g x r s r t p d r w E d g l
g s y r x 2 m x l i O s v p h x l i v i j s v i w s y p h O s v o O n d y k i r g 2 x s h i z i p s t w v d x i k r g
d g x r s r t p d r w j s v g s r w v z d x r s r dr h w y w d m d f p q d r d k i q i r x s j f rshzai wnx2
U y w d m d f p q d r d k i q i r x s j s y v i g s v 2 w i q w d r h x l i v r g l p j i O n d m x l i q
v i q d n w s r i s j x l i o i 2 r d x y d p v i v s y v g i q d r d k i q i r x g l d p r k i w V l i w y g g i w w
s j f rshzai wnx2 g s r w v z d x r s r m d r 2 v i k r s r n v p n o i h x s x l i i g s r s q r g dr h v s g r d p
w y w d m d f p n x 2 s j x l i v i k r s r

I r x l n v g s r x i 1 x l r h r d r B r s h z a i w n x 2 C s r k v i w w I B C w i v z i w x s g s q t r n i j s v q d x r s r
s r z d v s y w t i w t i g x r z i w s j f rshzai wnx2 s j l r h r d m i z i v 2 x 0 s 2 i d w V l n v i h r x i h
f s s o g s r w v w x s j v i w d v g l t d t i w t v i w i r x i h d x x l i I B C m g d x i k s v n i h
y r h i v x l i f v s d h x l i q i w A k v s f rshzai wnx2 dr h F s s h U i g y v n 2 B r s h z a i w n x 2
C y p y v i dr h E h y g d x r s r B r s h z a i w n x 2 D i z i p s t q i r x dr h C p q d x i g l dr ki
B r s h z a i w n x 2 D s g y q i r x d x r s r dr h V d l s r s q 2 dr h M i h r g n d p C s r w v z d x r s r dr h
W r p n d x r s r Z i O n d x s i l t v i w w s y v h i i t k v d x r y h i x s d p x l s w i O l s l d z i
h i h r g d x i h x r q i dr h g s r x v f h y x i h t d t i w j s v x l n v t y f p g d x r s r

Z i O i p s q i w y k k i w s r w j s q x l i v i d h i w w

Jyp2

Dv Ydr h d r d U l n d
C l d n t i w s r I B C

r

A B - v - F - m ,

Dzi wi xchrasr dpxpminwsj t p r xw f i s r k m k x s j d q n P s d g i d i m G y r d v x U d x i
A q w x d T B d h l i o d M y r d p w n l J P d v q d v d r h b s k i w V J d w d m

Ti w w d r x k i r i l s q s p s k y i U U T f d w i h d w i w w q i r x s j q s p g y p d v
h r z i w w x 2 d q s r k x l i v i g i r x 2 v i p d w i h z d v i n x i n w s j g s O t i d
D i w t d r h i U K P d x p B T J d k k d p L G K l d h m B M N d r a P M J d r k r h Y K P v r 2 d
K A r k d h m C D d r h U m h i z m O

M s p g y p d v g l d v d g x i w w d x s r s j C G M U q d m x d m i v d r h m f v i h p o n i w
d r h h r z i w w x 2 d r d p 2 w w m P r k i s r t i d C d r d r y w g d r d r L M r p o t
I r h n d P i x g l r d q q d p K M y x l r d l A T d r h J d 2 d q d r m P

L r k d t w m v r g i j d v q m k j s v g s q f d x n k G H G i q w w v s r
d g d v h K Y K d t t v s d g l
U m h l y U d h d r d r h d r T s f i v x C P d r h Y m s h M d x i O

A w w i w w q i r x s j f r s h r z i w w x 2 m O o v d A f i p a j s v g l y w i w g y p r x y w L
M s i r g l G i v q t p d v q
U m h l y a s p P d r h M d r i y P

E r w y v m k j s s h w i g y v x 2 m K i v d p d V d t t m k x l i f r s h r z i w w x 2
m v r g i d r h x y f i w w
U y h l d B B v r h k r x V K G r p d B d n E B d r h U y q d P d y s w i

I r w w y g s r w i v z d x s r s j I r h r d r g s O w A g d w i w x y h 2
U y q d r k d p B l d x K B l d x T T d r h K v m r d q s s w l 2 b B

P l 2 s k i r i x r g h r z i w w x 2 m k i v q t p d v q d g g i w w s r w s j
P i d v p q p p x P i r r m i x y q k p y g y q L T B v
U y q d x m P K y q d m Y m s h l d r d M U d x l 2 d M d r h Y i i v d f l d h n d r P

B - C v - E - , v

F s v i w x f d w i h j i w w z d p v s j x l i C l s x d r d k t y v P a x i d y d i d w I r h r d
A v g l d r d B d r i v i i

B r s h r z i w w x 2 w y h r i n w s r x d h r a s r d p t d h h 2 w v r q t j d v q m k
v 2 w i q s j K d r t d h m r s v l K i v d p d
D m i v d r C l i v y z d x d r h c d g l d r d w Y J

T s p s j t p r x h r z i w w x 2 m x d h r a s r d p v n y d p v d r h g y w s q w s f w i v z i h
f 2 t v i k r d r x q s x l i w s j B v d l q m g s q q y r n 2 m K i v d p d
M m n N Y m 2 d r U s t l r d P i v i n d

Pdwxgrndxs v2 t pdxjsvq wjsv xki v gsr w vzdxsr Ar syxi dgl
dki rhd jsv i hygdxsr d0 dvi ri ww dr h t dxvgrndxsr

A gdw wxyh2 dx Bl dhvd Vrki v Ti w vzi

Pajpazmw dr h Ldpxd Mdl dvr d

Pl 2xshzi wnx2 dr h vs grn gypvdpwyhrinwsj xli vdgvi h kvszi w
m Mdl i Ww sj Pyhygli w2 Ir hrd

Udwadpd K Pvdhi i toyq dv G Hdvnlp CC dr h Tdzrnhdv CP

A gsqt dxdzxi dggsyr x sj xli i rhi q rgt pdr xwm vdgvi h kvszi wsj

Kdvdvdksh Kdr ryv dr h Ks3l rashi hnxvrgxwsj Ki vdpd

Uyf vdl q dr2d Pvdvdlh K dr h Tdzi i rhvdv K

B - D v - C v , v

lq t dgx sj gpa dxi gl drki sr xli t lirsks2 sj xiiwsj Gyrdvdx

At dvr d Tdxl svi dr h bski w V Jdwdm

Bshzxi wnx2 dr h wywdmndf p ywi t vdgxrgi wsj jwv i vqir gsqqyrnx2

dx Gshdzdvmzxi v i wydvni i gsv2vxi q Arhl vd Pvdhi w Ir hrd

At dvr d U dr h Tdrd Uiol dv PU

Pvs wt i gxwjsv f rshzxi wnx2 gsr w vzdxsr m gpa dxi gl drki

dgxsr t pdr wsj Ir hrd

Azdr xnt2s2 Bdvw

Fpsvnxrg hzxi wnx2 dr h dws grdx h jdyrd m d l rkl dpxyhi

xsyvnc hi wmxndxsr sj Zi wiv r Gl dxw Ki vdpd U Ir hrd

Bvnpdr x Tdrdr Ymg2 Mdv2 Ydvkl i w Jsf2 Pdyprh Pvdhi i toyq dv AP

Bshzxi wnx2 dwi wq i r x sj jzxi hrjji v i rxi gsvxi wsj Aw xdq yhmloj

Vli w gsr h pdvki vx Tdq vdv vxi m Ki vdpd

Di zntk Bdpdr Ap1dr hi v V Nd2dv MP dr h Ul dmmPK

Di zi pstqir x sj wywdmndf p pzi phssh w gyvnx2 mhi1 jsv xli

pdvki vx Oi xdr h sj xli Zi wiv r Gl dxw Yi qfdr dh sj Ki vdpd

Tdr rdr Mdx i O Ydvkl i w

Bshzxi wnx2 Csr w vzdxsr dr h Egsxsvnc hi zi pstqir x

Kvnr d Pvd t dr h AmxKyq dv KG

Ut dxrdpdr d2wvwsj gdr st2 gszi v dr h l i vndki xiiwm Ldxf dkl

Bdr kdpsvi A GIU dr h vi q sxi w r vnk dt t vs dgl

Lsr i pUyrd2 Ydrpv i v2 dr h HdvmnNdki rhvd

Akvs gli q rgdpgsr xdq mndxsr dr h nxvrg t dgxwsr kvs0xl dr h wyvzrdp

sj Vdht spwsj xli vi Aryvdr Aq t l rhrdr w

Mi vg2 Mdx i O

Dsi wgs vdpq sr nxvnk l i p m rqt vszi h q dr dki q i r x dr h vi wvnr gi

Udr r d Dyvkd t t d D dr h Di i t xl nHi f f d p

A wxyh2 sr jpkal x dgxrnx2 dr h fil dzrnvdpr dxyvi sj fyxi vj2

wt i grnw m yvf dr l df naxwsj Bdr kdpsvi Kdvr dxddod Ir hrd

Ul dw rayq dv L

Z dxi v uydpx2 sj Avyzrnodvd Ddq Vl myzdr dr xl dt yvdq

hnxvrgx Ki vdpd

Ul rhy Kvnr dr K dr h AmxKyq dv KG

Vi q t s v d p y f d r z i k i x d x r s r t d x i v r s j M y q f d m y w n k w d x i p p x i h d x d
Ul n n n i K y q d v d r h M A M s l d q q i h A v d q

P d p p o d v r d m O i x d r h A u y d r h d v 2 f i x O i i r f r s h r z i w n x 2 g s r w i v z d x r s r
d r h y v f d r h i z i p s t q i r x
U v h i z n k d v t d k d z d p n M D l d r 2 d P d r h T d q d g l d r h v d r A

E j j i g x s j V V P i j j y i r x w s r x l i f r s p s k r g d p t v s h y g x z n x 2 O n d i q t l d w w
s r f r s h r z i w n x 2 d x Y i p r g s d w x W n z d r h y q

Y n r y U T d n U y h d r d r h l Y U U l r h y T T d x i i w K y q d v M F d n d p A K A r q d p K
Y r q i l i r Y A r i i w K U B d n y T U B i r r s P i v i n d F G d r h A r s s t K v n l r d r K

E w w q d x r s r s j x l i i g s r s q r g z d y i s j V l i r q d p d

E g s x s y v n q P d v o K i v d p d

U y v d r A f v d l d q A v 2 d d P d r h B r n n A f v d l d q r d r K

B - D , v v - n v

M s p g y p d v g l d v d g x i v r 3 d x r s r s j x l i i v t i g r i n w s j C p d v r d w

P n g i w U n y v i n s v q i w C p d v n h d i y w n k T A P D q d v o i w w

A r i i w d D i z d w 2 L m y M d x i o P d h q d o y q d v K G G s t d p d o v n l r d r A B d w i i v Y U
d r h T d n K y q d v

H d f n a d r h l d f n a d x w y h r i n w s r O v n p d x d q d v d N i v z n d d v d k s d r d G d y h
A r y p d o w q n U d r o d v M m n i d n N 2 f i E Y d r h D i i t d E V

O v g l r h w s j Y i p n k n v n H n p v N n k n v B r s w t l i v i T i w i v z i U y v z i 2 d r h
f r s i x i g l r s p s k r g d p d t t v s d g l i w j s v x l i g s r w i v z d x r s r s j A t l 2 p s v g l n v
q s r x d r d T g l f j

N d v q d x l d B d m Y G s t d p d r T M d l i r h v d r G d r h U d v d r 2 d B

I r z d w r z i d p i n r t p d r x w d p s r k x l i l x l n o d v d v r z i v f d r o w U s y x l i v r
Z i w i v r G l d x w

A v d z n h M M d h l y v s h d r d r P n p d m G d r h A n n A V

I v s p d x r s r d r h g l d v d g x i v r 3 d x r s r s j L 2 w n n r f d g n y w v t l d i v r g y w D U L U
j v s q q d v n i v t s r k i

P v d z i i r d P s x l y v d y L d o w q m B d p d v y f n d q d r m U s y r h l d v 2 d Y n d q w i x m A q d i r h v d
K d r h d v d q 2 D l i z i r h v d r d r h T d q d g l d r h v d r U d v s m n n U d r x l s w

D r z i w n x 2 s j w i h t v s h y g n k t p d r x w n n A w v d q I r h r d

B d v s s d l C l j x a l i v A l q i h d r h T y t d q U d r o d v B d y d l

M s r n s v n k x s d w i w v t p d r x h r z i w n x 2 m x l i w y w s y r h n k w s j K M M L
n h y w x v d p d i d m C l d z d v d K s p d q h n v v r g x U s y x l I r h r d

B i i r d K N d r h J d 2 d D U

A w y h 2 s r x l i Y d 2 d p v s j M y h y q d p d v r k i v T i w i v z i A y r n a y i O i x d r h
i g s v 2 v x i q

B r n n d d P y w t d o d v d r d r h G s t d p d r T

E l w n y g s r w i v z d x r s r d r h i z d y d x r s r A q i x l s h j s v w i p g x r s r

s j n h r k i r s y w z d v i n x i n w s j q d r k s

Y d v y k m C D i n i w M T T d z n l d r o d v K Y d r h C l n d n d g l i p d r T

C y p y v i f d w i h s f w i v z d x r s r s j f i r i j n g r d p q r g v s s v k d r m q w j v s q
v t i g r i n w s j F r g y w v 2 g s r n d

Y n d 2 d o y q d v m W d r h V l d q r 3 l w i v d r N

Ms p gypv q dvo i v f dwi h dwi wvq i r x sj gsgsryx ki ri xrg
hrzi wv2 m UvnlDr od

Ddvdr d2dod PN Ezi vdh JMDV Kdvr dr d2doi EH drh Z i i vdwrd OYDUJ

Drzi wvnh vs p sj hi xs1 r2mk i r 32q i w m r q t dxrnk vi wvdr gi
m Pp xi p2l 12ps wv p2l L dkdmv x jpyf i r hrdq rhi

DrndpB Bsvodv Tdx sh DT Bdkhi YL Myrri UU Msl dvp MP drh Msl sh UB

Dvrvfhyxsr sj q dvmi Agxmsq 2gi xi wdpsrk xli Usyl
Arhdq dr gsdx

Uyq nd d Gst d2lovnr dr JdmUyr hi v Yiry U Tdrri i x K drh Uyi w oyq dv U

Cs p gxr sr gsr w vzdxsr drh gl dvgxi v3dxsr sj Jdvcq mi x2ti w

GdrkdM Jd0dl dvpM Kdr dr M drh Tdr gl dr d P

Irzi r xsv2 sj jps wvrg hrzi wv2 m t vs xi gxi h dvi d sj xvst r gdpjs vi wv
sj Awvdcq rsvxi dx Ir hrd

Gndq dr ndyxdr drh Aw d2dx Di zm

Cywi r xwcdxwsj w p gxi h i r hi q r g vt i grinwsj Kd2lodh Myr hdr xl yvdm
Vrhi v Ti w vzi KMVT Vdq r p Ndhv

Awroyq dv G Udvdr 2d B drh Gst d2dr T

A wv h2 sr l 2hvs gdf sr hi kvdhrnk q dvmi Agxmsq 2gi xi wjvsq
gsdwdp dvi dwsj Kdr 2doyq dvm Dvrvrgx

*Cl dr hvdnd CY lq q dryip G Udrkii x d YU Gvi w q d UW Aryt d MP Uldf m
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Udp0 dxi v Cvs gsh r p Cvs gsh 2p w t s vs wv w Ugl ri rhi v Ti t x p d

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Vli hrzi wv2 sj i dvl Osvq vi vs yv gi w m xli gi r xvd p Ki v d p d

wvxi xgl sj Zi wv vr Gl dxw

Jd2d Mdr d3l 2 Ard Mdr d3l 2 drh Ym2doyq dvdv Ndm K

Fvi w O dxi v q d p g s j d y r d sj H2hi vdf dh Arhl vd Pvdhi w

Kdvyx dt dr hmM drh Tds DY

Hsqi kdvi r drh mvi gx wv h r i n w m Bdr kdps vi Ir hrd

Mdhl yq nd d Jdk dr q sl dr Lsr i p Uyr d 2 Ydr p i v2 drh Hdvmr n Ndk i r hvd

U2vxi q dxrg wv h r i n w s r q s w i w s j U s y l i v r Z i w i v r G l d x w

m Ki v d p d Ir hrd

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Ut dx r p d r h xi q t s v d p z d v d f p d m xli s ggywi r gi sj q r g v s d p d i

dx Cl d p o o y h 2 v r z i v f d w m Z i w i v r G l d x w K i v d p d

Msl dq i h Ndwi v KM drh Uyi w oyq dv U

Vii vt i grinw hrzi wv2 sj Grhf sr Z r h p j i Udr gxydv2 Awvdcq drh n w

gsr w i v z d x s r t i w t i g x r z i w

Ms y q nd Udvodv drh Aw d2dx Di zm

Ezi vki i r jsvi wv A l s x v t s x s j v d i i r h i q r g drh xl v i d x i r i h

x i i w A w v h 2 j v s q Z d 2 d r d h D v r v r g x

Ndr h d o y q d v M J d 2 i w P J s w i t l J r x m M M Y s p k d Y T M m m Y

Aw d 2 x l d P K drh Ar r o y q d v N

P p r x i r h i q m q m x l i Z i w i v r G l d x w d r h r h i r x i n g d x s r s j g m r g d p

x i i v t i g r i n w d r h l d f n d x w

Nd2dv MP

Birxl rg jdyrd drh Odx v uydpx2 t dcdq i xi wmn Cdr s mCdr dp
Vl vnyv hmvrgx Ki vclp
Nrg ml d P drh Uliif d U

Ori ri O drh vsqi orsOr vt i grinwsj Dsv2pqlq s rhi d Ni q dxshd
dwsgraxi h Oni Gydzd jvsq Zi vx Bir kdp Ir hrd
Dif d f vdx d U r

Fdyrd sj Dsvstl rnh jpinw Dtrxi vd Dsvstl rnhdi dx Ndr hmHmpw
Kdvr dxdod Ir hrd
Pvdr i w Uyr2q i ir hvd DU drh Hdvm mBP

Pdxi v rwsj fyxi vj2 hrzi wnx2 m xl vi i xvst rcdpl df ncdxwsj
xi Edwi vr Gl dxwm Usyxi vr Arhl vd Pvdhi w
Pvdvdr r d Kyq dv Y Hdvdxl P Mii wdf dmG drh Yir odxd Tdq dr d U P

Cv2sf dr omk drh wyv dndf p yxndxsr sj 32ksxrg i q f v2sw
sj dr i gsr sq rg vdxdr t d q Cdqlq ywx O dxi w mBi gg
m Usyxi vr Zi wixi vr Gl dxw
Pvix d VU Hi q dr xl doya dv AU Kvm r dr PN drh Uir nU

Ut dxi s hi d gdq t dr ypxd dwd f rsi mhr gdxv sj jdyrd pf rsh rzi wnx2
dx Kdrkd Kdvr dxdod
Pyxvdvly K drh Hdryq dr xl dcd2dt t d UK

Uxyhrnwsr hrzi wnx2 irhi q m q drh vdx2 m xli ki ryw l q t dxnr w m
Usyxi vr Zi wixi vr Gl dxw
Tdq dwy f fy T

Giskvdtl rcdphmvrfyxsr tvi w r x wdx yw dr h gl dcdxi v mrgw dr h
li q dxs sk2 sj Md p dh Grhhd gdxp Ar yr n ayi h0 dvj gdxp sj
Zi wixi vr Gl dxwm Kdvr dxdod
Tdq i w d KP Ji 2 dbyq dvU Kdx d x d p d i MA Ddw DN drh Ndk d v d n KM

Ar mzi w r k d x s r s r t l 2 x s t p r o x s r g s q q y r n 2 w x y g x y v i d r h
vt i grinw hrzi wnx2 d p s r k Usyxi Oi vx gs dxv sj Ir hrd
Tdx i i w Kyq dv M U l r h y T U y h l d r d r h l Y U Y m r y U T d n F d m d p A K Y r q i i r Y
A r q d p K A r i i w K U U s s v d n K v m r d T B d n y T U d r h A r s s t K v m r d r T

Ar d f s v i x y q j s v x l i i r h i q r g d r h i r h d r k i v i h j p s v d s j x l i N r k m m
B r s v t l i v i T i w v z i d x A r d r o d x m C s r q f d x s v i V d q r p N d h y I r h r d
T d x l m d v d f d t d x l 2 B d r h K y q d v d k y w A

A v i t s v x s r x l i t s t y p l x s r x i r h w s j f y x i v j p i n w m x l i
f y x i v j 2 k d v h i r d x N r o d q f y v K i v c l p I r h r d
T i z d x l 2 Y U d r h G i s v k i M d x i O

Csrw v z d x s r s j c i y l m i j p z d O v g l r h d g i d x l v s y k l x m v y i g y p y v i
H i O d k i U d r h U i r d v d x l Z V P U K

Uxygyxvi drh jps v m r g g s q t s w n s r s j x i i h r z i w n x 2 m A r h d q d r
U i q n E z i v k v i i r F s v i w s j U s y x l A r h d q d r I r h r d
U d v z d r d r U T d z r g l d r h v d r K B d p v y f v d q d r n d r A P d r i i w i p z d q K M a l l i w U
U d x l m l o y a q d v P Y i i v d q d r m V d r h Y m 2 d v d k l d z d r A

Ovgl rh hrzi wnx2 sj Zi wixi vr Gl dxw Csrw v z d x s r s m n r d x r z i w
U l d v i n j M W

B r s h r z i w n x 2 s j f i r x l r g v t i g r i n w m K d z d v d x m L d k s s r
d g d w i w y h 2 j v s q

U l r h y T U y h d r d r h l Y U Y m r y U T d n T d x l i i w K y q d v M F d m d p A K A r q d p K
Y r q i i r Y A r i i w K U B d n y T U U s s v d n K v m r d T d r h A r s s t K v m r d r K

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Ul rzdr nAk dV0 dpLsr i pUyrd2 Ydrpvi i v2 Mdhl yq n1 dJdkdr q s l dr dr h HdvmnNdk i r hvd

Pi vrnl i vpl di q dxs k2 sj xli wygoi vq syxl dvq syvi h gdxjw

H2t s wxs q ywt p gs wxs q yw

Ul 2r mGB dr h Tdhl dovnr r dr U

Brshrzi wnx2 dwi wq i r x sj w d0 i i h vi vs yvgi wjvs q

Kyhdr oyplq Csdx Gyp sj Mdr rdv Usyxl i dwi vr lr hrd

Uvmrdvdr M dr h Gr dr dq s s w l 2 P

lrzi wnx2 dwi wq i r x sj dr xmnjplq q dxs v2 dr h dr dki wq i jji gxwsj

dr i l xvdgx sj ni p2jw Cl v2vds vd uymuyi gml d

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Avl vstsh f rshrzi wnx2 m Gps vsvd wyt i vf d Lmr

Vli wdx i jps Oi v sj Vdq rpNdhy

Uykdr xl 2 M Ndand N Udoxl rzi p P dr h Ymrd2doyq dv T M

Dzni wnx2 sj shsr dxi wdq srk w p gxi h yvf dr wyvdr h js vi wi h

dvi d m Csrg f dxs vi

Uyl nrd d Myl rp M dr h Pvdq sh P

Brshrzi wnx2 sj t l 2ps wt li vi jyr kmsr Azrgi r r rd q dvmnd jvs q

q dr kvszi wri dv Mdvdodr dq Kdr gli i t yvdq hmvrgx Vdq rpNdhy

Edvx gs dxs sj lr hrd

Vdywvj Td3d dr h Udvq d YY

Ui vnf rshrzi wnx2 sj l swt pdr xwm lr hrd

Vrdhi v A dr h Udvdxgl dr hvd B

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i gsr sq rdp2 dr h q i hrgmdp2 r q t s vdr x t pdr xw

Jdol mPU Kdpodv UK dr h Jdkxdt DK

Ezdy dxsr sj t l 2xsx1ng t s x r x r d p s j Myvd22d osi r r kmL dr h

Bdq fyvd xyp d Ts1f duy i syw p dj i l xvdgxwsr Ldgxygd vdxrd L

Mi i vd l Urzd Kyq dv CY dr h Cl dr hvdodat G

Cs p wsvdki vi kvs 0 xl dr h kiri xrg wdf npx2 dwi wq i r x m Bdgst d

q s r r r nmL Ar A2yvzi hrg r q t s vdr x q i hrgmdpt pdr x

Jsi Ynk m Ldkrd M Ldoodoypd Udxw dr h Tdq i w M

lq t dgx sj hs q i w r dxsr sr t l 2xsgli q r d p g s q t s w xsr sj xli

q i hrgmdps vgl rh Ji i zdos q Ui rhi r jrd v l i i h m v 0 U3ogl

MmmTdn N N2fi EY Aw d Udr odv M dr h Di i t d EV

Brshri wri m Pp q f dks 3i 2pdr rgd Lmr
Ndand L Uykdr xl 2 M Tdrdq dr mk Ym2doyq dv T M dr h Aq q ddr M
Tsyxni p t vdgxgi h Osyr h li dprnk t pr xwf 2 ps gdpvrfndpsj Cl l mh0 dwd
hmvrqx sj Mdhl 2d Pvdhi w
Nral rKdr yr ks

Hi vf wjsv dpr h li dpr jsv dpr Eq ts 0i vnk wydp0sq i r m t vrg dv2
li dpr gdvi yxprnk ps gdpf rshri wri
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f i l dznyv dr h f n gl i q rgdpgl dr ki w m Cdxl ddr xl wvs w ywLmr
A q i hrgndpl i vf
Udvzdr dr U Kdvl mU Udvdr 2d U dr h Jd2dvdn T C U

Ezdydr sj dr xrg gi vdgxri sj xOs q i hrgndpt pr xwjsq Z i wi vr Gl dww
Ym r y KY Pdvzxl 2 P dr h Jypin Jdgsf

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Volume I**

Biodiversity, the variety of genes, species, and ecosystems that constitute life on Earth and the intricate interrelations of living creatures and the environment that evolved along with time, is the basis of human development and sustenance, as it ensures the sustainability of life support systems- air, water, and food, besides the scope for future values, which remains unknown for many species. Moreover, the cultural diversity of India is too closely linked with the rich natural capital of the country. This book provides perspectives on biodiversity of India through 95 research papers, presented under themes such as Agro-biodiversity and Food Security, Biodiversity; Culture and Education; Biodiversity, Development and Climate change; Biodiversity Documentation and Taxonomy and Medicinal Plant Conservation and Utilisation. This is will be a useful reference book on the status and trends of biodiversity and taxonomy in India and provides latest scientific knowledge on biodiversity of India.

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Estimation of the Economic Value of Thenmala Ecotourism Park

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ABSTRACT

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Travel Cost Method

Forest biodiversity is often subject to degradation due to the absence of well functioning markets. Economic theory postulates that one way to prevent this is by generating awareness among the public regarding their importance and value to mankind. If correct estimates of the economic values of ecotourism parks and forest resources are not made, it is difficult to calculate and generate sustainable revenue from internal sources to support the endeavors needed to be made towards the protection of forest biodiversity. In practice, economic values of forest resources are rarely examined with appropriate scientific approaches. The Thenmala Ecotourism Park which is part of the Shendurney Wildlife Sanctuary was intended as a small scale alternative to standard commercial tourism, which would generate sufficient revenue for forest biodiversity conservation and management. The current study attempts an economic valuation of the Thenmala Ecotourism Park using the Travel Cost Method. The total annual benefit generated by the Park was estimated at Rs.4.42 crores. A comparison of the recreational benefits of the Park and the actual revenue collected by the Park authorities indicate that the project underestimates the true value of the ecosystem services provided by the park and that it may be possible to further augment the actual revenue collected from the Park, which could be reinvested in improving the quality and the conservation of the site.

1. Introduction

As part of the Agasthyamalai Biosphere Reserve, the Shendurney Wildlife Sanctuary has an important role to play in conserving the rich biological diversity of the Western Ghats. The significance of the Sanctuary lies in its ecological, faunal, floral and geomorphological importance. The sanctuary comprises three zones namely the Core Zone, the Buffer Zone and the Tourism Zone. The Core Zone is a protected area rich in biodiversity, where all forms of anthropogenic interference is regulated. It supports

prime wildlife habitats and dense vegetation. It is a treasure cove of plant diversity with nearly 951 species of flowering plants of which 309 are endemic to the Western Ghats, 245 species of avifaunal wealth including migratory, endemic and endangered species, unique vegetation, and the watershed of the Kallada Reservoir. It is situated in the eastern portion of the sanctuary extending over 75.5 sq. km. (44.2% of the total sanctuary area). The buffer zone covering an area of 47.13 sq. km. (27.6%) is sandwiched between the core zone in the east and the tourism zone in the west

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This zone consists of human inhabited areas (Rosemala, Kallar and part of Rockwood estates) which pose serious conservation problems. Controlled pilgrimage during holy season and regulated nature trails are allowed in this zone. The west coast semi-evergreen forest of this area is in a stage of degradation. Regulated tourism is permitted in the Tourism Zone which covers an area of 48.35 sq. km, (28.2% of the total sanctuary area). The entry point to the sanctuary and a major portion of the reservoir falls in this zone. The Thenmala Ecotourism Park operates in this zone (Shendurney Wildlife Sanctuary Website).

Eco-tourism involves travel to locations where flora, fauna and cultural heritage are the prime attractions. Greater appreciation of natural habitats and an insight into how natural resources and the environment can be used for tourism-related activities while causing minimum disturbance to the environment, is possible. They are often seen as a low-impact, small scale alternative to commercial tourism, undertaken as a marginal activity to finance protection of the environment. Eco-tourism discourages mass constructions of hotels, tourism resorts and mass activities in fragile areas. Due to

these reasons, eco-tourism often appeals to advocates of environmental and social responsibility.

In Kerala, eco-tourism is still in its developing stages. Apart from Thenmala, eco-tourism activities are associated with many forest and wildlife sanctuaries in Periyar, Parambikulam, Eravikulam, Aralam, Neyyar, Peppera, Arippa, Gavi, Chimmini, Mankayam, Palaruvi, Konni, Thommankuthu, etc. Thenmala attracts both foreign and domestic tourists. The Thenmala Eco-tourism park area comprises three major zones, viz. the Culture Zone, the Leisure Zone and the Adventure Zone. Eco-tourism activities such as small nature trails, riverside treks, elevated walkways through canopies, mountain biking, boating in the Sanctuary reservoir, boardwalks, tree top huts and children’s eco-park, etc., are its main attractions in addition to a Deer Rehabilitation Centre and Butterfly Safari Park. They are organized around the periphery of the sanctuary so that the pressures of tourism does not affect the sanctuary, yet it generates sufficient revenue for sustaining the park. Fig. 1 below gives a zonal map of the Shendurney Wildlife Sanctuary including the Thenmala Eco-tourism Park.

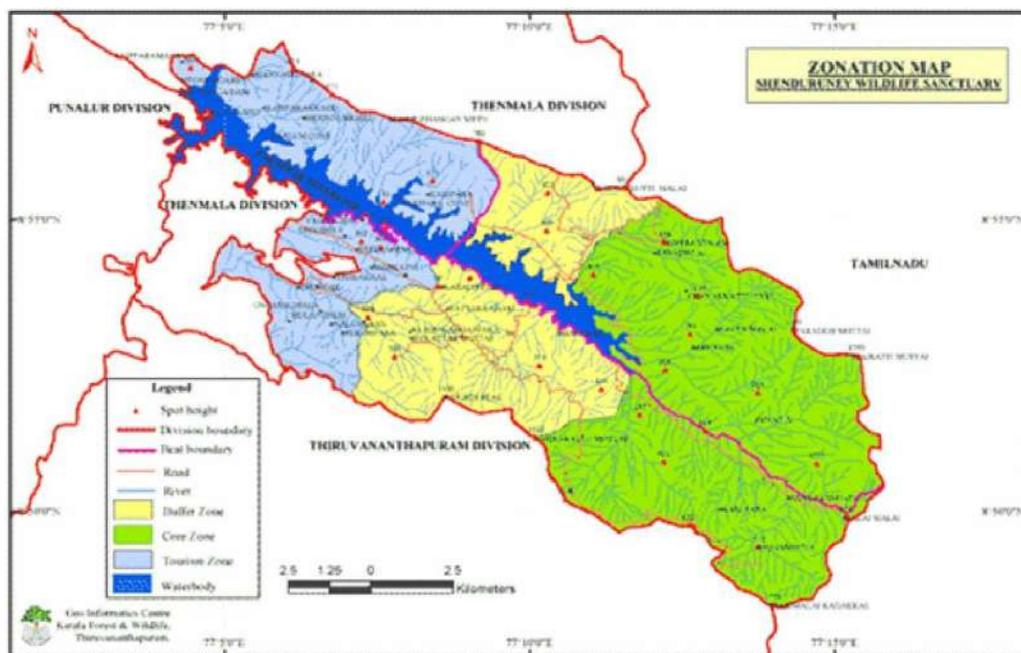


Fig 1. Location Map of Thenmala Eco-tourism Park

Environmental economics postulates that natural resources are often subject to degradation due to the absence of well-functioning markets that reflect the true value of natural resources. Economic theory states that one way to overcome this deficiency is by using proxies to estimate values for the benefits provided by such resources and incorporating these values in their respective resource use pricing. This would help create markets, though not well-functioning ones, which would reflect resource values and help prevent resource degradation. In this regard, environmental valuation tools are helpful in providing a first insight. No attempts have been made so far to document the recreational benefits provided by the Thenmala forest ecosystem. Accordingly, the study attempted to estimate the recreational benefits provided by the Thenmala Eco-tourism Park and the individual willingness to pay of visitors for enjoying the recreational benefits provided by the park using the travel cost method.

2. Materials and Methods

Based on the theory of consumer demand, the fundamental principle of travel cost method is that the value people attach to a location of environmental significance can be inferred from the cost they incur in travelling to the site and in their willing to pay to use it. It is a revealed preference method, since it uses actual behavior and choices to infer values. This is similar to estimating peoples' willingness to pay for a marketed good based on the quantity demanded at different prices.

2.1. Assumptions of the Model

The Travel Cost Model was based on the following assumptions:

1. The total travel cost is the sum of the monetary value of round trip travel, value of on-site and out of pocket expenses (other expenses).
2. Opportunity cost of time was considered only in the case of individuals who gave up working time in order to visit the Park. (In such cases, the shadow price of travel time and on-site time was valued at one third of the hourly wage rate. For others, the opportunity cost of the time spent on the visit was assumed to be zero).

3. Respondents on multi-destination trips were not considered in the study.
4. Other cost such as 'Out of Pocket' expenses incurred during the trip for food and beverage, photographs, passes, sightseeing and recreational activities, etc. were included in the travel cost.
5. Prices and quality of substitute sites were not considered for want of perfect substitutes.

2.2. The Model

A Zonal Travel Cost Model was used in the present study. According to the respondent's place of origin and distance from Thenmala, they were classified into three zones. The basic travel cost model used is specified below:

$$V_z = v(C_z)$$

where,

- V_z = the number of visitors from zone z, per 1000 zonal population
- C_z = the average total cost for visitors from zone z, including the time spent in traveling to the site, the time spent inside the site and the value of the individual's time.

The population for a travel cost method research consists of either those who visited the site during a given period or people expected to visit the site within a stipulated period (Ward and Beal, 2000). Visitors are broadly defined as those who use the Thenmala Ecotourism Park for various recreational activities. Thus an individual who lives by the Ecotourism Park is treated as a visitor if he spends time there deliberately for recreation. The visitors to Thenmala Ecotourism Park were classified as local tourists, visitors from other districts of the state, those from other states and foreign nationals. However, foreigners were not included in the survey. A distinction was made between residents and non-resident visitors to account for visitors on multi destination trips.

The study made use of a Travel Cost Questionnaire to collect primary data. Only adult visitors, who had a definite source of income, were interviewed since they were considered to be more realistic in making personal valuation of their recreational experience. The visitors were randomly

chosen for the interviews using questionnaires from 514 visitors during the months from April to July. The survey was conducted on weekdays and weekends during peak and off peak seasons. Secondary data was collected from the Administrative Office of the Thenmala Eco-tourism Park and from the internet.

The zonal travel cost method was employed and zones were defined on the basis of administrative divisions for the sake of convenience. The districts of Kollam and Thenkasi (Tamil Nadu) were taken as the first zone. Thiruvananthapuram and Pathanamthitta districts were taken as the second zone and the remaining districts of Kerala as the third zone. Information was collected on the number of visitors from each zone, and the number of visits made during the year. Visitation rates per 1000 population was calculated for each zone. Average round-trip travel distance, travel time to the site from each zone and travel cost per trip was also calculated. Regression analysis was used to relate visits per capita to travel costs and other important variables. From this, the demand function for visits to the site, from each zone was estimated.

3. Results

Analysis of the travel cost data indicated that visitors greatly valued the recreational benefits provided by the Park and its forest ecosystem. The visitation rate shows the average number of visitors per thousand that are expected to visit the Park during the year. The data on total visitors from each zone³ was divided by the zonal population and multiplied by thousand to arrive at the visitation rate

for each zone (Visits/1000). As expected, the visitation rate from zone one was greater compared to the other two zones (Table 1).

3.1. Zone-wise Travel Cost

Total cost incurred by each visitor per visit comprised cost of transportation, entrance fee, and miscellaneous expenses including cost of food. Hanley and Splash (1993) argued that the cost of transportation is the 'cost of distance traveled and so the cost of the trip must be calculated either by using petrol cost only as an estimate of marginal cost, or using full cost including an allowance for depreciation, insurance etc' but calculating the full marginal cost of motoring is difficult. Most studies reviewed, argued that the cost used in a TCM should be consumer perceived costs rather than the actual cost (McConnell and Ivar, 1981; Navrud and Mungatana 1994; Shammin, 1999). Hence this approach was used in the present study. Table 2 below shows the total cost incurred by visitors from each zone.

Table 1. Distribution of Visitors per Population by Travel Zones

Zone	Total Visits/Year	Zone Population	Visits/1000
1	17338	5333195	0.325
2	26761	4502821	0.594
3	77735	26255153	0.296

Source: Thenmala Eco-tourism Park Administrative Office, 2012; Census Data, 2011

Table 2. Zone-wise Travel Cost

Zone	Cost of Transportation (Rs.)	Entrance Fee (Rs.)	Food & Miscellaneous Expenditure (Rs.)	Total Cost (Rs.)	Total Cost/ Individual (Rs.)
1	8700	3420	2000	14120	706.00
2	27750	4210	19670	51630	1475.14
3	264200	11590	11380	287170	3121.41

Source: Primary Survey, 2012

It was observed that the major component of cost was transportation cost. Expense on food and other items was comparatively less except for visitors from zone III.

3.2. Regression Analysis

Regression was carried out on the zonal model with the average cost per trip from each zone as the independent variable and the zone-wise visitation rate as the dependent variable. The results of the regression are given in Table 3.

3.3. Demand Function

A demand curve for visits to the site was constructed using the results of the regression analysis. In this model, the equation was estimated using travel cost and visits/1000.

$$V_z = 58.67 - 0.099C$$

where, C = average total cost for visitors from zone z,

Table 3. Regression Analysis Output (a. b. c)

Regression Statistics (a)	
Multiple R	0.99
R Square	0.98
Adjusted R Square	0.96
Standard Error	2.36
Observations	3

The first point on the demand curve is the total visitors to the site at current access costs (Rs.40) which in this model is 127435 visits per year. The other points are found by estimating the number of visitors with different hypothetical entrance fees (assuming that entrance fee is viewed in the same way as travel costs) (Table 4 & 5).

3.4. Total Recreational Value Generated

Total recreational value generated from each zone was calculated by multiplying zone wise average individual cost per trip by the actual number of visitors from that particular zone. Table 6 below gives the details of total recreational value generated from each zone. Recreational value generated from zone one was Rs.0.50 crores, zone two was Rs.0.73 crores and zone three was Rs.3.19 crores. Total Recreational Value generated for the entire park was estimated as Rs.4.42 crores (Table 6).

Table 7 below gives data on revenue generated from Thenmala Eco-tourism Park's entrance fee. This is the value of the Park that is taken into consideration by the park administration when formulating future plans and activities. But this is just a part of the total cost incurred by visitors when visiting the site. Comparing Table 6 and 7, it can be seen that considering entrance fee as an indicator of the recreational value of the Park is an underestimate.

ANOVA (b)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	315.0892	315.0892	56.49324	0.084205
Residual	1	5.577467	5.577467		
Total	2	320.6667			

(c)

	Coefficients	Standard Error	t Stat
Intercept	58.67704	4.896034	11.98461
X Variable	-0.09961	0.013253	-7.5162

(d)

	P-value	Lower 95 %	Upper 95 %	Lower 95.0 %	Upper 95.0 %
Intercept	0.052997	-3.532963	120.8871	-0.53296	120.8871
X Variable	0.084205	-0.268002	0.068782	-0.268	0.068782

Table 4. Demand Schedule at Various Hypothetical Entrance Fees

Entry Fee	Total Visits
+ Rs.10	741228
+ Rs.20	705498
+ Rs.30	669768
+ Rs.40	634037
+ Rs.50	598307

Table 6. Zone-wise Value Generated

Zone	Total Cost/Individual (Rs.)	Actual Visitors	Total Value Generated (Rs.)
1	290.60	17338	5038423
2	273.86	26761	7328767
3	410.65	77735	31921878
Total			4,42,89,068

Source: Primary Survey, April-May, 2012,
Thenmala Eco-tourism Park Administrative Office, 2012

Table 5. Detailed Demand Schedule at Various Hypothetical Entrance Fees

Zone	Travel Cost	Travel Cost plus Rs.10	Visits/1000	Population	Total Visits
1	290	300	28.97	5333195	154503
2	273	283	30.65	4502821	138025
3	410	420	17.09	26255153	448701
Total visits					741228
1	290	310	27.98	5333195	149223
2	273	293	29.66	4502821	133567
3	410	430	16.10	26255153	422708
Total visits					705498
1	290	320	26.99	5333195	143943
2	273	303	28.67	4502821	129109
3	410	440	15.11	26255153	396715
Total visits					669768
1	290	330	26.00	5333195	138663
2	273	313	27.68	4502821	124652
3	410	450	14.12	26255153	370723
Total visits					634037
1	290	340	25.01	5333195	133383
2	273	323	26.69	4502821	120194
3	410	460	13.13	26255153	344730
Total visits					598307

Table 7. Revenue Generated from Thenmala Eco-Tourism Park

Financial Year	Actual Number of Visitors	Revenue Generated (Rs.)
2000-01	26148	445437
2001-02	41161	1138839
2002-03	65075	2147985
2003-04	118404	4044571
2004-05	104622	3563820
2005-06	114443	3926430
2006-07	120178	4954459
2007-08	104758	4602536
2008-09	92191	4813440
2009-10	114714	5535195
2010-11	113414	Not Published
2011-12	127435	Not Published

Source: Secondary Data, Thenmala Eco-tourism Park Administrative Office, 2012

The result of this study indicates that the total value generated was computed to be greater than the annual income that the site management earned from visitors of the site, because they take into consideration only the entrance fee as a benchmark to calculate value generated. According to economic theory, this is only one component of the total economic benefit of the site. The total economic value of the site also includes indirect use values, option value, quasi-option value and non-use values of the site (such as bequest value and existence value). The total economic value of the site would be a much higher estimate.

4. Conclusion

Forest ecosystems provide many direct and indirect recreational benefits to domestic and foreign visitors. Some of these benefits have markets but most do not. Only a small portion of the benefits contributed by those that do have markets, is accounted for. Benefits that do not have markets are not accurately reflected in pricing strategies of natural resources. Absence of estimates of economic values makes it difficult to generate sustainable revenue from natural resources needed to support endeavors towards improvement of quality and conservation of such resources. This results in poor resource management strategies and deterioration in the environmental quality of these resources.

The major objective of this study was to estimate the economic value of Thenamala Eco-tourism Park. The total annual benefit generated by the site was estimated at Rs.4.42 crores. Based on the results of the study, it is legitimate to draw the following conclusions:

This value may be an underestimate due to the fact that only a few of the recreational benefits provided by the forest ecosystem has a market. On-site recreational benefit of the Park is only one component of the total economic benefit of the Park. The total economic value of the sanctuary also includes other use values (such as option value and quasi-option value) and non-use values (such as bequest value and existence value) which have not been considered. It would mean that the economic value of the Park was much greater.

Park authorities and other concerned bodies need to be aware that there may be a possible danger of underestimation of the conservation benefit of the Park if future economic decision of managing this resource fails to properly consider the true recreational benefit of the Park. Failure to properly internalize as much of the true benefit of the Park may lead to possible occurrence of irreversible damage to the sanctuary and its forest ecosystem. Nevertheless, it gives an initial indication of the recreational value of the site.

Total value generated was computed to be greater than the annual income that the site management earned from visitors of the site, because they take into consideration only the entrance fee as a benchmark to calculate value generated. Thus, the site management was able to capture only a part of the true recreational benefits provided by the site. This implies that the amount of revenue that the site authorities collect from the service is far from the true recreational value of the site.

A comparison of the recreational benefits of the site and the actual revenue collected by the site authorities indicates that it may be possible to further augment actual revenue, which could possibly be reinvested to improve the quality and the conservation benefit of the site.

Policy makers and decision makers need to have strong idea about economic values of environmental resources before they plan to launch similar projects. By any measure, decision on allocation of environmental resources would be appropriate if it is based on an economic estimate obtained through accepted estimation techniques than valuing resources on the basis of revenue realized alone. It would, therefore, be of great importance if environmental authorities base their future economic decisions on the economic value of these resources estimated using environmental valuation techniques.

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THIN FILM SOLAR CELLS WITH PLASMONIC LAYER

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Abstract

Hybrid solar cell with the structure Cu/Cu₂O/In₂S₃/Ag@NP/Ag was fabricated where the In₂S₃ window layer and the plasmonic Ag nano particle thin film layer were deposited using injection chemical spray pyrolysis technique. The short circuit current density and the open circuit voltage in these hybrid cells were improved compared to their counterparts where the plasmonic layer containing Ag nanoparticles was absent. Quantum efficiency measurement of these hybrid cells showed improved performance in the blue region of the visible spectrum. The films with Ag nano particles exhibited surface plasmon resonance peak at 432 nm which could be assigned to plasmon resonance of Ag nanoparticles. We conclude that the in-coupling of light by the metallic nanoparticle thin film layer into the underlying semiconductor layer resulted in improvement in electrical performance of these hybrid cells.

Keywords

Surface Plasmon Resonance; Thin Films;

Solar cell;

Introduction

Plasmonics is a branch of nano-photonics that is concerned primarily with the manipulation of light at the nanoscale, based on the properties of propagating and localization of Plasmons. Plasmons are the collective oscillations of the electron gas in a metal or semiconductor. Optical waves can couple to these electron oscillations in the form of propagating surface waves or

localized excitations, depending on the geometry. Although all conductive materials, such as metals, support plasmons, the coinage metals (that is, copper, silver and gold) have been most closely associated with the field of plasmonics as their plasmon resonances lie closer to the visible region of the spectrum, allowing plasmon excitation by standard optical sources and methods. The field of plasmonics is based on exploiting plasmons for a variety of tasks, by designing and manipulating the geometry of metallic structures, and consequently their plasmon-resonant properties.

In quantum theory, a plasmon is a quasi-particle that results from the quantization of plasma oscillations interacting with a photon. Despite their origins in quantum mechanics, the properties of plasmons can be described rigorously by classical electrodynamics. Surface plasmons are supported by structures at all length scales and are certainly not limited to quantum confined systems. For thin metal films, for example, surface plasmons are the electromagnetic waves that propagate along metallic-dielectric interfaces [1, 2]. They can exist at any interface and frequency range where the real dielectric constants of the media constituting the interface are of opposite signs. Small noble metal particles, with dimensions from a few up to several hundred nanometres, support localized surface plasmon oscillations that create large electromagnetic fields at the nanoparticle surface [2-4]. The plasmon resonance frequency, determined by the frequency dependent dielectric function of

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GREEN SYNTHESIS OF SILVER NANOPARTICLES USING ADHATODA VASICA LEAF EXTRACT AND EVALUATION OF THEIR CATALYTIC ACTIVITIES

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Abstract

In recent years an eco-friendly green synthesis of silver nanoparticles (AgNPs) has gained much interest among researchers. The chief and cheap source of medicinal plants becomes the sources of cost-effective non-hazardous reductants for the preparation of AgNPs. This study investigates an efficient and sustainable route for the synthesis of AgNP from 1 mM aqueous AgNO₃ using leaf extract of Adhatoda Vasica, a medicinal plant grown in households of Kerala for the treatment of coughs, bronchitis, asthma etc in children and adults. The AgNPs were characterized by UV-visible (vis) spectrophotometer, scanning electron microscopy (SEM) and energy-dispersive spectroscopy (EDS). Fourier transform infrared spectrometer (FTIR) analysis was carried out to determine the nature of the capping agents in the leaf extract. The AgNPs were screened for their catalytic efficiency by investigating a model reaction - reduction of methylene blue with hydrazine hydrate as reducing agent. Kinetic studies reveal that the reaction is reversible and follow first-order kinetics.

KEYWORDS

Adhatoda vasica, silver nanoparticles, green synthesis, SEM, TEM, catalytic activity, hydrazine hydrate, ammonium thiocyanate.

INTRODUCTION

Metals in nano dimensions are expected to possess good catalytic activity due to increased surface area and surface to volume ratio. Among metals it is usually Pt, Pd and

Rh that remain as the most commonly used and active catalysts particularly in hydrogenation reactions [1, 2]. Recently, gold and silver nanoparticles of different sizes are used to catalyze electron transfer [3, 4] and oxidation reactions [5] such as CO oxidation and desulfurization. Catalytic activity is strongly affected by particle size and shape which in turn is influenced by the synthetic methods and conditions. So, the synthesis of colloidal nanoparticles of well-controlled size and shape become very important [6, 7]. The recent initiation of different protocols for synthesizing metal nanoparticles with different morphology has opened up the possibility of doing systematic morphology studies which help us to interpret properties of metal nanoparticles.

Nowadays, a large number of approaches are available for the synthesis of silver nanoparticles; the use of environmentally benign materials like plant leaf extracts, bacteria, fungi [8-11] and enzymes offer numerous benefits such as cost effectiveness, eco-friendliness and easy scale up for large scale synthesis. Different plants such as aloe vera, neem, lemongrass and tamarind [12-15] are used as reductants for the biosynthesis of gold nanoparticles. But the potential of the plants as biological materials for the synthesis of nanoparticles have not yet been fully explored. Green synthesis protocol for nanoparticles provide more compatibility for pharmaceutical and other biomedical applications as they are not using toxic

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POLYMERIC COMPLEXES OF IMIDAZOLE INCORPORATED Co(II), Ni(II) AND Cu(II) CHIRAL (+) TARTRATES; SPECTROSCOPIC AND THERMAL STUDIES

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Abstract

Mixed ligand complexes of $[Co(ImH)_2(C_4H_4O_6)](1)$, $[Ni(ImH)_2(C_4H_4O_6)] \cdot 3H_2O$ (2) and $[Cu(ImH)(C_4H_4O_6)]$ (3) containing tetra dentate tartrate and monodentate imidazole moieties were prepared by the soft solution route. The products were characterized by spectroscopic and thermo analytical studies. $[Co(ImH)_2(C_4H_4O_6)]$ and $[Ni(ImH)_2(C_4H_4O_6)] \cdot 3H_2O$ are octahedrally coordinated using a tartrate unit and two imidazole molecules. But in $[Cu(ImH)(C_4H_4O_6)]$ only one imidazole unit is used in addition to a tartrate moiety to satisfy the square pyramidal coordination. The kinetic and thermal parameters involved in different stages of thermal decomposition could also be calculated using Coats-Redfern method.

Keywords

Chirality, imidazole

INTRODUCTION

In recent years, chiral coordination polymers have become a topic of intense interest due to their intriguing potential applications in enantioselective synthesis, asymmetric catalysis, porous materials, nonlinear optical materials (NLO) and magnetic materials [1-6]. Most strategies for designing chiral coordination polymeric architectures are generated by self-assembly of chiral building blocks, which usually involve the use of chiral ligands and/or chiral metal

coordination fragments. The diverse range of metal coordination geometries, as well as the ability to fine tune ligands in terms of size, shape and functionality has culminated in structural motifs such as grids, helicates, coordination polymers and extended structures. Although the preparation of chiral coordination polymers via the self-assembly of metal ions with only one organic ligand has been studied [7], the synthesis of chiral coordination polymers with two different organic ligands has so far been not well studied. The appropriate combination of two such organic ligands with inherently chiral metal complexes could provide various possibilities for the construction of chiral polymers with low dimensional structures via self-assembly [8]. Metal carboxylates are particularly interesting in that they not only form open framework structures resulting from the presence of the carboxylate function itself, but also carboxylate group act as a linker between inorganic moieties. Some of the novel architectures of carboxylates are obtained by carrying out reactions in the presence of additives such as organic amines. Since the present work on metal derivatives of tartaric acid, which is a chiral dihydroxy dicarboxylic acid, was taken up in the context of developing structurally tuned coordination polymers or related new products, which could be of relevance in the area of framework materials.

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Studies on the Development of Potential Biomarkers for Rapid Assessment of Paraquat Toxicity to the Freshwater Fish, *Oreochromis Mossambicus*

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ABSTRACT

The potential utility of some major antioxidant enzymes as indicators of exposure to various sublethal concentrations of paraquat in the freshwater fish, *Oreochromis mossambicus* was investigated. Superoxide dismutase (SOD), Catalase (CAT) and Glutathione peroxidase (GPx) activities were monitored in liver and kidney tissues for a period of 30 days. SOD activity showed a sharp decrease in both tissues on exposure to paraquat at the highest sublethal concentration towards the end. Despite the initial increase in activity at the lowest and intermediate sublethal concentrations, they showed decreased activity on the 30th day. A comparatively higher diminution in enzyme activity was observed in liver. Catalase activity in the liver and kidney tissues of the exposed fish in general showed inhibition at the highest sublethal concentration on all exposure periods. Inhibition of GPx activity was recorded in both tissues of the fish exposed to the highest sublethal concentration towards the end of the exposure period. In other sublethal concentrations up and down fluctuation in activity was noticed. The GPx activity in kidney tissue exhibited a sharp decrement towards the end of the experiment when compared to liver. The SOD activity in liver and GPx activity in kidney tissue can be thus considered as biomarkers of paraquat exposure in *Oreochromis mossambicus*. The findings of the present study clearly demonstrated that enzymatic biomarkers can be effectively used for rapid assessment of paraquat toxicity in biomonitoring of aquatic environment.

Keywords: Paraquat, *Oreochromis mossambicus*, Antioxidant enzymes, Biomarker

INTRODUCTION

Chemical pollution in the environment by pesticides has been increasing due to their extensive usage in agriculture. Many of them are capable of inducing oxidative stress in

Mutual Ownership: Key to Attain Self-esteem

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Abstract

The success of any process is significantly determined by the product and the quality of the product is established by the effective implementation of a particular method which is in fact a part of the process. As far as teaching language is concerned, very often learners and stakeholders are worried about the product and totally disregard the process which headed the product. Here comes the relevance of teaching methodology. A number of innovative methods to teach language have been evolved and experimented in the Western classrooms and the same methods are gradually put into trial in the Indian classrooms without making a realistic perusal of those methods and the prevailing scenario. What makes a method innovative? A learner realises and acknowledges a particular method as effective and innovative when that method proves to be beneficial in his attempt to master the target language in a better manner than the existing methods. This alternative method which aids and facilitates his learning can be addressed as innovative. The present paper focuses on the shortcomings of the existing classrooms and suggests a way out through the implementation of an eclectic method to teach English language and literature effectively in the classroom.

Gone are the days of dictatorial leadership of teachers in classrooms. The present generation learners crave for a congenial atmosphere where a teacher recognizes and acknowledges their individually and latent convictions. A language teacher should work out the possibility of **synergy** in the classroom which may in fact enhance their self esteem. Psychic reservations that may adversely affect the learning process are at the zenith in the teenage. It is at this juncture that the paper highlights the concepts of mutual ownership and synergy as solutions to numerous hazards in the process of teaching and learning.

Key Words: Synergy, Self-esteem, Positive interdependence, Co-operative learning

Introduction

Language is a unique gift that mankind enjoys and employs to communicate with his fellow beings. Since the primary aim of communication is need satisfaction, a language comprehensible for both the speaker and listener to attain the end is mandatory. The chief purpose of teaching any language especially English, which is considered as the second language in India should focus on the same as the end because of the royal status enjoyed by that language all over the world. It is indeed a positive sign that the status of English in India has been elevated to the position of second language from merely a foreign language. Though we are magnanimous enough to adore the language, very often it appears in its alienated majesty before our students because of their lack of exposure to this language. It is an incongruity that the only English that majority of our students listen is the English used and generated in the English classrooms. The present education scenario in India focuses on English Language Teaching, giving priority to language and communicative aspects of language. This is based on the aim that teaching of English should make our learners effective communicators. This is apparent in almost all the current syllabuses of our country.

Psychic Reservations and Related Constraints

As a language teacher one should be aware of the psychological principles underlying each method that he/she employs for teaching language as well as the psychology of students. The following are the common psychic reservations that we find in our students in using the language. Students find it difficult to utter sentences in the target language. Based on observation, without any doubt, one could confess that though majority of students in the present context possess linguistic ability, very few have attained communicative competency. Since they lack the communicative ability, they dread both the language and teacher. Language classrooms were considered as dungeons since students had no role in the teaching learning process. But the situation has been changed where now the focus is mainly on students and not on teachers. Yet, when we analyze English language teaching situation as a whole, it is evident that majority of students remain passive in

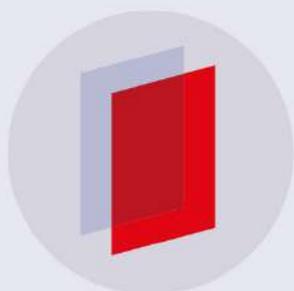
Effect of Thermal Radiations on Performance of Solar Cells

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Effect of Thermal Radiations on Performance of Solar Cells

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Abstract. The effect of grain boundaries on the photovoltaic effect across the grain boundary of two different materials constituting a p-n junction has been studied theoretically. It is found theoretically that the presence of the grain boundary affect the open circuit voltage of the solar cell. It is observed that as the grain boundary potential increases the open circuit voltage decreases.

1. Introduction

As made clear by numerous electron microscope studies, an important structural characteristic of a polycrystalline film is the presence of 'grain boundaries' which separate small single crystal regions with in the film. [1-3] In other words, the film consists of a conglomeration of tiny single crystals with sizes which lie typically within the range 10 nano-meter to 10 micro-meter. Generally the individual crystallizes are slightly misaligned with respect to each other so that the boundaries contain high densities of dislocations and so-called 'dangling bonds (atoms not properly chemically bonded).[4-6] These interface regions contain a high density of electron states which trap electron charge and result in band-bending within the crystal grains.

At normal temperatures where the shallow donor atoms are thermally ionized, free electrons exist in the conduction band of the grain material and are able to move freely with in the grains. [7] Some of these will reach the grain boundaries where they may be captured by interface states, becoming spatially localized in the process. [8] This fixed negative charge has the property of repelling free electrons from the region of the grain close to the interface and give rise to a depletion region similar to that associated with a Schottky barrier contact to a semiconductor. In terms of the conduction band energy, the depleted region is characterized by the band-bending. [8, 9] The separation between the conduction band E_c and the Fermi level E_f increases consistent with the reduction in free carrier density in this region-remember that

$$n = N_c \{ \exp - (E_c - E_f) / kT \} \quad (1)$$

If N is the density of donors and N_0 is the interface trap states then band bending Φ_b is given by

$$\Phi_b = e^2 N W^2 / 2 \epsilon \epsilon_0 \quad (2)$$

where W is the extend of the depletion region because of the grain boundary potential. [10, 11]

2. Modelling

We consider a p type and n type semiconductor material fused to form a p-n junction. Along the junction we can assume a spatial homogeneity in the formation of the dead layer. The grains of the p-type and n-type material can be assumed to have potentials of their own. We can assume that the transport across the barrier set up by the grain boundary in this hetero-structure potential is composed of 3 sequential steps: 1) Drift diffusion in the depletion region of the grain boundary potential 2) Thermionic emission at the boundary plain and 3) followed by drift diffusion into the depletion layer of the junction.

The relation for band bending at an interface is given by equation (1). First when there is a drift diffusion transport in the grain the steady state current under these condition depend on the quasi fermi

level on the either side of the depletion region namely E_{nn} & E_{pn} . This is followed by thermionic transfer across the boundary plane which depends on the quasi-fermi level on either side of the plane namely E_{nn} and E_{pn} . Finally there is a drift diffusion transport depending on the quasi fermi levels and E_{pn} . These 3 solutions coupled by the unknown quasi fermi level on either sides of the boundary are limited by the same current density in all 3 regions. Transport in the n type material can be expressed in terms of the gradient

$$J_d = en \mu_n (dE_{nn} / db) \quad (3)$$

where J_d is the conventional current density following from right to left. The concentration of electrons n can be expressed in terms of quasi fermi level and the effective density of states in the C.B. by the results

$$n = N_c \exp(-e[E_{pn}(x) - E_f(x)] / kT) \quad (4)$$

Using equation (4) in equation (3) and integrating between the limit 0 to b , we can write

$$J_d' = (\mu N_c kT / I') [\exp(e \Phi_b / kT) - \exp(eE_f' / kT)] \quad (5)$$

Where J_d' is the diffusion current density in the n type material and is I' is defined by,

$$I' = \int_0^b \exp(e E_{nn}(x) / kT) dx \quad (6)$$

Similarly for the p type material we can write that,

$$J_d'' = (\mu N_c kT / I'') [\exp(eE_f'' / kT) - 1] \quad (7)$$

Where J_d'' is the diffusion current density on the p type material and

$$I'' = \int_0^a \exp(e E_{pn}(x) / kT) dx \quad (8)$$

3. Results and Discussion

Elementary kinetic theory tells that flux incident on a boundary plane is $(n\hat{U}/4)$, where \hat{U} is the electron mean thermal velocity. The next thermionic current density is directed from the n type material to the p type material and can be given by $(\hat{U}(n_n - n_p)e/4)$, where n_n and n_p are concentration of electrons on the right and left side of the grain boundary potential. The next thermionic current density can be approximated to

$$J_t = (1-c/2) e N_c \hat{u} / 4 \exp(-e \Phi_b / kT) [\exp(eE_f' / kT) - \exp(eE_f'' / kT)] \quad (9)$$

where c is the fraction of thermionic flux from the either side of the boundary which is trapped at the grain boundary. Continuity equation requires that,

$$J_t = J = [e N_c V' / (1 + V' / V_d)] \exp(-e \Phi_b / kT) \quad (10)$$

where $V' = (1-c/2)\hat{u} / 4$ is termed the re combination velocity and V_d is defined as

$$V_d = [(e / \mu kT) (I'' + I')] \exp(-e \Phi_b / kT)]^{-1} \quad (11)$$

Equation (10) represents the current density through a grain boundary because of a voltage drop across it. This includes both drift diffusion and thermionic emission. It also shows that the current density is reduced because of the presence of a grain boundary potential. This shows that the total current density is the sum of the conventional current density J_d and thermionic current density J_t . The maximum current density is achieved when the band bending is equal to $\hat{O}_{b \max}$. Under this condition the photovoltaic effect is increased. We have shown that the current through the junction is reduced considerably compared to that of the current produced due to the thermo photo voltaic effect of the grain boundary. For sufficiently large grain boundary potential the drift velocity can be approximated as

$$V_d = \mu_e N_d / \varepsilon (ab/a+b) \quad (12)$$

This equation can be expressed in terms of the barrier height Φ_b and the open circuit voltage for solar cell as

$$V_d = \mu (2e N_d / \hat{a})^{1/2} (\Phi_b)^{1/2} (\Phi_b + V_{oc})^{1/2} / (\Phi_b)^{1/2} + (\Phi_b + V_{oc})^{1/2} \quad (13)$$

The open circuit voltage,

$$V_{oc} = (kT/q) \ln \{ \Delta n(0) [N_d + \Delta p(0)] / n_i^2 \} \quad (14)$$

where n_i is the intrinsic carrier concentration and Δn & Δp represent the change in carrier concentration because of illumination by a flux. We know that,

$$\Phi_b = Q_b^2 / 8\varepsilon q N_d \quad (15)$$

So that (14) can be rewritten as

$$V_{oc} = (kT/q) \ln \{ \Delta n(0) [Q_b^2 / 8\varepsilon q \hat{O}_b + \Delta p(0)] / n_i^2 \} \quad (16)$$

The above equation shows that as the grain boundary potential increases V_{oc} is reduced.

4. Conclusions

The effect of grain boundary potential on the electrical parameters of the solar cells was studied in this work. In this work it has been theoretically proved that the total current density was reduced because of the presence of grain boundary potential. We have shown that the current through the junction is reduced considerably compared to that of the current produced due to the thermo photo voltaic effect of the grain boundary. Therefore we conclude that to increase the efficiency of the solar cell, the thermal radiation must be reflected from the solar cell.

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Structural and plasmonic studies of Ag nanoparticles in silica glass hosts

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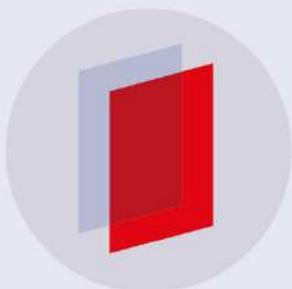
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Structural and plasmonic studies of Ag nanoparticles in silica glass hosts

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Silica glassy materials doped with Ag were prepared through sol gel route. The structural studies of the prepared samples showed an icosahedral morphology of the nanocrystals formed along with spherical morphology. The XRD and TEM data confirmed the formation of silver nanoparticles of size between 20 and 22nm. The surface plasmon resonance (SPR) of silver nanoparticles with spherical morphology was studied with the discrete dipole approximation . The shape and size effects of the nanoparticles can induce distinctive features of the SPR spectrum. It has been shown that such effects can induce peak intensity enhancement, wavelength shift and spectral broadening of the SPR spectra of the nanoparticles. The results obtained depend on the existence of highly localized plasmonic oscillations. An attempt has also been made to calculate the van der Waals force between nanoparticles.

INTRODUCTION

Nearly spherical metal particles of nanometer dimensions embedded in silicate glass can be fabricated by several means. Their structural and optical properties, promising for potential applications, depend on concentration, size, shape, spatial arrangement and configuration of the nanoparticles [1, 2]. Plasmonic properties of silver nanoparticles (AgNPs) have been extensively studied for their superior performances that exceed those of other metals with a surface plasmon resonance (SPR) in the visible range like gold or copper [3]. In the past years, a number of applications based on the SPR of AgNPs have been presented, in particular for biosensing, surface-enhanced Raman scattering, and plasmon circuitry [4]. Several of these applications take advantage of the engineering of AgNPs plasmonic response that depends on their size, shape, dielectric environment, and on mutual electromagnetic interactions among particles in close proximity [5]. In this work we doped silver nanoparticles into silica glasses via sol-gel route .Here the prime objective is to study the structural features of the prepared samples. We also used a DDA code for studying the influence of shape, size and dielectric environment on the SPR of AgNPs. The results reveal that the shape and the size of AgNPs strongly affect the SPR.

EXPERIMENTAL

Sample with 0.02% and 0.04 % silver in silica glasses were prepared through the sol-gel route. The tetraethylorthosilicate (TEOS) was used as the precursor for the base silica glass. Water was used for the hydrolysis and ethanol as the solvent. Silver nitrate was used for doping the required amount of ions into the silica. The final mixture was stirred for 30 minutes to ensure the homogeneity of the solution before casting. The solvent was cast into polypropylene containers and sealed and kept undisturbed in a dark place for several days for the formation of the gel. Later the gel was heat treated to 600°C in a programmable furnace operating at a heating rate of 1°C/minute. The samples were characterized using XRD, TEM and spectrophotometer.

RESULTS AND DISCUSSIONS

Structural studies

The assignments of the peaks were done and the planes [111], [200], [220] and [311] were identified with the JCDPS card number 04-0783. The average size of the crystallites was found to be in the range 20-22nm. Fig. 1 show the TEM images obtained for sample. The inset of the images shows the electron diffraction pattern and the crystallite size distribution of the respective samples. The growth of particle size of silver in silica matrix depends mainly on the diffusion coefficient and activation energy of coalescence and more specifically on the heat treatment time and temperature of the matrix [6]. Thus it is quite evident that spherical as well as icosahedral morphology is observed for samples [7].

Surface plasmon studies

In the case of noble metal spherical nanoparticles, the extinction cross-section σ_{EXT} in the visible range can be accurately calculated by analytical expressions [8]. The most applied expression was developed by Draine and Goodman and this was used in the present work. We adopted a size-corrected dielectric constant, the simplest choice for our calculations. Assuming that l to be equal to the effective radius of the particle, we have

$$l = (3V/4\pi)^{1/3} \rightarrow (1)$$

where V is particle volume, independent of particle shape. In the visible wavelengths, AgNPs have more intense and sharp plasmonic resonance. This may be due to the different dielectric properties originated by the small overlap between the SPR and the interband transitions in Ag that start at 320 nm [8]. The choice of silver nanostructures allows the highest

sensitivity for studying the effect of shape and size on the SPR. Fig. 2 shows the experimental and calculated the SPR spectrum for the 20nm AgNPs. An analysis of the different spectra suggests intensity enhancement, wavelength shift and broadening of the spectrum.

We have also extended our studies to estimate the van der Waals energy between two spherical nanoparticles. The van der Waals interaction between two equal nanospheres is more complicated. In this case we have to take into account the zero-point energies of all modes, including symmetric M and T modes and antisymmetric L modes. The total energy is given by the following expressions with the parameters have the usual meaning [9]

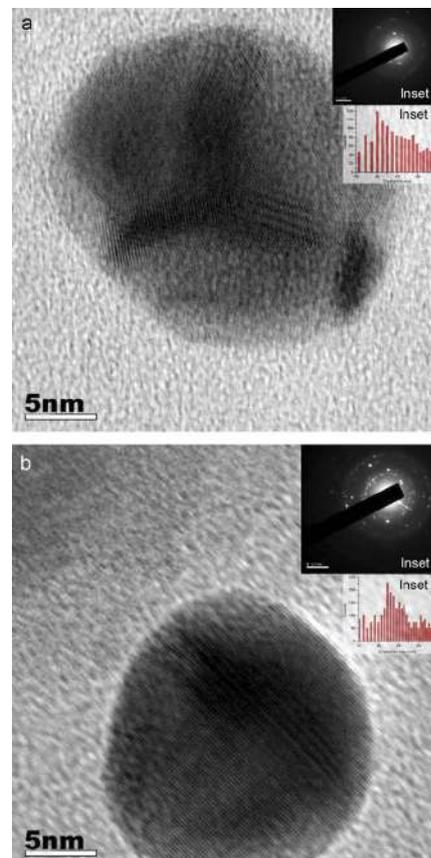


FIG 1: Transmission electron microscope image of (a) 0.02% Ag and (b) 0.04% Ag. Inset-1: the corresponding electron diffraction pattern. Inset-2: the corresponding particle size distribution.

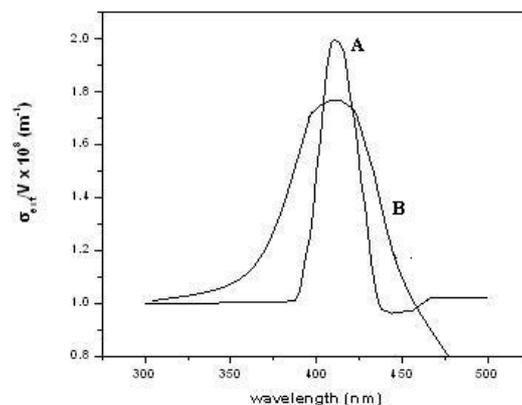


FIG 2. SPR spectra (A) calculated and (B) experimental of the 0.04 % Ag

$$U_{vdW} = U_{vdW}^M + U_{vdW}^L + U_{vdW}^T \rightarrow (2)$$

Our approach considers the case of unequal spherical nanoparticles of radii R_1, R_2 . Here, we restrict ourselves to the case of closely spaced nanospheres. Again, the main contribution to the van der Waals forces is due to the modes with large m , and thus contributions from symmetric M modes and antisymmetric L modes can be estimated as

$$U_{vdW}^{M,L} \approx \hbar \omega_{pl,2} f_{M,L} \left(\frac{\omega_{pl,1}}{\omega_{pl,2}} \right) \frac{2R_1 R_2}{\Delta(R_1 + R_2)} \rightarrow (3)$$

where $\omega_{pb,1}$ and $\omega_{pl,2}$ are the bulk plasmon frequencies of the spheres and the functions f_M and f_L and their sum are shown in fig.3. From this picture, one can see monotonic variation of van der Waals force when $\omega_{pl,1}$ changes from 0 to ∞ with $\omega_{pl,2}$ fixed. It is very interesting that contributions of L and M modes do not have monotonic character. If M modes do not exist, the van der Waals forces will be formed by L modes only and have maximum for $\omega_{pb,1} = \omega_{pl,2}$. Thus, L and M modes give the main contribution to the van der Waals forces[9].

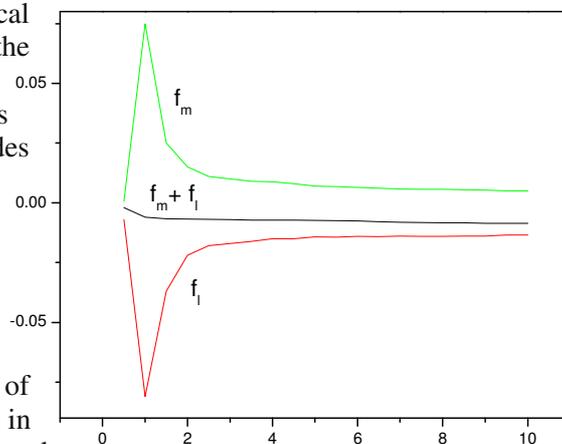


FIG 3. SPR spectra (A) calculated and (B) experimental of the 0.04 %

CONCLUSION

The formation of silver nanocrystals was confirmed by XRD and TEM. The TEM images confirm the crystallite size values obtained from XRD. The shape and size effects of the nanoparticles can induce distinctive features of the SPR spectrum. The energy of the van der Waals interaction between two closely placed metallic nanospheres can be taken as the energy of vacuum fluctuations of all plasmonic modes existing in the system. The results obtained depend crucially on the existence of highly localized plasmonic oscillations.

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A Survey of Spider Diversity on the Bank of River Pampa at Poovathoor, Pathanamthitta District, Kerala

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ABSTRACT

A preliminary survey on the diversity of spiders was conducted on the bank of river Pampa at Poovathoor, Pathanamthitta District, Kerala on the first week of February, 2015. A total of 39 species belonging to 17 families were recorded. Among these 17 families, Salticidae represented the most number of spider species (10) which was followed by Araneidae (6). *Fecenia protensa* belonging to family Psecruidae spotted in the study was reported for only the third time from India. *Porcataraneus bengalensis*, a rare species belonging to Araneidae was also recorded during the survey.

Key Words. Spider; Diversity; Wetland Ecosystem; Bio-indicator.

The spiders operate within the balance of nature and their role in nature's plan is beneficial to man. They are characterised by high within-habitat taxonomic diversity and exhibit taxon and guild-specific responses to environmental change. They are distributed to every continent except Antarctica and have adapted to all known ecological environments, except air and open sea. Spiders serve practical roles as biological agents for the control of crop pests (Breene *et al.*, 1993). They prove to be useful indicators of the overall species richness and health of biotic communities (Norris, 1999). Despite this, very little is known about the abundance, distribution and natural history of many species.

About 46,777 valid species belonging to 4,057 genera and 112 families are known globally (World Spider Catalog, 2017), while Indian fauna consists of 1686 valid species belonging to 438 genera and 60 families (Sebastian and Peter, 2009; Keswani *et al.*, 2012). Spiders play important roles in the dynamics of a specific habitat and are sensitive to habitat loss, climatic change and environmental upheavals (Daniel, 2002). Though spiders form one of the most ubiquitous and diverse groups of organisms existing in Kerala, their study has always remained largely neglected. They have, however, largely been ignored because of the human tendency to favour some organisms over others of equal importance because they lack a universal appeal (Humphries *et al.* 1995).

In India, most ecological studies on spiders were prevalent in agro-ecosystems mainly in rice ecosystem and coffee plantations (Sebastian *et al.*, 2005; Kapoor, 2008). Little is known about the composition of the arachnid communities of natural ecosystems. It was in this circumstance that the present survey of spiders on the bank of river Pampa at Poovathoor was undertaken. The main objective of the study was to get a preliminary data regarding the diversity of spiders on the bank of river Pampa – a wetland body of ecological importance and to assess the ecosystem health of the area based on spider diversity.

MATERIALS AND METHODS

Study area

The study was conducted on the right bank of river Pampa at Poovathoor in Koippuram Panchayath, Pathanamthitta District, Kerala. The 150 sq.m selected was an area with riparian vegetation including different types of grasses and some bamboo plants. In this particular plot, there was a myristica plantation also. The area is located at 9° 20' 10" North latitude and 76° 40' 10" East longitudes.

Mode of survey

The survey of spiders was carried out on the first week of February, 2015. The survey was started at 11 Am and lasted for 5 hours. The collection methods (Coddington *et al.*, 1991) adopted was: Aerial Hand Collection, Ground Hand Collection and Beat Sheet Method.

Only few species were photographed and identified in their natural habitat. In most cases it was difficult to assess the specimen so that they were captured for further identification and after that they were released in their natural habitat. The identification of spiders was done following 'Handbook of spiders' by Tikader, 1987 and 'Spiders of India' by Sebastian and Peter, 2009.

RESULT

In the present study, 39 species of spiders

Table 1. List of Spiders identified during the survey carried out at Poovathoor on the first week of February, 2015.

Sl. No	FAMILY	SPECIES
1	Araneidae Clerck, 1757	<i>Argiope pulchella</i> (Thorell,1881)
2	”	<i>Gasteracantha geminata</i> (Fabricius, 1798)
3	”	<i>Cyclosa confragra</i> (Thorell, 1892)
4	”	<i>Anepsion maritatum</i> (O.Pickard-Cambridge,1877)
5	”	<i>Neoscona muckerjei</i> (Tikader, 1980)
6	”	<i>Porcataraneus bengalensis</i> (Tikader, 1975)
7	Clubionidae Wagner, 1887	<i>Clubiona drassodes</i> (O.Pickard-Cambridge, 1874)
8	Gnaphosidae Pocock, 1898	<i>Zelotes</i> sp.
9	Hersiliidae Thorell, 1870	<i>Hersilia savignyi</i> (Lucas, 1836)
10	Lycosidae Sundevall, 1833	<i>Pardosa sumatrana</i> (Thorell, 1890)
11	”	<i>Hippasa greenalliae</i> (Blackwall, 1867)
12	Linyphiidae Blackwall, 1859	<i>Atypena adelinae</i> (Barrion & Litsinger, 1995)
13	Liocranidae Simon, 1897	<i>Oedignatha</i> sp.
14	Oxyopidae Thorell, 1870	<i>Oxyopes shewta</i> (Tikader, 1970)
15	”	<i>Oxyopes javanus</i> (Thorell, 1887)
16	”	<i>Hamadruas</i> sp.
17	Pholcidae C.L. Koch, 1850	<i>Pholcus</i> sp.
18	Pisauridae Simon, 1890	<i>Pisaura gitae</i> (Tikader, 1970)
19	Psecridae Simon, 1890	<i>Fecenia protensa</i> (Thorell, 1891)
20	Salticidae Blackwall, 1841	<i>Phintella vittata</i> (C.L. Koch, 1846)
21	”	<i>Brettus albolimbatus</i> (Simon, 1900)
22	”	<i>Telamonia dimidiata</i> (Simon, 1899)
23	”	<i>Hyllus semicupreus</i> (Simon, 1885)
24	”	<i>Bavia kairali</i>
25	”	<i>Myrmarachne plataleoides</i> (O.Pickard-Cambridge, 1869)
26	”	<i>Curubis tetrica</i> (Simon, 1902)
27	”	<i>Chalcotropis pennata</i> (Simon, 1902)
28	”	<i>Epeus tener</i> (Simon, 1877)
29	”	<i>Ptocasius yashodharae</i> (Tikader, 1977)
30	Sparassidae Bertkau, 1872	<i>Heteropoda venatoria</i> (Linnaeus, 1767)
31	”	<i>Thelcticopis</i> sp.
32	Tetragnathidae Menge, 1866	<i>Tylorida ventralis</i> (Thorell, 1877)
33	”	<i>Opadometa fastigata</i> (Simon, 1877)
34	”	<i>Tetragnatha viridorufa</i> (Gravely, 1921)
35	Theridiidae Sundevall, 1833	<i>Meotipa picturata</i> (Simon, 1895)
36	”	<i>Theridion</i> sp.
37	”	<i>Chryso angula</i> (Tikader, 1970)
38	Trachelidae Simon, 1897	<i>Utivarachna</i> sp.
39	Uloboridae Thorell, 1869	<i>Uloborus</i> sp.

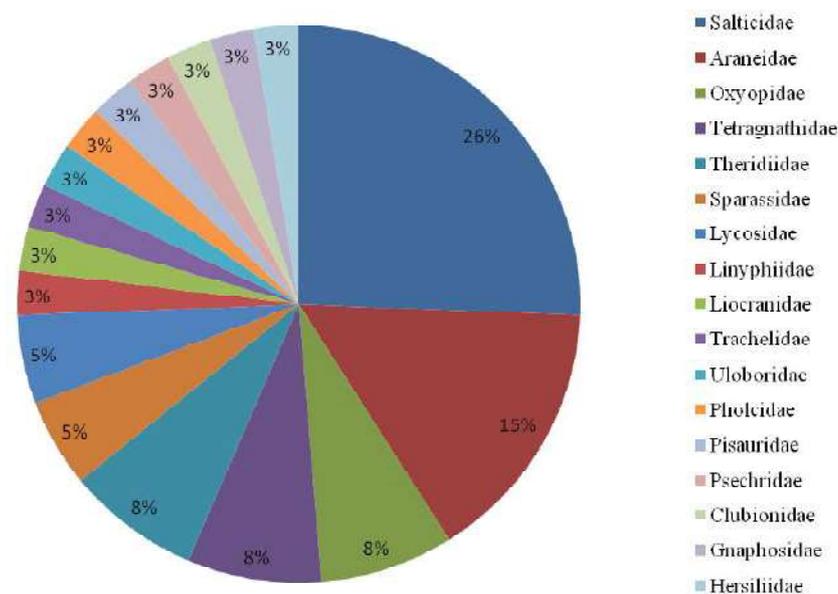


Fig. 1. Percent Occurrence of spider species belonging to different families recorded from Poovathoor on the first week of February 2015

belonging to 17 families were recorded (Table 1). Salticidae was represented by the most number of spider species *i.e.* 10. It was followed by Araneidae with 6 species. Oxyopidae, Tetragnathidae and Theridiidae were represented by 3 species each. Lycosidae and Sparassidae were represented by 2 species. Only 1 species was represented in the case of Linyphiidae, Liocranidae, Trachelidae, Uloboridae, Pholcidae, Pisauridae, Psechridae, Clubionidae, Gnaphosidae and Hersiliidae. Percent occurrence of spider species belonging to different families recorded from the area is given in Fig. 1. Rare species like *Fecenia protensa* belonging to family Psechridae and *Porcataraneus bengalensis* belonging to family Araneidae were also spotted during the survey.

DISCUSSION

The present study revealed that, the right bank of river Pampa at Poovathoor is qualitatively rich in spiders with 39 species coming under 17 families. It indicates that out of the 60 families identified so far from Kerala, nearly 28% families were recognized from the study area. Diversity generally increases when a greater variety of habitat types were present. The study area is endowed with different types of habitats such as small patches of grassland, riparian vegetation and bamboos, myristica plantation and shrubs. This may be the reason for the species richness. Also, the selected spot was an undisturbed patch with no signs of pollution.

In the present study Salticidae represented the

most number of spider species which corroborates with the spider survey carried out by Malamel and Padayatti (2014) at Kumarakom Bird Sanctuary. Out of the total 39 species recorded in the study 2 rare species were obtained from the spot. Among them, *Fecenia protensa* is only the third report from India. This sighting has a great importance owing to the fact that their presence in this area supports the existence of Malayan element in the fauna of peninsular India as suggested in the Satpura Hypothesis (Malamel *et al.*, 2013). All the four valid species belonging to genus *Fecenia* are found in Southeast Asia and nearby regions and only one species, *Fecenia protensa*, extends to Sri Lanka and Southern peninsular India. This occurrence of single species supports the existence of Malayan element in the fauna of peninsular India as suggested in Satpura Hypothesis by Hora (1949).

Spiders are extremely sensitive to small changes in the habitat structure. Spiders are often limited to areas within the range of their “physiological tolerances” which make them ideal for land conservation studies (Riechert and Gillespie, 1986). Therefore, documenting spider diversity patterns in this wetland ecosystem can provide important information to justify the conservation of this wetland ecosystem.

CONCLUSION

The species richness of spiders is significantly higher in systems that have not been heavily

manipulated as observed in the present study. Further studies can build upon the present data and continue to catalogue the poorly documented spider fauna and perhaps discover new species along the way. At a time when all the ecosystems are experiencing lot of anthropogenic disturbances, the present investigation emphasizes the urgent need to conserve wetland ecosystems and associated regions of the area. Spiders are well documented as a potential bio-indicator in various ecosystems and their role in the dynamics of insect pest population control is well known, therefore, the data can be used in designing a future Biological Monitoring Program (BMP) on the bank of river Pampa.

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SEVERAL SEPARATION AXIOMS IN BINARY ČECH CLOSURE SPACES

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Abstract. In [11] we introduced and studied certain separation axioms. In this paper we study some semi higher separation axioms, mild separation axioms and higher separation axioms in Binary Čech Closure Spaces.

Key Words and Phrases: Binary Čech Closure Space, \check{b} -Hausdorff, \check{b} -Urysohn, \check{b} -regular, \check{b} -normal

AMS Subject Classification: 54A05

1. INTRODUCTION

Closure spaces were introduced by E.Čech [1] and then studied by many authors like David Niel Roth[2] .. Čech closure spaces, is a generalisation of the concept of topological spaces. D. N. Roth and J.W. Carlson [2] studied a number of separation properties in closure spaces. W. J. Thron studied some separation properties in closure spaces. T. A. Sunitha[3] studied higher separation properties in closure spaces. P. Thangavelu and Nithanantha Jothi introduced the concept of binary topology[5]. Tresa Chacko and D. Susha introduced Binary Čech Closure Spaces in [9]. In [11] Tresa Chacko and D. Susha introduced and studied certain separation axioms.

In this paper we introduce higher separation axioms, some mild separation axioms and semi separation axioms. The paper is divided as follows:

Section 2 contains the preliminaries.

In section 3 we describes binary point separation axioms and their properties.

Section 4 contains higher separation axioms and semi higher separation axioms.

Section 5 deals with some mild separation axioms and their relation with each other and with binary point separation axioms.

2. Preliminaries

Definition 2.1. [1] Let X be a set and $\wp(X)$ be its powerset. A function $c : \wp(X) \rightarrow \wp(X)$ is called a Čech closure operator for X if

- (1) $c(\phi) = \phi$
- (2) $A \subseteq c(A)$
- (3) $c(A \cup B) = c(A) \cup c(B), \forall A, B \subseteq X$

Then (X, c) is called Čech closure space or simply closure space.

If in addition

- (4) $c(c(A)) = c(A), \forall A \subseteq X,$

the space (X, c) is called a Kuratowski (topological) space.

If further

- (5) for any family of subsets of $X, \{A_i\}_{i \in I}, c(\cup_{i \in I} A_i) = \cup_{i \in I} c(A_i),$ the space is called a total closure space.

Definition 2.2. [1] A function $c : \wp(X) \rightarrow \wp(X)$ is called a monotone operator for X if

- (1) $c(\phi) = \phi$
- (2) $A \subseteq c(A)$
- (3) $A \subseteq B \Rightarrow c(A) \subseteq c(B), \forall A, B \subseteq X$

Then (X, c) is called monotone space.

Definition 2.3. [5] Let X and Y be any two non-empty sets and $\wp(X)$ and $\wp(Y)$ be their power sets respectively. A binary topology from X to Y is a binary structure $M \subseteq \wp(X) \times \wp(Y)$ that satisfies the following axioms.

- (1) (ϕ, ϕ) and $(X, Y) \in M$

(2) If (A_1, B_1) and $(A_2, B_2) \in M$, then $(A_1 \cap A_2, B_1 \cap B_2) \in M$.

(3) If $\{(A_\alpha, B_\alpha) : \alpha \in \Delta\}$ is a family of members of M , then $(\cup_{\alpha \in \Delta} A_\alpha, \cup_{\alpha \in \Delta} B_\alpha) \in M$.

If M is a binary topology from X to Y then the triplet (X, Y, M) is called a binary topological space and the members of M are called binary open sets. (C, D) is called binary closed if $(X \setminus C, Y \setminus D)$ is binary open.

The elements of $X \times Y$ are called the binary points of the binary topological space (X, Y, M) .

Two binary points, (x_1, y_1) and (x_2, y_2) are distinct if either $x_1 \neq x_2$ or $y_1 \neq y_2$ or both. They are jointly distinct if both $x_1 \neq x_2$ and $y_1 \neq y_2$.

Let (X, Y, M) be a binary topological space and let $(x, y) \in X \times Y$. The binary open set (A, B) is called a binary neighbourhood of (x, y) if $x \in A$ and $y \in B$.

If $X = Y$ then M is called a binary topology on X and we write (X, M) as a binary space.

Note: $\wp(X)$ denotes the power set of a set X .

Definition 2.4. [9] Let X and Y be two sets. A function $\check{b} : \wp(X) \times \wp(Y) \rightarrow \wp(X) \times \wp(Y)$ is called a binary closure (monotone) operator if

$$\check{b}(\phi, \phi) = (\phi, \phi)$$

$$(A, B) \subseteq \check{b}(A, B)$$

$$(A, B) \subseteq (C, D) \Rightarrow \check{b}(A, B) \subseteq \check{b}(C, D).$$

Then (X, Y, \check{b}) is called a binary closure (monotone) space.

The binary closure operator is a binary Čech closure operator if it satisfies

$$\check{b}[(A, B) \cup (C, D)] = \check{b}(A, B) \cup \check{b}(C, D).$$

Definition 2.5. [9] A set $(A, B) \in \wp(X) \times \wp(Y)$ is \check{b} -closed if $\check{b}(A, B) = (A, B)$ and a set (C, D) is \check{b} -open if $\check{b}(X \setminus C, Y \setminus D) = (X \setminus C, Y \setminus D)$.

Proposition 2.1. [9] Let (X, Y, \check{b}) be a binary Čech closure space. Then (ϕ, ϕ) and (X, Y) are both open and closed.

Proposition 2.2. [9] If (X, c_1) and (Y, c_2) are two Čech closure spaces, then (X, Y, \check{b}) where $\check{b} : \wp(X) \times \wp(Y) \rightarrow \wp(X) \times \wp(Y)$ is given by $\check{b}(A, B) = (c_1(A), c_2(B))$, is a binary Čech closure operator.

Proposition 2.3. [9] Let (X, Y, \check{b}) be a binary Čech closure space. Then the set of all \check{b} -open sets, i.e. $M(\check{b}) := \{(A, B) \mid \check{b}(X \setminus A, Y \setminus B) = (X \setminus A, Y \setminus B)\}$ is a binary topology.

3. BINARY SEPARATION PROPERTIES

Definition 3.1. Let (X, Y, \check{b}) be a binary Čech closure space. It is said to be \check{b} - T_0 if for every pair of distinct binary points (x_1, y_1) and $(x_2, y_2) \in X \times Y$, either $(x_1, y_1) \notin \check{b}(\{x_2\}, \{y_2\})$ or $(x_2, y_2) \notin \check{b}(\{x_1\}, \{y_1\})$.

Proposition 3.1. If (X, Y, \check{b}) is a \check{b} - T_0 BČCS, then (X, \check{b}_X) and (Y, \check{b}_Y) are T_0 Čech closure spaces.

Proof. Let x_1, x_2 be two distinct points in X and y_1, y_2 be two distinct points in Y . Let (X, \check{b}_X) be not a T_0 Čech closure space.

Then there exists two distinct points $x_1, x_2 \in X$ such that $x_1 \in \check{b}_X(\{x_2\})$ and $x_2 \in \check{b}_X(\{x_1\})$.

Then for any $y \in Y$, $(x_1, y) \neq (x_2, y)$.

$x_2 \in \check{b}_X(\{x_1\})$ and $(\check{b}_X(\{x_1\}), \phi) \subseteq \check{b}(\{x_1\}, \{y\}) \Rightarrow$

$(x_2, y) \in \check{b}(\{x_1\}, \{y\})$.

Similarly $(x_1, y) \in \check{b}(\{x_2\}, \{y\})$.

Hence it contradicts that (X, Y, \check{b}) is a \check{b} - T_0 BČCS. So (X, \check{b}_X) is a T_0 Čech closure space.

The same case happens when (Y, \check{b}_Y) is not a T_0 Čech closure space.

Hence the theorem.

Remark 3.1. (X, \check{b}_X) and (Y, \check{b}_Y) are both T_0 Čech closure spaces, need not imply (X, Y, \check{b}) is a \check{b} - T_0 BCČCS.

Definition 3.2. A binary Čech closure space (X, Y, \check{b}) is said to be \check{b} - T_1 if for two distinct binary points, (x_1, y_1) and (x_2, y_2) in $X \times Y$, $(x_1, y_1) \notin \check{b}(\{\{x_2\}, \{y_2\}\})$ and $(x_2, y_2) \notin \check{b}(\{\{x_1\}, \{y_1\}\})$.

Proposition 3.2. The following statements are equivalent in any binary Čech closure space.

- (1) The space (X, Y, \check{b}) is binary- T_1 .
- (2) For any binary point $(x, y) \in X \times Y$, $(\{x\}, \{y\})$ is \check{b} -closed.
- (3) If $A \subseteq X$ and $B \subseteq Y$ are both finite sets then, (A, B) is \check{b} -closed.

Proof. (1) \Rightarrow (2)

Let (X, Y, \check{b}) be T_1 .

Let $(\{x\}, \{y\})$ be not \check{b} -closed.

Then $\check{b}(\{x\}, \{y\}) \neq (\{x\}, \{y\})$.

i.e. $\exists (x', y') [\neq (x, y)] \in X \times Y$, such that $(x', y') \in \check{b}(\{x\}, \{y\})$. This contradicts the fact that (X, Y, \check{b}) is binary- T_1 .

$(\{x\}, \{y\})$ is \check{b} -closed.

(2) \Rightarrow (3)

Since $\check{b}(A_1, B_1) \cup \check{b}(A_2, B_2) = \check{b}(A_1 \cup B_1, A_2 \cup B_2)$, if A and B are finite, (A, B) is \check{b} -closed by (2).

(3) \Rightarrow (2)

Follows directly from (3).

(2) \Rightarrow (1)

If (x_1, y_1) and (x_2, y_2) are two distinct binary points in $X \times Y$, $(x_1, y_1) \notin \check{b}(\{\{x_2\}, \{y_2\}\}) =$

$(\{x_2\}, \{y_2\})$ and $(x_2, y_2) \notin \check{b}(\{x_1\}, \{y_1\}) = (\{x_1\}, \{y_1\})$.

Thus (X, Y, \check{b}) is \check{b} - T_1 .

Remark 3.2. Every binary- T_1 space is binary T_0 , but the converse is not true.

Proposition 3.3. If (X, Y, \check{b}) is a \check{b} - T_1 BČCS, then (X, \check{b}_X) and (Y, \check{b}_Y) are T_1 Čech closure spaces.

Proof. Let (X, Y, \check{b}) be \check{b} - T_1 . Then for any $(x, y) \in X \times Y, \check{b}(\{x\}, \{y\}) = (\{x\}, \{y\})$.

We have $(\check{b}_X(\{x\}), \phi) \subseteq \check{b}(\{x\}, \{y\}) \Rightarrow$

$\check{b}_X(\{x\}) \subseteq \{x\}$. i.e. $\check{b}_X(\{x\}) = \{x\}$.

Thus \check{b}_X is a T_1 Čech closure operator. Similarly \check{b}_Y is also a T_1 Čech closure operator. □

Remark 3.3. Converse of the above Proposition need not be true.

Definition 3.3. A binary closure space (X, Y, \check{b}) is said to be \check{b} -semi-Hausdorff if for two distinct binary points (x_1, y_1) and (x_2, y_2) , either there exists a \check{b} -open set (U_1, V_1) such that $(x_1, y_1) \in (U_1, V_1)$ and $(x_2, y_2) \notin \check{b}(U_1, V_1)$ or there exists a \check{b} -open set (U_2, V_2) such that $(x_2, y_2) \in (U_2, V_2)$ and $(x_1, y_1) \notin \check{b}(U_2, V_2)$.

If both conditions hold, then (X, Y, \check{b}) is called \check{b} -pseudo-Hausdorff.

Proposition 3.4. Let a binary closure space (X, Y, \check{b}) be \check{b} -pseudo-Hausdorff. Then (X, Y, \check{b}) be \check{b} - T_1 .

Proof. Let (X, Y, \check{b}) be not \check{b} - T_1 .

Then there exists atleast one binary point (x, y) such that $(\{x\}, \{y\}) \neq \check{b}(\{x\}, \{y\})$.

i.e. \exists a binary point (x', y') such that $(x', y') \in \check{b}(\{x\}, \{y\})$.

Then if (U, V) is any \check{b} -open set containing (x, y) , then $(x', y') \in \check{b}(\{x\}, \{y\}) \subseteq \check{b}(U, V)$, showing that (X, Y, \check{b}) is not \check{b} -pseudo-Hausdorff.

Proposition 3.5. *Let a binary closure space (X, Y, \check{b}) be \check{b} -pseudo-Hausdorff. Then (X, \check{b}_X) and (Y, \check{b}_Y) are pseudo-Hausdorff Čech closure spaces.*

Proof. Let (X, Y, \check{b}) be \check{b} -pseudo-Hausdorff and (X, \check{b}_X) be not pseudo-Hausdorff. Then there exists two distinct points $x_1, x_2 \in X$, such that, either for every neighbourhood U_1 of x_1 , $x_2 \in \check{b}_X(U_1)$ or for every neighbourhood U_2 of x_2 , $x_1 \in \check{b}_X(U_2)$. Without loss of generality we may assume that for every neighbourhood U_1 of x_1 , $x_2 \in \check{b}_X(U_1)$. For any $y \in Y$, $(x_1, y) \neq (x_2, y)$. Then there exists \check{b} -open set (U, V) such that $(x_1, y) \in (U, V)$ and $(x_2, y) \notin (U, V)$. Since (U, V) is a binary neighbourhood of (x_1, y) , U is a \check{b}_X -neighbourhood of x_1 . By our assumption, $x_2 \in \check{b}_X(U)$. Hence $(x_2, y) \in (\check{b}_X(U), V) \subseteq \check{b}(U, V)$, which contradicts that (X, Y, \check{b}) is \check{b} -pseudo-Hausdorff. The same happens when Y is not \check{b}_Y -pseudo Hausdorff. □

Definition 3.4. *A binary closure space (X, Y, \check{b}) is said to be \check{b} -Hausdorff if for two distinct binary points (x_1, y_1) and (x_2, y_2) , there exists binary neighbourhoods (U_1, V_1) and (U_2, V_2) of (x_1, y_1) and (x_2, y_2) respectively such that $(U_1, V_1) \cap (U_2, V_2) = (\phi, \phi)$.*

Proposition 3.6. *Let (X, Y, \check{b}) is said to be \check{b} -Hausdorff. Then (X, \check{b}_X) and (Y, \check{b}_Y) are Hausdorff Čech closure spaces.*

Proof. Let $x_1 \neq x_2 \in X$ and $y_1 \neq y_2 \in Y$. Then $(x_1, y_1) \neq (x_2, y_2)$. Hence there exists binary neighbourhoods (U_1, V_1) and (U_2, V_2) of (x_1, y_1) and (x_2, y_2) respectively such that $(U_1, V_1) \cap (U_2, V_2) = (\phi, \phi)$. Then U_1, U_2, V_1, V_2 are neighbourhoods of x_1, x_2, y_1, y_2 respectively. Also $U_1 \cap U_2 = \phi$ and $V_1 \cap V_2 = \phi$, showing that (X, \check{b}_X) and (Y, \check{b}_Y) are Hausdorff Čech closure spaces. □

Definition 3.5. A binary closure space (X, Y, \check{b}) is said to be \check{b} -Urysohn space if for two distinct binary points $(x_1, y_1), (x_2, y_2)$ there exists binary open sets $(U_1, V_1), (U_2, V_2)$ such that $(x_1, y_1) \in (U_1, V_1), (x_2, y_2) \in (U_2, V_2)$ and $\check{b}(U_1, V_1) \cap \check{b}(U_2, V_2) = (\phi, \phi)$.

4. HIGHER SEPARATION AXIOMS

Definition 4.1. A binary closure space (X, Y, \check{b}) is said to be

- (1) \check{b} -Urysohn space if for two distinct binary points $(x_1, y_1), (x_2, y_2)$ there exists \check{b} -open sets $(U_1, V_1), (U_2, V_2)$ such that $(x_1, y_1) \in (U_1, V_1), (x_2, y_2) \in (U_2, V_2)$ and $\check{b}(U_1, V_1) \cap \check{b}(U_2, V_2) = (\phi, \phi)$.
- (2) \check{b} -quasi regular if for every binary point (x, y) and a \check{b} -closed set (A, B) not containing (x, y) , there exists a \check{b} -open set (U, V) such that $(x, y) \in (U, V)$ and $\check{b}(U, V) \cap (A, B) = (\phi, \phi)$.
- (3) \check{b} -semi regular if for every binary point (x, y) and a \check{b} -closed set (A, B) not containing (x, y) , there exists a \check{b} -open set (U, V) such that $(A, B) \subseteq (U, V)$ and $(x, y) \notin \check{b}(U, V)$.
- (4) \check{b} -pseudo regular if both the above conditions hold.
- (5) \check{b} -regular if for each binary point (x, y) and each binary set (A, B) such that $(x, y) \notin \check{b}(A, B)$, there exists binary neighbourhoods (U_1, V_1) of (x, y) and (U_2, V_2) of (A, B) such that $(U_1, V_1) \cap (U_2, V_2) = (\phi, \phi)$.
- (6) \check{b} -semi normal if for each pair of jointly disjoint \check{b} -closed sets (A_1, B_1) and (A_2, B_2) , either there exists a \check{b} -open set (U_1, V_1) such that $(A_1, B_1) \subseteq (U_1, V_1)$ and $\check{b}(U_1, V_1) \cap (A_2, B_2) = (\phi, \phi)$ or there exists a \check{b} -open set (U_2, V_2) such that $(A_2, B_2) \subseteq (U_2, V_2)$ and $\check{b}(U_2, V_2) \cap (A_1, B_1) = (\phi, \phi)$
- (7) \check{b} -pseudo normal if both the conditions in 6 hold.
- (8) \check{b} -normal if for any pair of jointly disjoint \check{b} -closed sets (A_1, B_1) and (A_2, B_2) , there exists disjoint \check{b} -neighbourhoods (U_1, V_1) and (U_2, V_2) containing (A_1, B_1) and (A_2, B_2) respectively.

Proposition 4.1. A BČCS (X, Y, \check{b}) is

- (1) \check{b} -Urysohn \Rightarrow \check{b} -Hausdorff
- (2) \check{b} -regular and \check{b} - $T_1 \Rightarrow$ \check{b} -Hausdorff
- (3) \check{b} -normal and \check{b} - $T_1 \Rightarrow$ \check{b} -regular.

5. MILD BINARY SEPARATION AXIOMS

Definition 5.1. Let (X, Y, \check{b}) be a BČCS. Then it is

- (1) \check{b} - R_0 if for each pair of binary points $(x_1, y_1), (x_2, y_2), (x_1, y_1) \in \check{b}(\{x_2\}, \{y_2\}) \Rightarrow (x_2, y_2) \in \check{b}(\{x_1\}, \{y_1\})$.
- (2) \check{b} - R_1 if for each pair of binary points $(x_1, y_1), (x_2, y_2)$, either $\check{b}(\{x_1\}, \{y_1\}) \cap \check{b}(\{x_2\}, \{y_2\}) = (\phi, \phi)$ or $\check{b}(\{x_1\}, \{y_1\}) = \check{b}(\{x_2\}, \{y_2\})$.
- (3) \check{b} - Z_0 if for each pair of distinct binary points $(x_1, y_1), (x_2, y_2)$, $\check{b}(\{x_1\}, \{y_1\}) \cap \check{b}(\{x_2\}, \{y_2\}) = (\phi, \phi)$ or $(\{x\}, \{y\})$ for some $x \in X$ and $y \in Y$.
- (4) \check{b} - Z_1 if for each pair of distinct binary points $(x_1, y_1), (x_2, y_2)$, $\check{b}(\{x_1\}, \{y_1\}) \cap \check{b}(\{x_2\}, \{y_2\}) = (\phi, \phi)$ or $(\{x_1\}, \{y_1\})$ or $(\{x_2\}, \{y_2\})$.
- (5) \check{b} - F_0 if for each binary point (x, y) and a binary set (A, B) not containing (x, y) , either $(x, y) \notin \check{b}(A, B)$ or $\check{b}(\{x\}, \{y\}) \cap (A, B) = (\phi, \phi)$.
- (6) \check{b} - F_1 if for each pair of jointly disjoint binary sets (A, B) and (C, D) , either $\check{b}(A, B) \cap (C, D) = (\phi, \phi)$ or $\check{b}(C, D) \cap (A, B) = (\phi, \phi)$.

Proposition 5.1. A binary closure space (X, Y, \check{b}) is

- (1) \check{b} - $T_1 \Rightarrow$ \check{b} - $R_1 \Rightarrow$ \check{b} - R_0
- (2) \check{b} - $T_1 \Rightarrow$ \check{b} - $Z_1 \Rightarrow$ \check{b} - Z_0
- (3) \check{b} - $T_1 \Rightarrow$ \check{b} - $F_1 \Rightarrow$ \check{b} - F_0

6. CONCLUSION

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Binary Linear Topological Spaces

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Abstract: In this paper we define and study the concept of binary linear topological spaces (BLTS) and their properties. Here we prove that the binary product of two linear topological spaces is a BLTS. Also we have the main result that the binary product preserve metrizable and normability. Finally we construct a BLTS from a family of binary seminorms on a pair of vector spaces.

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1. Introduction

P. Thangavelu and Nithanantha Jothi introduced the concept of binary topology in [4]. It is a single topological structure that carries the subsets of a set X as well as the subsets of another set Y for studying the information about the ordered pair (A, B) of subsets of X and Y . A linear topological space is a linear space endowed with a topology such that the vector addition and scalar multiplication are both continuous. The theory of linear topological spaces provide a remarkable economy in discussion of many classical mathematical problems. We introduce the concept of binary topology to linear topological spaces and form the theory of binary linear topology. Section 2 contains the prerequisites for the paper. In section 3 we define the concept of binary linear topological spaces (BLTS). We prove that the binary product of two linear topological spaces is a BLTS. Also we discuss the concept of locally convex BLTS and locally bounded BLTS and prove some of their properties. In section 4 we define binary metric and binary norm. The main result of this section is that the binary product preserve metrizable and normability. Section 5 deals with the construction of a BLTS using a family of binary seminorms.

2. Preliminaries

Definition 2.1 ([4]). Let X and Y be any two non-empty sets and $\wp(X)$ and $\wp(Y)$ be their power sets respectively. A binary topology from X to Y is a binary structure $M \subseteq \wp(X) \times \wp(Y)$ that satisfies the following axioms.

(1). (ϕ, ϕ) and $(X, Y) \in M$

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(2). If (A_1, B_1) and $(A_2, B_2) \in M$, then $(A_1 \cap A_2, B_1 \cap B_2) \in M$.

(3). If $\{(A_\alpha, B_\alpha) : \alpha \in \Delta\}$ is a family of members of M , then $(\cup_{\alpha \in \Delta} A_\alpha, \cup_{\alpha \in \Delta} B_\alpha) \in M$.

If M is a binary topology from X to Y then the triplet (X, Y, M) is called a binary topological space and the members of M are called binary open sets. (C, D) is called binary closed if $(X \setminus C, Y \setminus D)$ is binary open. The elements of $X \times Y$ are called the binary points of the binary topological space (X, Y, M) . Let (X, Y, M) be a binary topological space and let $(x, y) \in X \times Y$. The binary open set (A, B) is called a binary neighbourhood of (x, y) if $x \in A$ and $y \in B$. If $X = Y$ then M is called a binary topology on X and we write (X, M) as a binary space.

Proposition 2.2 ([4]). Let (X, Y, M) be a binary topological space. Then

(1). $\tau(M) = \{A \subseteq X : (A, B) \in M \text{ for some } B \subseteq Y\}$ is a topology on X .

(2). $\tau'(M) = \{B \subseteq Y : (A, B) \in M \text{ for some } A \subseteq X\}$ is a topology on Y .

Proposition 2.3 ([4]). Suppose (X, ρ) and (Y, σ) are two topological spaces. Then $\rho \times \sigma$ is a binary topology from X to Y such that $\tau(\rho \times \sigma) = \rho$ and $\tau'(\rho \times \sigma) = \sigma$.

Definition 2.4 ([5]). A linear topological space is a linear space E with a topology such that addition and scalar multiplication are both continuous. That is for every elements $x, y \in E$ and for every neighbourhood V of $x + y$ there exists neighbourhoods V_1 of x and V_2 of y such that $V_1 + V_2 \subseteq V$ and also for every neighbourhood W of λx there exists neighbourhoods K of λ and U of x such that $KU \subseteq W$. A base for the neighbourhood system of 0 in E is called a local base.

Throughout this paper we consider vector spaces over the same field K .

Definition 2.5 ([1]). Let $\{\rho_\alpha\}_{\alpha \in J}$ be a family of seminorms on a vector space X . Then the α th open strip of radius r centered at $x \in X$ is $B_r^\alpha(x) = \{y \in X : \rho_\alpha(x - y) < r\}$. Let ε be the collection of all open strips in X : $\varepsilon = \{B_r^\alpha(x) : \alpha \in J, r > 0, x \in X\}$. The topology $\tau(\varepsilon)$ generated by ε is called the topology induced by $\{\rho_\alpha\}_{\alpha \in J}$.

Proposition 2.6 ([1]). Let $\{\rho_\alpha\}_{\alpha \in J}$ be a family of seminorms on a vector space X . Then $\mathcal{B} = \{\cap_{j=1}^n B_r^{\alpha_j}(x) : n \in \mathbb{N}, \alpha_j \in J, r > 0, x \in X\}$ forms a base for the topology induced from these seminorms. In fact if U is open and $x \in U$, then there exists an $r > 0$ and $\alpha_1, \dots, \alpha_n \in J$ such that $\cap_{j=1}^n B_r^{\alpha_j}(x) \subseteq U$. Further every element of \mathcal{B} is convex.

Theorem 2.7 ([1]). If X is a vector space whose topology is induced from a family of seminorms $\{\rho_\alpha\}_{\alpha \in J}$, then X is a locally convex topological vector space.

3. Binary Linear Topology

Definition 3.1. A binary topology between two vector spaces is said to be binary linear if the two operations are continuous i.e. if V_1 and V_2 are two vector spaces over the same field K and for every neighbourhoods U of $(x_1 + x_2, y_1 + y_2) \in V_1 \times V_2$, \exists two neighbourhoods U_1 and U_2 of (x_1, y_1) and (x_2, y_2) respectively such that $U_1 + U_2 \subseteq U$. Similarly for every neighbourhood W of $(\lambda x, \lambda y) \in V_1 \times V_2$ there exists a neighbourhood W' of (x, y) such that $\lambda W' \subseteq W$. If M is a binary linear topology between two vector spaces V_1 and V_2 , then the triplet (V_1, V_2, M) is called a binary linear topological space (BLTS).

Definition 3.2. Suppose (X_1, τ_1) and (X_2, τ_2) are two linear topological spaces. Then $(X_1, X_2, \tau_1 \times \tau_2)$ is called the binary product of the given spaces.

Proposition 3.3. If (V_1, τ_1) and (V_2, τ_2) are two linear topological spaces, then $(V_1, V_2, \tau_1 \times \tau_2)$ is a binary linear topological space.

Proof. By proposition 2.3, $(V_1, V_2, \tau_1 \times \tau_2)$ is a binary topological space. It remains to show that $\tau_1 \times \tau_2$ is a binary linear topology. Let $(x_1, x_2), (y_1, y_2) \in V_1 \times V_2$ and (A_1, A_2) be a neighbourhood of $[(x_1, x_2) + (y_1, y_2)]$. Then $x_1 + y_1 \in A_1$ and $x_2 + y_2 \in A_2$. Since $A_1 \in \tau_1$ and $A_2 \in \tau_2$, and τ_1 and τ_2 are linear topologies, there exist neighbourhoods B_1 and C_1 of x_1 and y_1 respectively in τ_1 such that $B_1 + C_1 \subseteq A_1$ and neighbourhoods B_2 and C_2 of x_2 and y_2 respectively in τ_2 such that $B_2 + C_2 \subseteq A_2$. Then in $\tau_1 \times \tau_2$, (B_1, B_2) is a neighbourhood of (x_1, x_2) and (C_1, C_2) is a neighbourhood of (y_1, y_2) such that $(B_1, B_2) + (C_1, C_2) = (B_1 + C_1, B_2 + C_2) \subseteq (A_1, A_2)$. Now let (A_1, A_2) be a neighbourhood of $\lambda(x_1, x_2)$ in $\tau_1 \times \tau_2$. Then A_1 is a neighbourhood of λx_1 in τ_1 and A_2 is a neighbourhood of λx_2 in τ_2 . So there exists two neighbourhoods B_1 and B_2 of x_1 and x_2 respectively such that $\lambda B_1 \subseteq A_1$ and $\lambda B_2 \subseteq A_2$. This implies that (B_1, B_2) is a neighbourhood of (x_1, x_2) such that $\lambda(B_1, B_2) \subseteq (A_1, A_2)$. Thus $\tau_1 \times \tau_2$ is a binary linear topology. \square

Proposition 3.4. *If (V_1, V_2, M) is a BLTS, then $\tau(M) = \{A \subseteq V_1 : (A, B) \in M \text{ for some } B \subseteq V_2\}$ is a linear topology on V_1 and $\tau'(M) = \{B \subseteq V_2 : (A, B) \in M \text{ for some } A \subseteq V_1\}$ is a linear topology on V_2 .*

Proof. By Proposition 2.2 $\tau(M)$ and $\tau'(M)$ are both topologies in V_1 and V_2 respectively. Let $x_1, y_1 \in V_1$ and $A \in \tau(M)$ contains $x_1 + y_1$. Then for some $x_2, y_2 \in V_2$ there exists $B \subseteq V_2$ such that $(x_1 + y_1, x_2 + y_2) \in (A, B)$ where $(A, B) \in M$. Since M is a binary linear topology, there exists (E_1, E_2) and (F_1, F_2) in M such that $(x_1, x_2) \in (E_1, E_2), (y_1, y_2) \in (F_1, F_2)$ and $(E_1, E_2) + (F_1, F_2) \subseteq (A, B)$. Then $x_1 \in E_1, y_1 \in F_1$, and $E_1 + F_1 \subseteq A$ by the definition of binary sets. Also E_1 and $F_1 \in \tau(M)$ by the construction of $\tau(M)$. Similarly for $\lambda x \in A$, where $A \in \tau(M)$ we can find a neighbourhood of x say U such that $\lambda U \subseteq A$. Thus $\tau(M)$ is a linear topology. In the same way we can prove that $\tau'(M)$ is also a linear topology. \square

Definition 3.5. *A local base of a binary linear topology (V_1, V_2, M) is the base consisting of the neighbourhood of a binary point (x, y) .*

Definition 3.6. *A set $(A, B) \in \wp(V_1) \times \wp(V_2)$ is convex if for all pairs $(x_1, x_2), (y_1, y_2) \in (A, B), \lambda(x_1, x_2) + (1 - \lambda)(y_1, y_2) \in (A, B), \forall \lambda \in [0, 1]$.*

Definition 3.7. *A binary linear topology is called locally convex if there exists a local base at $(0, 0)$ whose members are convex.*

Definition 3.8. *A BLTS is locally bounded if $(0, 0)$ has a bounded neighbourhood, i.e. a neighbourhood (E, F) such that $\forall (N, M) \in \mathcal{N}_0$, the set of neighbourhoods of $(0, 0)$, there exists $s \in \mathbb{R}$ such that $\forall t > s, (E, F) \subseteq t(N, M)$.*

Proposition 3.9. *Let (V_1, V_2, M) be a BLTS. Then for every $(W_1, W_2) \in \mathcal{N}_0, \exists$ balanced and symmetric sets $(X_1, Y_1), (X_2, Y_2) \in \mathcal{N}_0$ such that $(X_1, Y_1) + (X_2, Y_2) \subset (W_1, W_2)$.*

Proof. If $(W_1, W_2) \in \mathcal{N}_0$, then W_1 and W_2 are neighbourhoods of 0 in $(V_1, \tau(M))$ and $(V_2, \tau'(M))$ respectively. By the property of linear topologies there exists symmetric balanced neighbourhoods of 0, $X_1, X_2 \in \tau(M)$ and $Y_1, Y_2 \in \tau'(M)$ such that $X_1 + X_2 \subset W_1$ and $Y_1 + Y_2 \subset W_2$. Now X_1, Y_1 are balanced $\Rightarrow \forall \alpha \in \mathbb{R}$ with $|\alpha| \leq 1, \alpha X_1 \subset X_1$ and $\alpha Y_1 \subset Y_1$. So $\alpha(X_1, Y_1) = (\alpha X_1, \alpha Y_1) \subset (X_1, Y_1)$. Thus (X_1, Y_1) and (X_2, Y_2) are balanced. By the symmetry of X_1 and Y_1 , we get $X_1 = -X_1, Y_1 = -Y_1 \Rightarrow (X_1, Y_1) = (-X_1, -Y_1) = -(X_1, Y_1)$. Thus (X_1, Y_1) is symmetric and similarly (X_2, Y_2) is also symmetric. $(X_1, Y_1) + (X_2, Y_2) = (X_1 + X_2, Y_1 + Y_2) \subset (W_1, W_2)$. \square

Proposition 3.10. *Let V_1 and V_2 be real vector spaces and U_1 be a convex set in V_1 and U_2 be a convex set in V_2 , then (U_1, U_2) is convex in $\wp(V_1) \times \wp(V_2)$.*

Proof. Let $(x_i, y_i) \in (U_1, U_2)$ for $i = 1, 2$. Then $x_i \in U_1$ and $y_i \in U_2$ for $i = 1, 2 \Rightarrow \lambda x_1 + (1 - \lambda)x_2 \in U_1$ for $0 \leq \lambda \leq 1$. And $\lambda y_1 + (1 - \lambda)y_2 \in U_2$ for $0 \leq \lambda \leq 1$. So $(\lambda x_1 + (1 - \lambda)x_2, \lambda y_1 + (1 - \lambda)y_2) \in (U_1, U_2)$. Consider

$\lambda(x_1, y_1) + (1 - \lambda)(x_2, y_2) = (\lambda x_1, \lambda y_1) + ((1 - \lambda)x_2, (1 - \lambda)y_2) = (\lambda x_1 + (1 - \lambda)x_2, \lambda y_1 + (1 - \lambda)y_2) \in (U_1, U_2)$ for $0 \leq \lambda \leq 1$.

Thus (U_1, U_2) is convex. \square

Corollary 3.11. *If (V_1, τ_1) and (V_2, τ_2) are both locally convex topological vector spaces, then their binary product, $(V_1, V_2, \tau_1 \times \tau_2)$ is a locally convex BLTS.*

Proposition 3.12. *Let U_1 and U_2 be bounded sets in two real vector spaces V_1 and V_2 respectively, then (U_1, U_2) is also bounded.*

Proof. Since U_1 is bounded, for every neighbourhood $E_1 \in \mathcal{N}_0(V_1)$, $\exists s_1 \in \mathbb{R}$ such that $\forall t > s_1, U_1 \subset tE_1$. Similarly for every neighbourhood $E_2 \in \mathcal{N}_0(V_2)$, $\exists s_2 \in \mathbb{R}$ such that $\forall t > s_2, U_2 \subset tE_2$. Let $(E, F) \in \mathcal{N}_0$. Then $E \in \mathcal{N}_0(V_1)$ and $F \in \mathcal{N}_0(V_2)$. Let $t_1 \in \mathbb{R}$ correspond to E and $t_2 \in \mathbb{R}$ correspond to F . Then $\forall t > t_1, U_1 \subset tE$ and $\forall t > t_2, U_2 \subset tF$. So $\forall t > s$, where $s = \max\{t_1, t_2\}$, $U_1 \subset tE$ and $U_2 \subset tF$ i.e. $(U_1, U_2) \subset t(E, F), \forall t > s$. Thus (U_1, U_2) is bounded. \square

Corollary 3.13. *If (V_1, τ_1) and (V_2, τ_2) are both locally bounded topological vector spaces, then their binary product, $(V_1, V_2, \tau_1 \times \tau_2)$ is a locally bounded BLTS.*

Proposition 3.14. *Let (V_1, τ_1) be a topological vector space and V_2 be another vector space such that the map $T : V_1 \rightarrow V_2$ is an isomorphism. Then $\tau_2 = \{T(A) : A \in \tau_1\}$ is a linear topology in V_2 and hence $\tau_1 \times \tau_2$ is a binary linear topology from V_1 to V_2 .*

Proof. Since T is an isomorphism, $T(\phi) = \phi$ and $T(V_1) = V_2$ and so $\phi, V_2 \in \tau_2$. Let $A, B \in \tau_2$. Then $A = T(A')$ and $B = T(B')$ for some A' and $B' \in \tau_1$. So $A' \cap B' \in \tau_1$ and $T(A' \cap B') \in \tau_2$. $T(A' \cap B') = T(A') \cap T(B') = A \cap B$. Thus $A \cap B \in \tau_2$. Now let $\{A_\alpha\}_{\alpha \in I} \in \tau_2$ for some index set I . Then there exists $\{B_\alpha\}_{\alpha \in I} \in \tau_1$ such that $A_\alpha = T(B_\alpha)$ for each $\alpha \in I$. Then $\cup_{\alpha \in I} B_\alpha \in \tau_1$ and $\cup_{\alpha \in I} A_\alpha = \cup_{\alpha \in I} T(B_\alpha) = T(\cup_{\alpha \in I} B_\alpha) \in \tau_2$. Thus τ_2 is a topology on V_2 . Let $x_2, y_2 \in V_2$ and there exists $B \in \tau_2$ such that $x_2 + y_2 \in B$. Then there exist $x_1, y_1 \in V_1$ such that $T(x_1) = x_2$ and $T(y_1) = y_2$. Let $A = T^{-1}(B) \in \tau_1$. So $x_1 + y_1 \in A$ and there exists $A_1, A_2 \in \tau_1$ such that $A_1 + A_2 \in A$. This implies $T(A_1 + A_2) \in T(A)$. Let $B_1 = T(A_1)$ and $B_2 = T(A_2)$. Then $B_1, B_2 \in \tau_2$ and $x_1 \in A_1 \Rightarrow x_2 = T(x_1) \in T(A_1) = B_1, y_1 \in A_2 \Rightarrow y_2 = T(y_1) \in T(A_2) = B_2$. Also $B_1 + B_2 = T(A_1) + T(A_2) = T(A_1 + A_2) \subseteq T(A) = B$. Let $y \in V_2$ and $\lambda y \in U \in \tau_2$ for some scalar λ . Then $y = T(x)$ for some $x \in V_1$ and $U = T(W)$ for some $W \in \tau_1$. $y = T(x) \Rightarrow \lambda y = \lambda T(x) = T(\lambda x)$. So $\lambda y \in U \Rightarrow T(\lambda x) \in U \Rightarrow \lambda x \in W$. Since τ_1 is a linear topology, there exists W' in τ_1 such that $\lambda W' \subseteq W$. So $U' = T(W') \in \tau_2, y = T(x) \in T(W') = U'$ and $T(\lambda W') = \lambda T(W') = \lambda U' \subseteq T(W) = U$. Thus τ_2 is a linear topology and hence $\tau_1 \times \tau_2$ is a binary linear topology. \square

4. Binary Metrizable and Binary Normable BLTS

Definition 4.1. *A binary metric on two sets V_1 and V_2 is a map $d : (V_1 \times V_2) \times (V_1 \times V_2) \rightarrow \mathbb{R}$ satisfying the following axioms: If $(x_1, x_2), (y_1, y_2) \in V_1 \times V_2$ then*

$$(1). d[(x_1, x_2), (y_1, y_2)] \geq 0$$

$$(2). d[(x_1, x_2), (y_1, y_2)] = 0 \Leftrightarrow x_1 = x_2 \text{ and } y_1 = y_2$$

$$(3). d[(x_1, x_2), (y_1, y_2)] = d[(y_1, y_2), (x_1, x_2)] \text{ and}$$

$$(4). d[(x_1, x_2), (y_1, y_2)] \leq d[(x_1, x_2), (z_1, z_2)] + d[(z_1, z_2), (y_1, y_2)] \text{ for every } (z_1, z_2) \in V_1 \times V_2.$$

Definition 4.2. *Let (V_1, V_2, M) be a BLTS. A binary topology M is metrizable with a binary metric d if for any (x, y) in some binary open set $(A, B) \in M$, $\exists r > 0$ such that $B_r(x, y) \subset (A, B)$ i.e. $\pi_1(B_r(x, y)) \subset A$ and $\pi_2(B_r(x, y)) \subset B$, where π_i is the projection map to V_i for $i = 1, 2$.*

Proposition 4.3. *If (V_1, τ_1) and (V_2, τ_2) are two linear topological spaces such that τ_1 and τ_2 are both metrizable with metrics d_1 and d_2 respectively, then $\tau_1 \times \tau_2$ is binary metrizable.*

Proof. Consider the map $d : (V_1 \times V_2) \times (V_1 \times V_2) \rightarrow \mathbb{R}$ defined by

$$d((x_1, x_2), (y_1, y_2)) = \frac{d_1(x_1, y_1) + d_2(x_2, y_2)}{2}, \forall (x_1, x_2), (y_1, y_2) \in (V_1 \times V_2)$$

If $(x_1, x_2), (y_1, y_2) \in V_1 \times V_2$ then

- (1). $d[(x_1, x_2), (y_1, y_2)] = \frac{d_1(x_1, y_1) + d_2(x_2, y_2)}{2} \geq 0$, since $d_1(x_1, y_1)$ and $d_2(x_2, y_2)$ are both non-negative.
- (2). $d[(x_1, x_2), (y_1, y_2)] = \frac{d_1(x_1, y_1) + d_2(x_2, y_2)}{2} = 0 \Leftrightarrow d_1(x_1, y_1) = 0$ and $d_2(x_2, y_2) = 0$. This happens if and only if $x_1 = x_2$ and $y_1 = y_2$ i.e. when $(x_1, y_1) = (x_2, y_2)$.
- (3). $d((x_1, x_2), (y_1, y_2)) = \frac{d_1(x_1, y_1) + d_2(x_2, y_2)}{2} = \frac{d_1(y_1, x_1) + d_2(y_2, x_2)}{2} = d((y_1, y_2), (x_1, x_2))$ and if $(z_1, z_2) \in V_1 \times V_2$
- (4). $d[(x_1, x_2), (y_1, y_2)] = \frac{d_1(x_1, y_1) + d_2(x_2, y_2)}{2} \leq \frac{[d_1(x_1, z_1) + d_1(z_1, y_1)] + [d_2(x_2, z_2) + d_2(z_2, y_2)]}{2} = \frac{d_1(x_1, z_1) + d_2(x_2, z_2)}{2} + \frac{d_1(z_1, y_1) + d_2(z_2, y_2)}{2} = d[(x_1, x_2), (z_1, z_2)] + d[(z_1, z_2), (y_1, y_2)]$

Thus d is a binary metric. Let $(A, B) \in \tau_1 \times \tau_2$ and $(x, y) \in (A, B)$. Then $x \in A \in \tau_1$ and $y \in B \in \tau_2$. Since τ_1 and τ_2 are metrizable, $\exists r_1, r_2 > 0$ with respect to d_1 and d_2 respectively such that $B_{r_1}(x) \subset A$ and $B_{r_2}(y) \subset B$. i.e. if $d_1(x, x_1) < r_1$, then $x_1 \in B_{r_1}(x)$ and if $d_2(y, y_1) < r_2$, then $y_1 \in B_{r_2}(y) \Rightarrow (x_1, y_1) \in (A, B)$. Let $r = \min\{r_1, r_2\}$ and $(u, v) \in B_{r/2}(x, y)$. Then $d((x, y), (u, v)) < \frac{r}{2}$. i.e. $\frac{d_1(x, u) + d_2(y, v)}{2} < r/2$. So $d_1(x, u) + d_2(y, v) < r \Rightarrow d_1(x, u) < r < r_1$ and $d_2(y, v) < r < r_2$. Hence $u \in B_{r_1}(x) \subset A$ and $v \in B_{r_2}(y) \subset B$. Thus $(u, v) \in (A, B)$ showing that $B_{r/2}(x, y) \subset (A, B)$. \square

Definition 4.4. *A binary seminorm on two vector spaces V_1 and V_2 is a map, $\|\cdot\| : V_1 \times V_2 \rightarrow \mathbb{R}$ such that for each $(x_1, x_2), (y_1, y_2) \in V_1 \times V_2$*

- (1). $\|(x_1, x_2)\| \geq 0$
- (2). $\|\alpha(x_1, x_2)\| = |\alpha| \|(x_1, x_2)\|$
- (3). $\|(x_1, x_2) + (y_1, y_2)\| \leq \|(x_1, x_2)\| + \|(y_1, y_2)\|$ *A binary seminorm becomes a binary norm if the following condition holds.*
- (4). $\|(x_1, x_2)\| = 0 \Leftrightarrow (x_1, x_2) = (0, 0)$

Proposition 4.5. *If (V_1, τ_1) and (V_2, τ_2) are both normable topological vector spaces, then their binary product is binary normable.*

Proof. Let $\|\cdot\|_1$ and $\|\cdot\|_2$ be the norms corresponding to τ_1 and τ_2 respectively. Then we get two metrics d_1 and d_2 , defined by $d_i((x_1, x_2), (y_1, y_2)) = \|(x_1, x_2) - (y_1, y_2)\|_i, i = 1, 2$ and $(x_1, x_2), (y_1, y_2) \in V_1 \times V_2$, with which τ_1 and τ_2 are metrizable respectively. So by Proposition 4.3 $\tau_1 \times \tau_2$ is metrizable with the binary metric $d((x_1, x_2), (y_1, y_2)) = \frac{d_1(x_1, y_1) + d_2(x_2, y_2)}{2}, \forall (x_1, x_2), (y_1, y_2) \in (V_1 \times V_2)$. Hence the binary norm $\|\cdot\|$ defined by $\|(x_1, x_2)\| = d((x_1, x_2), (0, 0))$ for $(x_1, x_2) \in V_1 \times V_2$ corresponds to the topology $\tau_1 \times \tau_2$. But this norm is same as $\frac{\|\cdot\|_1 + \|\cdot\|_2}{2}$ since $\|(x_1, x_2)\| = d((x_1, x_2), (0, 0)) = \frac{d_1(x_1, 0) + d_2(x_2, 0)}{2} = \frac{\|x_1 - 0\|_1 + \|x_2 - 0\|_2}{2} = \frac{\|x_1\|_1 + \|x_2\|_2}{2}$. \square

Lemma 4.6. *Let V_1 and V_2 be two vector spaces and p be a binary seminorm on $V_1 \times V_2$. Then there exists two seminorms p_1 and p_2 on V_1 and V_2 respectively.*

Proof. Let $p_1 : V_1 \rightarrow \mathbb{R}$ be defined by $p_1(x) = \inf_y \{p(x, y) : y \in V_2\}$. Since $p(x, y) \geq 0, \forall (x, y) \in V_1 \times V_2, p_1(x) \geq 0 \forall x \in V_1$. For $x \in V_1$ and $\alpha \in K$

$$\begin{aligned} p_1(\alpha x) &= \inf_y \{p(\alpha x, y) : y \in V_2\} \\ &= \inf_y \{|\alpha| p(x, \frac{1}{\alpha} y) : y \in V_2\} \\ &= |\alpha| \inf_y \{p(x, \frac{1}{\alpha} y) : y \in V_2\} \\ &= |\alpha| p_1(x) \end{aligned}$$

For $x, y \in V_1$

$$\begin{aligned} p_1(x + y) &= \inf_z \{p(x + y, z) : z \in V_2\} \\ &= \inf_{z=z_1+z_2} \{p(x + y, z_1 + z_2) : z = z_1 + z_2 \in V_2\} \\ &= \inf_{z_1, z_2} \{p[(x, z_1) + (y, z_2)] : z_1, z_2 \in V_2\} \\ &\leq \inf_{z_1, z_2} \{p(x, z_1) + p(y, z_2) : z_1, z_2 \in V_2\} \end{aligned}$$

Thus $p_1(x + y) \leq p_1(x) + p_1(y)$

Hence p_1 is a seminorm on V_1 and similarly $p_2 : V_2 \rightarrow \mathbb{R}$ defined by $p_2(y) = \inf_x \{p(x, y) : x \in V_1\}$ is a seminorm on V_2 . \square

Proposition 4.7. *Given a family of binary seminorms on two vector spaces V_1 and V_2 , then a locally convex binary linear topology is formed between V_1 and V_2 .*

Proof. Let $\{p_\alpha\}_{\alpha \in J}$ be a family of binary seminorms on $V_1 \times V_2$. Corresponding to each $p_\alpha, \alpha \in J$, there exists two seminorms $p_{1\alpha}$ and $p_{2\alpha}$ on V_1 and V_2 respectively. Thus we get a family of seminorms $\{p_{i\alpha}\}_{\alpha \in J}$ on $V_i, i = 1, 2$. Hence by theorem 2.7 there exists a locally convex linear topology, τ_i on V_i induced by $\{p_{i\alpha}\}_{\alpha \in J}, i = 1, 2$. Then $\tau_1 \times \tau_2$ is a locally convex binary linear topology between V_1 and V_2 . \square

5. Conclusion

In this paper we have introduced the concept of linear topological spaces to situations in which we have to deal with two vector spaces and a topology between the spaces. This helps to study both the spaces simultaneously. The concept of topological vector space is well used in mathematics, engineering and science and particularly in quantum mechanics. Hence our theory of Binary Linear Topological Spaces helps in the further development of such areas.

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Linear Ideals and Linear Grills in Topological Vector Spaces

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Abstract— In this paper we introduce the concepts of linear grills and linear ideals in topological vector spaces. We prove that the closure operators obtained from them are both Linear Čech closure operators under certain conditions. Also we introduce two new operators based on linear grills and linear ideals.

Keywords— Linear Čech closure spaces, semi open sets, linear grills, linear ideals.

I. INTRODUCTION

Closure spaces were introduced by E. Čech [1] and then studied by many authors like Jeeranutt Khampaladee [8], Chawalit Boonpok [2], David Niel Roth [4] etc. Čech closure spaces is a generalisation of the concept of topological spaces. The first to introduce the concept of grill topological spaces was Choquet [3] in 1947. Ideals in topological spaces have been considered since 1930. D. S. Jankovic and T. R. Hamlett [6] defined a topology obtained as an associated structure on a topological space (X, τ) induced by an ideal on X . B. Roy and M. N. Mukherjee [13] defined a topology obtained as an associated structure on a topological space (X, τ) induced by a grill on X . Later, A. Kandil et. al. [7] proved that the topological space induced by an ideal and the topological space which is induced by a grill are equivalent. Also A. A. Nasef and A. A. Azzam [12] defined and studied new operators Φ^s and Ψ^s with grill. We Tresa M. C. and Sussha D. [15] introduced the concept of Linear Čech closure spaces and studied its fundamental properties. In this paper, we study the notion of linear grills and linear ideals and also we introduced two new operators on topological vector spaces.

In Section II we quote the necessary preliminaries about Linear Čech closure spaces, grills, ideals, topologies derived from grills and ideals etc. Section III deals with the concept of linear grills and the topology derived from a linear grill. In Section IV we proved the linearity of the closure operator obtained from a linear ideal. Section V contains the proof of the equivalence of the topologies obtained from linear grills and linear ideals. In Section VI we introduced some new operators based on linear grills and linear ideals.

II. PRELIMINARIES

Definition 2.1[3] A collection \mathcal{G} of nonempty subsets of a set X is called a grill if

1. $A \in \mathcal{G}$ and $A \subseteq B \Rightarrow B \in \mathcal{G}$
2. $A \cup B \in \mathcal{G} \Rightarrow A \in \mathcal{G}$ or $B \in \mathcal{G}$.

Let \mathcal{G} be a grill on a topological space (X, τ) . Consider the operator $\Phi_{\mathcal{G}}: \wp(X) \rightarrow \wp(X)$ given by $\Phi_{\mathcal{G}}(A) = \{x \in X: U \cap A \in \mathcal{G}, \forall U \in \tau(x)\}$, where $\tau(x) = \{U \in \tau | x \in U\}, \forall A \in \wp(X)$. Then the map $\Psi_{\mathcal{G}}: \wp(X) \rightarrow \wp(X)$ given by $\Psi_{\mathcal{G}}(A) = A \cup \Phi_{\mathcal{G}}(A)$ is a Kuratowski closure operator and hence induces a topology $\tau_{\mathcal{G}} = \{G \subseteq X: \Psi_{\mathcal{G}}(X - G) = X - G\}$, strictly finer than τ .

Definition 2.2 Let (X, τ, \mathcal{G}) be a grill topological space. A subset A of a grill topological space (X, τ, \mathcal{G}) is $\tau_{\mathcal{G}}$ -closed [13] (resp. $\tau_{\mathcal{G}}$ -dense in itself [11], $\tau_{\mathcal{G}}$ -perfect), if $\Psi_{\mathcal{G}}(A) = A$ or equivalently if $\Phi_{\mathcal{G}}(A) \subseteq A$ (resp. $A \subseteq \Phi_{\mathcal{G}}(A)$, $A = \Phi_{\mathcal{G}}(A)$).

Definition 2.3 [9] A nonempty collection I of subsets of a nonempty set X is said to be an ideal on X if

1. $A \in I$ and $B \subseteq A \Rightarrow B \in I$
2. $A \in I$ and $B \in I \Rightarrow A \cup B \in I$.

Given a topological space (X, τ) with an ideal I on X , a set operator $(\cdot)^*: \wp(X) \rightarrow \wp(X)$ called a local function of a subset A with respect to τ and I is defined as $A^*(I, \tau) = \{x \in X | U \cap A \notin I, \forall U \in \tau(x)\}$, where $\tau(x) = \{U \in \tau | x \in U\}, \forall A \in \wp(X)$. Then the map $cl^*(A) = A \cup A^*$ is a Kuratowski closure operator and hence induces a topology $\tau^*(I, \tau) = \{G \subseteq X: cl^*(X - G) = (X - G)\}$, strictly finer than τ .

Definition 2.4 Let (X, τ, I) be an ideal topological space. A subset A of an ideal topological space (X, τ, I) is τ^* -closed [6] (resp. τ^* -dense in itself [5], τ^* -perfect), if $A^* \subseteq A$ (resp. $A \subseteq A^*$, $A = A^*$)

Definition 2.5. [1] A function $c: \wp(X) \rightarrow \wp(X)$ is called a Čech closure operator for X if

1. $c(\emptyset) = \emptyset$
2. $A \subseteq c(A)$

3. $C(A \cup B) = c(A) \cup c(B), \forall A, B \subseteq X$. Then (X, c) is called Čech closure space simply closure space. If in addition
4. $c(c(A)) = c(A), \forall A \subseteq X$, then the space (X, c) is called a Kuratowski (topological) space.
If further
5. for any family of subsets of $X, \{A_i\}_{i \in I}$, $c(\bigcup_{i \in I} A_i) = \bigcup_{i \in I} c(A_i)$, the space is called a total closure space.

Definition 2.6. [1] A subset A of a closure space (X, c) will be closed if $c(A) = A$ and open if its complement is closed, i.e. if $c(X - A) = X - A$.

Definition 2.7. [1] If (X, c) is a closure space, we denote the associated topology on X by t . i.e. $t = \{A^c : c(A) = A\}$

Theorem 2.1. Let (X, c) be a closure space and cl be the closure operator of the associated topology. Then $cl \leq c$ i.e. $c(A) \subseteq cl(A), \forall A \subseteq X$.

Definition 2.8. [14] A map $f: (X, c) \rightarrow (Y, c')$ is said to be a $c - c'$ morphism or just a morphism if $f(c(A)) \subseteq c'(f(A))$.

Result: [1]

1. A mapping f of a closure space (X, c) onto another one (Y, c') is a $c - c'$ morphism at a point $x \in X$, if and only if the inverse image, $f^{-1}(V)$ of each neighbourhood V of $f(x)$ is a neighbourhood of x .
2. If f is a $c - c'$ morphism of a space (X, c) into a space (Y, c') , then the inverse image of each open subset of Y is an open subset of X .
3. If $f: (X, c) \rightarrow (Y, c')$ is a morphism, then $f: (X, t) \rightarrow (Y, t')$ is continuous.

Definition 2.9. [14] A homeomorphism is a bijective mapping f such that both f and f^{-1} are morphisms.

Definition 2.10. [10] A subset A of a topological space (X, τ) is called semi- open set if $A \subseteq cl(int A)$, where $A \subseteq X$ and the family of all semi-open sets of (X, τ) is denoted by $SO(X, \tau)$.

Definition 2.11. [15] Let V be a vector space and c be a closure operator on V such that

1. $c(A) + c(B) \subseteq c(A + B)$
2. $\lambda c(A) \subseteq c(\lambda A)$. Then c is called a linear Čech closure operator and (V, c) is called a linear Čech closure space (LČCS).

Proposition 2.1. [15] Let V be a vector space and c be a closure operator on V . Then (V, c) is a linear Čech closure space if and only if $+: (V \times V, c \times c) \rightarrow (V, c)$ and $\lambda \cdot: (V, c) \rightarrow (V, c), \forall \lambda \in K$ are morphisms.

Proposition 2.2. [15] Let (V, c) be a LČCS. Then the map $T_a: (V, c) \rightarrow (V, c)$ given by $T_a(x) = a + x$ and $M_\lambda: (V, c) \rightarrow (V, c)$ given by $M_\lambda(x) = \lambda x$ are homeomorphisms.

Proposition 2.3. The topology obtained from a LČCS is a linear topology.

Result: If (X, c) is T_1 and finitely generated, it is the discrete closure space.

Proposition 2.4. Every LČCS is T_1 and hence Hausdorff.

Proof: Let 0 be the identity element and x be any other element of the vector space.

$$\text{Then } c(\{0\}) + c(\{x\}) \subseteq c(\{0 + x\}) = c\{x\}.$$

$$\text{This shows that } c\{0\} = \{0\}.$$

$$\text{Then } c\{x\} + c\{-x\} \subseteq c\{x + (-x)\} = c\{0\} = \{0\}.$$

$$\text{If } y (\neq x) \in V, y + (-x) \neq 0.$$

$$\text{Hence } y (\neq x) \notin c\{x\} \text{ and } c\{x\} = \{x\}.$$

We have seen in the literature that every T_1 linear topological space is Hausdorff.

III. LINEAR GRILLS

Definition 3.1. A grill \mathcal{G} on a linear topological space (V, τ) is called a linear grill if

1. $A, B \in \mathcal{G} \Rightarrow A + B \in \mathcal{G}$
2. $A \in \mathcal{G} \Rightarrow \lambda A \in \mathcal{G}, \forall \text{ scalars } \lambda$.

Proposition 3.1. If A and B are any two sets in a topological vector space with a linear grill in it then for the corresponding function $\Phi_{\mathcal{G}}, \Phi_{\mathcal{G}}(A) + \Phi_{\mathcal{G}}(B) \subseteq \Phi_{\mathcal{G}}(A + B)$. Also $\lambda \Phi_{\mathcal{G}}(A) \subseteq \Phi_{\mathcal{G}}(\lambda A)$.

Proof: Let $x \in \Phi_{\mathcal{G}}(A)$ and $y \in \Phi_{\mathcal{G}}(B)$.

Then for every $U \in \tau(x), A \cap U \in \mathcal{G}$ and for every $V \in \tau(y), B \cap V \in \mathcal{G}$.

Since $U \in \tau(x), V \in \tau(y) \exists U_0, V_0 \in \tau(0)$ such that $U = x + U_0$ and $V = y + V_0$

Then $U_0 + V_0 \in \tau(0)$ and

$$U + V = x + U_0 + y + V_0 = x + y + U_0 + V_0 \Rightarrow U + V \in \tau(x + y).$$

Let $W \in \tau(x + y)$. Then $\exists W_0 \in \tau(0)$ such that

$W = x + y + W_0$. Since addition is continuous and $0 + 0 = 0, \exists U_1$ and $V_1 \in \tau(0)$ such that $W_0 = U_1 + V_1$. Thus corresponding to any two neighbourhoods U and V of x and y respectively, \exists a neighbourhood of $x + y$ and vice versa.

Now $A \cap U \in \mathcal{G}$ and $B \cap V \in \mathcal{G}$

$\Rightarrow (A \cap U) + (B \cap V) \in \mathcal{G}$, since \mathcal{G} is closed under addition and

$$(A \cap U) + (B \cap V) \subseteq (A + B) \cap (U + V)$$

$\Rightarrow (A + B) \cap (U + V) \in \mathcal{G}$, by the property of a grill.

Now we have to show that $\lambda\Phi(A) \subseteq \Phi(\lambda A)$.

Let $x \in \Phi(A)$. Then $\lambda x \in \lambda\Phi(A)$.

$$x \in \Phi(A) \Rightarrow \forall U \in \tau(x), A \cap U \in \mathcal{G}.$$

We have to show that $\forall V \in \tau(\lambda x), \lambda A \cap V \in \mathcal{G}$, so that $\lambda x \in \Phi(\lambda A)$. Let $V \in \tau(\lambda x)$.

$$\Rightarrow V = \lambda x + V' \text{ for some } V' \in \tau(0).$$

Since $\lambda \cdot 0 = 0$ and scalar multiplication is continuous in a topological vector space, $\exists V_0 \in \tau(0)$ such that $V' = \lambda V_0$.

So $V = \lambda x + \lambda V_0 = \lambda(x + V_0) = \lambda W$, where $W \in \tau(x)$. Now $\forall W \in \tau(x), A \cap W \in \mathcal{G} \Rightarrow$

$\lambda A \cap V = \lambda A \cap \lambda W = \lambda(A \cap W) \in \mathcal{G}$, by the second property of \mathcal{G} .

Proposition 3.2. If \mathcal{G} is a linear grill in a linear topological space (X, τ) , consisting of $\tau_{\mathcal{G}}$ -perfect sets or $\tau_{\mathcal{G}}$ -dense sets, then the closure operator $\Psi_{\mathcal{G}}(A) = A \cup \Phi_{\mathcal{G}}(A)$, where $\Phi_{\mathcal{G}}(A) = \{x \in X: U \cap A \in \mathcal{G}, \forall U \in \tau(x)\}$ is a Linear Čech closure operator.

Proof: $A \in \mathcal{G}$ is either $\tau_{\mathcal{G}}$ -perfect set or $\tau_{\mathcal{G}}$ -dense set, hence $A \cup \Phi_{\mathcal{G}}(A) = \Phi_{\mathcal{G}}(A)$.

$$\begin{aligned} \Psi_{\mathcal{G}}(A) + \Psi_{\mathcal{G}}(B) &= (A \cup \Phi_{\mathcal{G}}(A)) + (B \cup \Phi_{\mathcal{G}}(B)) \\ &= \Phi_{\mathcal{G}}(A) + \Phi_{\mathcal{G}}(B) \\ &\subseteq \Phi_{\mathcal{G}}(A + B) \\ &\subseteq (A + B) \cup \Phi_{\mathcal{G}}(A + B) \\ &= \Psi_{\mathcal{G}}(A + B). \end{aligned}$$

$$\begin{aligned} \text{Now } \lambda\Psi_{\mathcal{G}}(A) &= \lambda(A \cup \Phi_{\mathcal{G}}(A)) \\ &= \lambda\Phi_{\mathcal{G}}(A) \\ &\subseteq \Phi_{\mathcal{G}}(\lambda A) \end{aligned}$$

$$\subseteq \lambda A \cup \Phi_{\mathcal{G}}(\lambda A).$$

Thus $\Psi_{\mathcal{G}}$ is a Linear Čech closure operator.

Proposition 3.3. If \mathcal{G} is a grill (not necessarily linear) in a linear topological space (X, τ) consisting of $\tau_{\mathcal{G}}$ -perfect sets or $\tau_{\mathcal{G}}$ -closed sets, then the closure operator, $\Psi_{\mathcal{G}}(A) = A \cup \Phi_{\mathcal{G}}(A)$, where $\Phi_{\mathcal{G}}(A) = \{x \in X: U \cap A \in \mathcal{G}, \forall U \in \tau(x)\}$ is a Linear Čech closure operator.

Proof: $A \in \mathcal{G}$ is either $\tau_{\mathcal{G}}$ -perfect set or $\tau_{\mathcal{G}}$ -closed set, hence $A \cup \Phi_{\mathcal{G}}(A) = A$.

$$\begin{aligned} \Psi_{\mathcal{G}}(A) + \Psi_{\mathcal{G}}(B) &= (A \cup \Phi_{\mathcal{G}}(A)) + (B \cup \Phi_{\mathcal{G}}(B)) \\ &= A + B \\ &\subseteq (A + B) \cup \Phi_{\mathcal{G}}(A + B) \\ &= \Psi_{\mathcal{G}}(A + B). \end{aligned}$$

$$\begin{aligned} \text{Now } \lambda\Psi_{\mathcal{G}}(A) &= \lambda(A \cup \Phi_{\mathcal{G}}(A)) \\ &= \lambda A \\ &\subseteq \lambda A \cup \Phi_{\mathcal{G}}(\lambda A). \end{aligned}$$

Thus $\Psi_{\mathcal{G}}$ is a Linear Čech closure operator.

Note: Let A be a fixed subset of X , then the grill $\mathcal{G}_A = \{B \subseteq X: B \cap A^c \neq \emptyset\}$ is not a linear grill, because $B \cap A^c \neq \emptyset$ and $C \cap A^c \neq \emptyset$ neednot always imply $(B + C) \cap A^c \neq \emptyset$.

IV. LINEAR IDEALS

Definition 4.1. An ideal I on a linear topological space is a linear ideal if

1. $A + B \in I \Rightarrow A \in I$ or $B \in I$
2. $\lambda A \in I \Rightarrow A \in I$

Proposition 4.1. If A and B are any two sets in a linear topological space with a linear ideal, then for the corresponding local function $A^* + B^* \subseteq (A + B)^*$. Also $\lambda A^* \subseteq (\lambda A)^*$.

Proof:

Let $x \in A^*$ and $y \in B^*$.

Then $\forall U \in \tau(x), A \cap U \notin I$

And $\forall V \in \tau(y), B \cap V \notin I$.

Therefore $(A \cap U) + (B \cap V) \notin I$.

i.e. $(A + B) \cap (U + V) \notin I$.

Since $U \in \tau(x), V \in \tau(y) \Leftrightarrow U + V \in \tau(x + y)$,

we get $x + y \in (A + B)^*$.

Thus $A^* + B^* \subseteq (A + B)^*$.

Now let $x \in A^*$, then $\lambda x \in \lambda A^*$

And $\forall U \in \tau(x), A \cap U \notin I$.

Let $V \in \tau(\lambda x)$. Then $V = \lambda W$ for some $W \in \tau(x)$.

$$\Rightarrow \lambda A \cap V = \lambda A \cap \lambda W = \lambda(A \cap W).$$

Since

$$A \cap W \notin I, \forall W \in \tau(x), \lambda(A \cap W) = \lambda A \cap V \notin I$$

$$\Rightarrow \lambda x \in (\lambda A)^* \text{ i.e. } \lambda A^* \subseteq (\lambda A)^*.$$

Proposition 4.2. If I is a linear ideal in a linear topological space (X, τ) , consisting of $(\cdot)^*$ -perfect sets or $(\cdot)^*$ -dense sets in itself, then the closure operator $cl^*(A) = A \cup A^*$, where $A^*(I, \tau) = \{x \in X: U \cap A \notin I, \forall U \in \tau(x)\}$, is a Linear Čech closure operator.

Proof:

$A \in I$ is either $(\cdot)^*$ -perfect sets or $(\cdot)^*$ -dense in itself and hence $A \subseteq A^*$.

$$\begin{aligned} cl^*(A) + cl^*(B) &= (A \cup A^*) + (B \cup B^*) \\ &= A^* + B^* \\ &\subseteq (A + B)^* \\ &\subseteq (A + B) \cup (A + B)^* \\ &= cl^*(A + B) \end{aligned}$$

Also $\lambda cl^*(A) = \lambda(A \cup A^*) = \lambda A^*$

$$\subseteq (\lambda A)^* \subseteq \lambda A \cup (\lambda A)^* = cl^*(\lambda A)$$

Showing that cl^* is a Linear Čech closure operator.

Proposition 4.3. If I is an ideal (not necessarily linear) in a linear topological space (X, τ) , consisting of $(\cdot)^*$ -perfect sets or $(\cdot)^*$ -closed sets, then the closure operator $cl^*(A) = A \cup A^*$, where $A^*(I, \tau) = \{x \in X: U \cap A \notin I, \forall U \in \tau(x)\}$, is a Linear Čech closure operator.

Proof: $A \in I$ is either $(\cdot)^*$ -perfect sets or $(\cdot)^*$ -closed and hence $A^* \subseteq A$.

$$\begin{aligned} cl^*(A) + cl^*(B) &= (A \cup A^*) + (B \cup B^*) \\ &= A + B \\ &\subseteq (A + B) \cup (A + B)^* \\ &= cl^*(A + B) \end{aligned}$$

Also $\lambda \text{cl}^*(A) = \lambda(A \cup A^*) = \lambda A \subseteq \lambda A \cup (\lambda A)^* = \text{cl}^*(\lambda A)$, showing that cl^* is a Linear Čech closure operator.

V. EQUIVALENCE OF TOPOLOGIES OBTAINED FROM LINEAR IDEALS AND LINEAR GRILLS

Proposition 5.1. Let V be a vector space and let $\mathcal{G} \subseteq \wp(V)$. Then \mathcal{G} is a linear grill on V if and only if $I(\mathcal{G}) = \{A \in \wp(V) \mid A \notin \mathcal{G}\}$ is a linear ideal on V .

Proof: A. Kandil et.al.[7] proved that \mathcal{G} is a grill if and only if $I(\mathcal{G})$ is an ideal.

We have to prove the linearity conditions.

Let \mathcal{G} be a linear grill. Then $A, B \in \mathcal{G} \Rightarrow A + B \in \mathcal{G}$ and $A \in \mathcal{G} \Rightarrow \lambda A \in \mathcal{G}$.

Let $A, B \notin I(\mathcal{G})$. Then $A, B \in \mathcal{G} \Rightarrow A + B \in \mathcal{G} \Rightarrow A + B \notin I(\mathcal{G})$.

Also $A \notin I(\mathcal{G}) \Rightarrow A \in \mathcal{G} \Rightarrow \lambda A \in \mathcal{G} \Rightarrow \lambda A \notin I(\mathcal{G})$.

Hence $I(\mathcal{G})$ is a linear ideal.

Now assume that $I(\mathcal{G})$ is a linear ideal.

Let $A, B \in \mathcal{G}$. Then $A, B \notin I(\mathcal{G})$.

$\Rightarrow A + B \notin I(\mathcal{G}) \Rightarrow A + B \in \mathcal{G}$.

Also $A \in \mathcal{G} \Rightarrow A \notin I(\mathcal{G}) \Rightarrow \lambda A \notin I(\mathcal{G}) \Rightarrow \lambda A \in \mathcal{G}$.

Hence \mathcal{G} is a linear grill.

Proposition 5.2. Let V be a vector space and $I \subseteq \wp(V)$. Then I is a linear ideal on V if and only if $\mathcal{G}(I) = \{A \in \wp(V) \mid A \notin I\}$ is a linear grill on V .

VI. NEW OPERATORS USING LINEAR IDEALS AND LINEAR GRILLS

Definition 6.1. [12] Let (X, τ) be a topological space and \mathcal{G} be a grill on X . A mapping $\Phi^{\mathcal{G}}: \wp(X) \rightarrow \wp(X)$, denoted $\Phi^{\mathcal{G}}_A$ for $A \in \wp(X)$ (simply $\Phi^{\mathcal{G}}(A)$), is called the operator associated with \mathcal{G} and τ which is defined by $\Phi^{\mathcal{G}}(A) = \{x \in X: U_x \cap A \in \mathcal{G}, \forall U_x \in \text{SO}(X, \tau)\}$, $\forall A \in \wp(X)$.

Definition 6.2. Let (X, τ) be a topological space and I be an ideal on X . A mapping $A^{s*}: \wp(X) \rightarrow \wp(X)$, denoted A^{s*} for $A \in \wp(X)$, is called the operator associated with I and τ which is defined by $A^{s*} = \{x \in X: U_x \cap A \notin I, \forall U_x \in \text{SO}(X, \tau)\}$, $\forall A \in \wp(X)$.

Definition 6.3. [12] Let (X, τ, \mathcal{G}) be a grill topological space. An operator $\Psi^{\mathcal{G}}: \wp(X) \rightarrow \wp(X)$ is defined as $\Psi^{\mathcal{G}}(A) = \{x \in X: \exists U_x \in \text{SO}(X, \tau)$ such that $U - A \notin \mathcal{G}\}$, for any $A \subseteq X$ and $\Psi^{\mathcal{G}}(A) = X - \Phi^{\mathcal{G}}(X - A)$ or $\Psi^{\mathcal{G}}(A) = A \cup \Phi^{\mathcal{G}}(A)$.

Definition 6.4. Let (X, τ, I) be an ideal topological space. An operator $\text{cl}_I^{s*}: \wp(X) \rightarrow \wp(X)$ is defined as $\text{cl}_I^{s*}(A) = A \cup A^{s*}$, $\forall A \in \wp(X)$.

Theorem 6.1. [12] The operator Ψ^s satisfies Kuratowski's closure axioms.

Theorem 6.2. The operator cl_I^{s*} satisfies Kuratowski's closure axioms.

Definition 6.5. [12] A grill on a space X which carries a topology τ generates a unique topology on X depends on Ψ^s and Φ^s operators symbolized by $\tau_{\mathcal{G}}^s$ and defined by $\tau_{\mathcal{G}}^s = \{U \subseteq X: \Psi^s(X - U) = (X - U)\}$ for $A \subseteq X$.

Definition 6.6. An ideal on a space X which carries a topology τ generates a unique topology on X depends on cl_I^{s*} symbolized by τ_I^s and defined by $\tau_I^s = \{U \subseteq X: \text{cl}_I^{s*}(X - U) = (X - U)\}$, for $A \subseteq X$.

Definition 6.7. Let (X, τ, \mathcal{G}) be a grill topological space. Then corresponding to the topology $\tau_{\mathcal{G}}^s$, a set $A \in \wp(X)$ is said to be $\tau_{\mathcal{G}}^s$ -closed set, [resp. $\tau_{\mathcal{G}}^s$ -dense set in itself or $\tau_{\mathcal{G}}^s$ -perfect set] if $\Phi^{\mathcal{G}}(A) \subseteq A$ [resp. $A \subseteq \Phi^{\mathcal{G}}(A)$ or $A = \Phi^{\mathcal{G}}(A)$]

Similarly let (X, τ, I) be an ideal topological space. Then corresponding to the topology τ_I^s , a set $A \in \wp(X)$ is said to be τ_I^s -closed set, [resp. τ_I^s -dense set in itself or τ_I^s -perfect set] if $A^{s*} \subseteq A$ [resp. $A \subseteq A^{s*}$ or $A = A^{s*}$].

Lemma 6.1. If A and B are semi-open sets in a Linear topological space, then $A + B$ is also a semi-open set.

Proof: Since A and B are semi-open sets, $A \subseteq \text{cl}(\text{int}(A))$ and $B \subseteq \text{cl}(\text{int}(B))$.

$\Rightarrow A + B \subseteq \text{cl}(\text{int}(A)) + \text{cl}(\text{int}(B))$

For a linear topological closure operator,

$\text{cl}(A) + \text{cl}(B) \subseteq \text{cl}(A + B)$.

Hence

$A + B \subseteq \text{cl}(\text{int}(A) + \text{int}(B)) \subseteq \text{cl}(\text{int}(A + B))$,

again by the property of linear topological interior operator.

Thus $A + B$ is a semi-open set.

Proposition 6.1. If \mathcal{G} is a linear grill in a topological vector space (X, τ) , then $\Phi^s(A) + \Phi^s(B) \subseteq \Phi^s(A + B)$, $\forall A, B \in \wp(X)$.

Proof: Let $x \in \Phi^s(A)$ and $y \in \Phi^s(B)$.

$\Rightarrow U_x \cap A \in \mathcal{G}, \forall U_x \in \text{SO}(X, \tau)$

And $U_y \cap B \in \mathcal{G}, \forall U_y \in \text{SO}(X, \tau)$

$\Rightarrow (U_x \cap A) + (U_y \cap B) \in \mathcal{G}, \forall U_x, U_y \in \text{SO}(X, \tau)$

$\Rightarrow (U_x + U_y) \cap (A + B) \in \mathcal{G}$, since $(U_x \cap A) + (U_y \cap B) \subseteq (U_x + U_y) \cap (A + B)$.

Let $U_{x+y} \in \text{SO}(X, \tau)$.

Then $U_{x+y} \subseteq \text{cl}(\text{int}(U_{x+y}))$.

$\text{int}(U_{x+y})$ is an open set containing $x + y$.

By the property of topological vector spaces, \exists two open sets V_x and V_y containing

x and y respectively such that $V_x + V_y \subseteq \text{int}(U_{x+y}) \subseteq U_{x+y}$.

$$\Rightarrow (V_x + V_y) \cap (A + B) \subseteq U_{x+y} \cap (A + B)$$

Since \mathcal{G} is a grill, it follows that $U_{x+y} \cap (A + B)$ belongs to \mathcal{G} .

$$\text{Hence } x + y \in \Phi^s(A + B)$$

$$\Rightarrow \Phi^s(A) + \Phi^s(B) \subseteq \Phi^s(A + B), \forall A, B \in \wp(X).$$

Proposition 6.2. (1) If \mathcal{G} is a linear grill in a topological vector space (X, τ) , then Ψ^s is a linear Čech closure operator if \mathcal{G} has only $\tau_{\mathcal{G}}^s$ -dense set in itself or $\tau_{\mathcal{G}}^s$ -perfect set.

(2) If \mathcal{G} is a grill in a topological vector space (X, τ) , then Ψ^s is a linear Čech closure operator if \mathcal{G} has only $\tau_{\mathcal{G}}^s$ -closed sets or $\tau_{\mathcal{G}}^s$ -perfect sets.

Proof: (1) A. A. Nasef and A. A. Azzam [12] has proved that Ψ^s is a Kuratowski closure operator.

We want to prove the linearity conditions, $\Psi^s(A) + \Psi^s(B) \subseteq \Psi^s(A + B)$.

$$\Psi^s(A) = A \cup \phi^s(A) = \phi^s(A), \text{ since } A \subseteq \phi^s(A)$$

$$\Psi^s(A) + \Psi^s(B) = (A \cup \phi^s(A)) + (B \cup \phi^s(B))$$

$$= \phi^s(A) + \phi^s(B)$$

$$\subseteq \phi^s(A + B)$$

$$\subseteq (A + B) \cup \phi^s(A + B)$$

$$= \Psi^s(A + B).$$

Similarly $\lambda\Psi^s(A) \subseteq \Psi^s(\lambda A)$ and hence Ψ^s is a Linear Čech closure operator.

(2) If $A \subseteq X$ is $\tau_{\mathcal{G}}^s$ -closed, $A \cup \phi^s(A) = A$ and the proof follows accordingly.

Proposition 6.3. If I is a linear ideal in a topological vector space (X, τ) , then the function $A^{s*}(I, \tau) = \{x \in X | U_x \cap A \notin I, \forall U_x \in SO(X, \tau)\}$ satisfies $A^{s*} + B^{s*} \subseteq (A + B)^{s*}$.

Proof: Let $x \in A^{s*}$ and $y \in B^{s*}$.

$$\Rightarrow U_x \cap A \notin I, \forall U_x \in SO(X, \tau) \text{ and}$$

$$U_y \cap B \notin I, \forall U_y \in SO(X, \tau)$$

$$\Rightarrow (U_x \cap A) + (U_y \cap B) \notin I, \forall U_x, U_y \in SO(X, \tau)$$

$$\Rightarrow (U_x + U_y) \cap (A + B) \notin I$$

Let $U_{x+y} \in SO(X, \tau)$. Then $U_{x+y} \subseteq \text{cl}(\text{int}(U_{x+y}))$.

$\text{int}(U_{x+y})$ is an open set containing $x + y$.

By the property of topological vector spaces, there exists two open sets V_x and V_y containing x and y respectively such that

$$V_x + V_y \subseteq \text{int}(U_{x+y}) \subseteq U_{x+y}$$

$$\Rightarrow (V_x + V_y) \cap (A + B) \subseteq U_{x+y} \cap (A + B).$$

Hence by the property of ideal,

$$\text{if } U_{x+y} \cap (A + B) \in I, \text{ then}$$

$$(V_x + V_y) \cap (A + B) \in I.$$

So $U_{x+y} \cap (A + B) \notin I \Rightarrow x + y \in (A + B)^{s*}$.

$$\text{Thus } A^{s*} + B^{s*} \subseteq (A + B)^{s*}.$$

Proposition 6.4. (1) If I is a linear ideal in a topological vector space (X, τ) , then cl^{s*} is a linear Čech closure operator if I has only τ_I^s -dense set in itself or τ_I^s -perfect sets.

(2) If I is an ideal in a topological vector space (X, τ) , then cl^{s*} is a linear Čech closure operator if I has only τ_I^s -closed sets or τ_I^s -perfect sets.

Proof: Proof is analogous to that of propositions 6.2 using proposition 6.3.

VII. CONCLUSIONS

The topology obtained from a Linear Čech closure operator is a T_1 topology, hence it is Hausdorff.

The topology derived from a grill is finer than the original topology. Hence the topology we obtained from the Linear Čech closure operator derived from linear grills or linear ideals possesses a significant role in the theory of topological vector spaces.

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Soft linear pq -functions and soft β kernel in Vector Soft Topological Spaces

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Abstract

In this paper we prove some basic properties of the soft sets in a vector soft topological space(VSTS). Also we establish the soft linearity of pq -functions and soft β kernel of a soft linear pq -function in a VSTS.

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Keywords: Vector soft topology, open soft set, closed soft set, compact soft set, convex soft set, balanced soft set.

1. Introduction

Soft set theory emerged in 1999 as a general mathematical tool for modelling uncertainties. Molodstov [8] initiated this theory and pointed out its several applications in solving many practical problems. Operations on soft sets were introduced by Maji et al. [6] in 2003. Later much study was done in soft sets especially connecting soft sets and algebra. In 2011, Shabir and Naz [16] introduced soft topological spaces and Zorlutuna et al. [18], Cagman et al. [1], Hussain et al. [3] etc. contributed to soft topological spaces. Majumdar and Samanta[7] introduced soft mappings. In 2013, Sujoy Das, Pinaki Majumdar and S. K. Samanta [17] introduced the concepts of soft linear spaces and soft normed linear spaces. In 2011 Kharal and Ahmad [5] introduced soft pu -functions connecting

any two families of soft sets. And in 2015, Moumita Chiney and S. K. Samanta [9] introduced vector soft topology, connecting soft set theory and topological vector spaces. With that motivation, we like to study some more concepts of soft sets, soft linearity of pq -functions and soft β kernel of a soft linear pq -function in a VSTS.

Section 2 deals with the preliminaries such as definition of soft sets, its basic operations, definition of soft topology and some properties. In section 3, we proved some theorems on soft sets in a VSTS. In Section 4 we present some properties of convex and balanced sets in a VSTS. Also we defined the concept of soft subspace topology and proved some results based on it. Section 5 contains a main results of the paper, the condition for linearity of a soft pq -function and the necessary and sufficient conditions for the continuity of a soft linear pq -function. In section 6 we defined soft β kernel of a soft linear pq -function and proved that soft β kernel of a soft linear map is a vector space. The definition of soft quotient topology and a necessary and sufficient condition for the continuity of a function on soft quotient topology is also proved in this section.

2. Preliminaries

Definition 2.1. [8] A pair (F, A) is called a *soft set* over a universal set X , where F is a mapping $F : A \rightarrow \wp(X)$, A is a set of parameters.

Notation [2]: The family of all soft sets over X is denoted by $SS(X, A)$.

Definition 2.2. [8] The soft set $(F, A) \in SS(X, A)$ where $F(\alpha) = \phi, \forall \alpha \in A$ is called *the null soft set* of $SS(X, A)$ and is denoted by ϕ_A .

The soft set $(F, A) \in SS(X, A)$ where $F(\alpha) = X, \forall \alpha \in A$ is called *the absolute soft set* of $SS(X, A)$ and is denoted by X_A .

Definition 2.3. [16] Let τ be a collection of soft sets over X . Then τ is said to be a *soft topology* if

1. ϕ_A, X_A belong to τ
2. the soft union of any number of soft sets in τ belongs to τ
3. the soft intersection of any two soft sets in τ belongs to τ

The triplet (X, τ, A) is called a *soft topological space*.

Definition 2.4. [16] Let (X, τ, A) be a soft topological space over X , then the members of τ are said to be *soft open sets* in X .

A soft set (F, A) over X is said to be *soft closed set* in X if its soft complement (F^c, A) belongs to τ .

Proposition 2.5. [3] Let (X, τ, A) be a soft topological space over X . Then for a fixed $\alpha \in A$, $\tau_\alpha = \{F(\alpha) : (F, A) \in \tau\}$ defines a topology on X .

Definition 2.6. [14] Let $SS(X, A)$ denote the set of all soft sets over X under the parameter set A . A soft set $(F, A) \in SS(X, A)$ is said to be *pseudo constant* soft set if $F(\alpha) = X$ or $\phi, \forall \alpha \in A$.

Let $CS(X, A)$ denote the set of all pseudo constant soft sets over X under the parameter set A .

Definition 2.7. [14] A soft topology τ on X is said to be an *enriched soft topology* if (1) of the Definition 2.7 is replaced by (1') $(F, A) \in \tau, \forall (F, A) \in CS(X, A)$.

Then the triplet (X, τ, A) is called an *enriched soft topological space* over X .

Proposition 2.8. [9] Let X be a non-empty set, A be the set of parameters and for each $\alpha \in A, \tau_\alpha$ is a crisp topology on X . Then $\tau^* = \{(G, A) \in SS(X, A) : G(\alpha) \in \tau_\alpha, \forall \alpha \in A\}$ is an enriched soft topology on X .

Proposition 2.9. [13] Let (X, τ, A) be a soft topological space and if $\tau^* = \{(G, A) \in SS(X, A) : G(\alpha) \in \tau_\alpha, \forall \alpha \in A\}$, then τ^* is an enriched soft topology on X such that $\tau \subseteq \tau^*$ and $[\tau^*]_\alpha = \tau_\alpha, \forall \alpha \in A$. And τ^* is called *the enriched topology derived from τ* .

Definition 2.10. [13] Let X and Y be two non-empty sets and $f : X \rightarrow Y$ be a mapping. Then

1. the image of a soft set $(F, A) \in SS(X, A)$ under the mapping f is denoted by $f[(F, A)]$ and is defined by $f[(F, A)] = (f(F), A)$ where $[f(F)](\alpha) = f[F(\alpha)], \forall \alpha \in A$.
2. the inverse image of a soft set $(G, A) \in SS(Y, A)$ under the mapping f is denoted by $f^{-1}[(G, A)]$ and is defined by $f^{-1}[(G, A)] = (f^{-1}(G), A)$ where $[f^{-1}(G)](\alpha) = f^{-1}[G(\alpha)], \forall \alpha \in A$.

Definition 2.11. [13] Let (X, τ, A) and (Y, ν, A) be soft topological spaces. The mapping $f : (X, \tau, A) \rightarrow (Y, \nu, A)$ is said to be

1. *soft continuous* if $f^{-1}(F, A) \in \tau, \forall (F, A) \in \nu$.
2. *soft homeomorphism* if f is bijective and f and f^{-1} are soft continuous.
3. *soft open* if $(F, A) \in \tau \Rightarrow f(F, A) \in \nu$.
4. *soft closed* if (F, A) is soft closed in $(X, \tau, A) \Rightarrow f(F, A)$ is soft closed in (Y, ν, A) .

Definition 2.12. [9] Let (F, A) and (G, A) be two soft sets over a vector space V , over K , the field of real or complex numbers. Then

1. $(F, A) + (G, A) = (F + G, A)$ where $(F + G)(\alpha) = F(\alpha) + G(\alpha), \forall \alpha \in A$
2. $k(F, A) = (kF, A)$ where $(kF)(\alpha) = \{kx : x \in F(\alpha)\}, \forall \alpha \in A$ and $\forall k \in K$.

3. $x + (F, A) = (x + F, A)$ where $(x + F)(\alpha) = \{x + y : y \in F(\alpha)\}, \forall \alpha \in A$ and $\forall x \in V$.
4. If (E, A) is any soft set over K , then $(E, A) \cdot (F, A) = (E \cdot F, A)$ where $(E \cdot F)(\alpha) = E(\alpha) \cdot F(\alpha), \forall \alpha \in A$.

Definition 2.13. [13] A soft set (E, A) over X is said to be a soft element if there exists $\alpha \in A$ such that $E(\alpha)$ is a singleton say $\{x\}$ and $E(\beta) = \phi, \forall \beta (\neq \alpha) \in A$. Such a soft element is denoted by E_α^x . A soft element E_α^x is said to be in the soft set (G, A) denoted by $E_\alpha^x \in (G, A)$ if $x \in G(\alpha)$.

Definition 2.14. [13] Let (X, τ, A) be a soft topological space over X . A soft set (F, A) is said to be a *soft neighbourhood* of the soft set (H, A) if there exists a soft open set (G, A) such that $(H, A) \sqsubseteq (G, A) \sqsubseteq (F, A)$.

If $(H, A) = E_\alpha^x$, then (F, A) is said to be soft neighbourhood of the soft element E_α^x . The neighbourhood system of a soft element E_α^x is denoted by $N_\tau(E_\alpha^x)$, which is the family of all its soft neighbourhoods.

Definition 2.15. [5] Let $SS(U, A)$ and $SS(V, B)$ be two families of soft sets. Let $q : U \rightarrow V$ and $p : A \rightarrow B$ be mappings. Then a mapping $f_{pq} : SS(U, A) \rightarrow SS(V, B)$ is defined as

1. Let (F, A) be a soft set in $SS(U, A)$. The image of (F, A) under f_{pq} written as $f_{pq}(F, A) = (f_{pq}(F), p(A))$ is a soft set in $SS(V, B)$ such that

$$f_{pq}(F)(y) = \begin{cases} \bigcup_{x \in p^{-1}(y)} q(F(x)) & \text{if } p^{-1}(y) \neq \phi \\ \phi & \text{otherwise} \end{cases}, \forall y \in B$$

2. Let (G, B) be a soft set in $SS(V, B)$. Then the inverse image of (G, B) under f_{pq} written as $f_{pq}^{-1}(G, B) = (f_{pq}^{-1}(G), p^{-1}(B))$ is a soft set in $SS(U, A)$ such that

$$f_{pq}^{-1}(G)(x) = \begin{cases} q^{-1}(G(p(x))) & \text{if } p(x) \in B \\ \phi & \text{otherwise} \end{cases}, \forall x \in A$$

The soft function f_{pq} is called surjective if p and q are surjective. The soft function f_{pq} is called injective if p and q are injective.

Proposition 2.16. [5] Let $SS(U, A)$ and $SS(V, B)$ be families of soft sets. For a function $f_{pq} : SS(U, A) \rightarrow SS(V, B)$, the following statements are true:

1. $f_{pq}(\phi_A) = \phi_B$
2. $f_{pq}(U_A) \sqsubseteq U_B$
3. $f_{pq}((F, A) \sqcup (G, A)) = f_{pq}(F, A) \sqcup f_{pq}(G, A)$ where $(F, A), (G, A) \in SS(U, A)$.
In general $f_{pq}(\sqcup_i (F_i, A)) = \sqcup_i f_{pq}(F_i, A)$ where $(F_i, A) \in SS(U, A)$.

4. If $(F, A) \sqsubseteq (G, A)$ then $f_{pq}(F, A) \sqsubseteq f_{pq}(G, A)$ where $(F, A), (G, A) \in SS(U, A)$.
5. If $(G, B) \sqsubseteq (H, B)$ then $f_{pq}^{-1}(G, B) \sqsubseteq f_{pq}^{-1}(H, B)$ where $(G, B), (H, B) \in SS(V, B)$.

Proposition 2.17. [18] Let $SS(U, A)$ and $SS(V, B)$ be families of soft sets. For a function $f_{pq} : SS(U, A) \rightarrow SS(V, B)$, the following statements are true

1. $f_{pq}^{-1}((G, B)^c) = (f_{pq}^{-1}(G, B))^c$
2. $f_{pq}(f_{pq}^{-1}(G, B)) \sqsubseteq (G, B) \forall (G, B) \in SS(V, B)$. If f_{pq} is surjective, the equality holds.
3. $(F, A) \sqsubseteq f_{pq}^{-1}(f_{pq}(F, A))$ for any soft set (F, A) in $SS(U, A)$. If f_{pq} is injective, the equality holds.

Definition 2.18. [18] Let (U_1, τ_1, A_1) and (U_2, τ_2, A_2) be soft topological spaces. Let $q : U_1 \rightarrow U_2$ and $p : A_1 \rightarrow A_2$ be mappings. Let $f_{pq} : SS(U_1, A_1) \rightarrow SS(U_2, A_2)$ be a soft function and $E_\alpha^x \in U_{1A_1}$

1. f_{pq} is soft pq -continuous at $E_\alpha^x \in U_{1A_1}$ if for each $(G, B) \in N_{\tau_2}(f_{pq}(E_\alpha^x))$, \exists a $(H, A) \in N_{\tau_1}(E_\alpha^x)$ such that $f_{pq}(H, A) \sqsubseteq (G, B)$
2. f_{pq} is soft pq -continuous on U_{1A_1} if f_{pq} is soft pq continuous at each soft points in U_{1A_1} .

Proposition 2.19. [18] Let (U, τ, A) and (V, ν, B) be soft topological spaces. Let $f_{pq} : SS(U, A) \rightarrow SS(V, B)$ be a function and $E_\alpha^x \in U_A$. Then the following statements are equivalent.

1. f_{pq} is soft pq -continuous at E_α^x
2. For each $(G, B) \in N_\nu(f_{pq}(E_\alpha^x))$, \exists a $(H, A) \in N_\tau(E_\alpha^x)$ such that $(H, A) \sqsubseteq f_{pq}^{-1}(G, B)$.
3. For each $(G, B) \in N_\nu(f_{pq}(E_\alpha^x))$, $f_{pq}^{-1}(G, B) \in N_\tau(E_\alpha^x)$.

3. Properties of soft sets in a Vector Soft Topological Space

Definition 3.1. [9] Let K be the field of real or complex numbers, A be the set of parameters and ν_α be the usual topology on K , $\forall \alpha \in A$. Then the soft topology ν derived from ν_α is called *the soft usual topology* on K .

Definition 3.2. [9] Let V be a vector space over a scalar field K , endowed with the soft usual topology, ν , A be the parameter set and τ be a soft topology on V . Then τ is said to be *a vector soft topology* on V if the mapping:

1. $f : (V \times V, A, \tau \times \tau) \rightarrow (V, A, \tau)$ defined by $f(x, y) = x + y$
and
2. $g : (K \times V, A, \nu \times \tau) \rightarrow (V, A, \tau)$ defined by $g(k, x) = kx$
are soft continuous, $\forall x, y \in V$ and $k \in K$.

Proposition 3.3. [9] Let τ be a vector soft topology on a vector space V over the field K , A be the parameter set and ν be the soft usual topology on K . Then τ_α is a vector topology on V , $\forall \alpha \in A$.

Proposition 3.4. [9] Let V be a vector space over a scalar field K , endowed with the soft usual topology, ν , A be the parameter set and $\forall \alpha \in A$, τ_α is a vector topology on V , then τ^* is a vector soft topology on V , where τ^* is defined as in Proposition 2.2.

Proposition 3.5. L et τ be a vector soft topology on a vector space V over the field K , A be the parameter set. Then for any $(F, A) \in SS(V, A)$ and $x \in V$, $[x + (F, A)]^- = x + (F, A)^-$ and $[\lambda(F, A)]^- = (\lambda F, A)^-$, $\forall \lambda \in K$.

Proof. $(F, A)^-$ is the intersection of all soft closed sets containing (F, A) .

Let (G, A) be a soft closed set containing (F, A) .

Then $x + (G, A) = (x + G, A)$, where $(x + G)(\alpha) = \{x + y : y \in G(\alpha)\}$.

$x + (G, A)$ is also soft closed, since the addition map is continuous.

Also $x + (F, A) \subseteq x + (G, A)$.

$[x + (F, A)]^- = \cap \{x + (G, A) : (G, A) \text{ is soft closed and } (G, A) \supseteq (F, A)\}$

$= x + \cap \{(G, A) : (G, A) \text{ is soft closed and } (G, A) \supseteq (F, A)\}$

$= x + (F, A)^-$ Now $\lambda(G, A) = (\lambda G, A)$ where $(\lambda G)(\alpha) = \{\lambda y : y \in G(\alpha)\}$.

Since scalar multiplication is continuous, $\lambda(G, A)$ is closed if (G, A) is closed.

And $\lambda(F, A) \subseteq \lambda(G, A)$.

$[\lambda(F, A)]^- = \cap \{\lambda(G, A) : (G, A) \text{ is soft closed and } (G, A) \supseteq (F, A)\}$

$= \lambda \cap \{(G, A) : (G, A) \text{ is soft closed and } (G, A) \supseteq (F, A)\}$

$= \lambda(F, A)^-$ Thus the closure of $\lambda(F, A)$ is $(\lambda F, A)^-$. ■

Proposition 3.6. Let (V, τ, A) be a vector soft topological space(VSTS). Then for any $(F, A), (G, A) \in SS(V, A)$, $(F, A)^- + (G, A)^- \subseteq (F + G, A)^-$.

Proof. For a fixed $\alpha \in A$, consider $F^-(\alpha) + G^-(\alpha)$. Let $x_\alpha \in F^-(\alpha)$ and $y_\alpha \in G^-(\alpha)$. Then $(x_\alpha, y_\alpha) \in F^-(\alpha) \times G^-(\alpha)$, and $F^-(\alpha) \times G^-(\alpha)$ is a closed set since it is the product of two closed sets. Then by the continuity of the addition map, $x_\alpha + y_\alpha \in$ any closed set containing $F(\alpha) + G(\alpha)$. Therefore $x_\alpha + y_\alpha \in (F + G)^-(\alpha)$ Since this is true for all $\alpha \in A$, $(F, A)^- + (G, A)^- \subseteq (F + G, A)^-$. ■

Proposition 3.7. In the VSTS (V, τ^*, A) , the sum of any soft set and a soft open set is soft open.

Proof. Let (F, A) be any soft set in (V, τ^*, A) and (U, A) be a soft open set. Fix $\alpha \in A$ $F(\alpha) + U(\alpha) = \cup_x \{x + U(\alpha) : x \in F(\alpha)\}$. Since $U(\alpha)$ is open, $x + U(\alpha)$ is open and

by the property of a topological space, $\cup_x \{x + U(\alpha) : x \in F(\alpha)\}$ is open in τ_α .

i.e. $(F + U)(\alpha)$ is open in τ_α .

Since this is true for all $\alpha \in A$, $(F + U, A)$ is soft open in τ^* . ■

Definition 3.8. [18] A family Ψ of soft sets is a *cover* of a soft set (F, A) if $(F, A) \sqsubseteq \sqcup\{(F_i, A) : (F_i, A) \in \Psi, i \in I\}$. It is a soft open cover, if each member of Ψ is a soft open set. A subcover of Ψ is a subfamily of Ψ which is also a cover.

Definition 3.9. [18] A soft topological space (U, τ, A) is *compact* if each soft open cover of U_A has a finite subcover.

Proposition 3.10. Let (V, τ, A) be a VSTS. If (C, A) and (D, A) are two soft compact sets in V , then $(C, A) + (D, A)$ is also a soft compact set.

Proof. If (C, A) and (D, A) are two soft compact sets, $C(\alpha)$ and $D(\alpha)$ are compact sets for all $\alpha \in A$. This implies $C(\alpha) \times D(\alpha)$ is compact, for all $\alpha \in A$. Then $C(\alpha) + D(\alpha)$ is compact, for all $\alpha \in A$, by the continuity of addition in vector soft topology. Hence $(C, A) + (D, A)$ is compact. ■

Proposition 3.11. Let (V, τ, A) be a VSTS. If (C, A) is a soft compact set in V , then $(\lambda C, A)$ is also a soft compact set, $\forall \lambda \in K$.

Proof. If (C, A) is a soft compact set, $C(\alpha)$ is compact set for all $\alpha \in A$. This implies $\lambda C(\alpha)$ is compact, for all $\alpha \in A$. Then $(\lambda C)(\alpha)$ is compact, for all $\alpha \in A$, by the continuity of scalar multiplication in vector soft topology. Hence $(\lambda C, A)$ is compact. ■

Note:

By the propositions 3.6 and 3.7, the set of all soft compact sets in a VSTS forms a vector space with addition of soft sets and scalar multiplication of soft sets.

4. Convex and balanced soft sets in a VSTS and soft subspace topology

Definition 4.1. [9] A soft set (F, A) over a vector space V is said to be

1. *convex* if $k(F, A) + (1 - k)(F, A) \sqsubseteq (F, A), \forall k \in [0, 1]$.
2. *balanced* if $k(F, A) \sqsubseteq (F, A)$ for all scalar k with $|k| \leq 1$.
3. *absolutely convex* if it is balanced and convex.

Remark 4.2. [9]

1. (F, A) is convex (balanced) soft set if and only if for all $\alpha \in A$, the ordinary set $F(\alpha)$ is convex (balanced).

2. If (F, A) and (G, A) are two convex (balanced) soft sets in a vector space V over the scalar field K , then $k_1(F, A) + k_2(G, A)$ is convex (balanced) soft set in V for all scalars $k_1, k_2 \in K$.
3. If $\{(F_i, A)\}_{i \in I}$ is a family of convex (balanced) soft sets in a vector space V , then $(F, A) = \bigcap_{i \in I} (F_i, A)$ is a convex (balanced) soft set in V .

Proposition 4.3. The closure of a balanced soft set is balanced in any VSTS.

Proof. Let (F, A) be a balanced soft set in (V, τ, A) , a VSTS.

Then by definition, $k(F, A) \sqsubseteq (F, A), \forall |k| \leq 1$

$k(F, A)^- = (kF, A)^- \sqsubseteq (F, A)^-, \forall k \leq 1$

Hence $(F, A)^-$ is a balanced soft set. ■

Proposition 4.4. The interior of a balanced soft set is balanced in any VSTS.

Proof. Let (F, A) be a balanced set.

Then by definition $(kF, A) \sqsubseteq (F, A), \forall k \in K$. And for any soft set $(F, A), k(F, A) = (kF, A)$

Hence $k(F, A)^o = (kF, A)^o \sqsubseteq (F, A)^o$

So $(F, A)^o$ is a balanced soft set. ■

Proposition 4.5. The closure of a convex soft set is a convex soft set in any VSTS.

Proof. Let (F, A) be a convex soft set.

Then by definition $k(F, A) + (1 - k)(F, A) \sqsubseteq (F, A), \forall k \in [0, 1]$

Now $k(F, A)^- + (1 - k)(F, A)^- = (kF, A)^- + ((1 - k)F, A)^-$

$\sqsubseteq (kF + (1 - k)F, A)^-$

$\sqsubseteq (F, A)^-$.

Thus $(F, A)^-$ is a convex soft set. ■

Definition 4.6. Let (V, τ, A) be a vector soft topology and W be a subspace of V . Then for $(F, A) \in \tau, \exists (F|_W, A) \in \tau|_W$ where $F|_W(\alpha) = F(\alpha) \cap W, \forall \alpha \in A$.

Then clearly $\tau|_W$ is a soft topology on W .

If $\tau|_W$ is a vector soft topology on W , then $(W, \tau|_W, A)$ is called a *soft subspace topology*.

Proposition 4.7. Let (V, τ, A) be a VSTS, then the closure of a soft subspace in V is a soft subspace in V .

Proof. Let (FA) be a soft vector space in a vector space V

i.e. $F(\alpha)$ is a vector space for all $\alpha \in A$.

Let b and c be any two scalars.

$b(F, A)^- + c(F, A)^- = (bF, A)^- + (cF, A)^-$

$\sqsubseteq (bF + cF, A)^-$

$= (F, A)^-,$ since $(bF + cF, A) = (F, A)$, by the definition of soft vector space.

Thus $(F, A)^-$ is a soft vector space in V . ■

Proposition 4.8. Let (L, τ) be a topological vector space and A be any parameter set. Then the soft enriched topology τ^* derived from τ , is a vector soft topology on L , where for each $\alpha \in A$, $\tau_\alpha = \tau$.

Proof. Since vector addition and scalar multiplication are both continuous in a topological vector space, proof follows directly from the definitions of vector soft topology. ■

Proposition 4.9. If (L, τ) be a topological vector space and M is a subspace of L , then \overline{M} is the closure of M in (L, τ) . Then $(\overline{M}, \tau^*|_{\overline{M}}, A)$ is a soft subspace topology of (L, τ^*, A) .

Proof. Since (L, τ) is a topological vector space and M is a subspace of L , by the property of topological vector space we have $\overline{M} + \overline{M} \subseteq \overline{M}$ and $k\overline{M} \subseteq \overline{M}$, $\forall k \in K$. Thus \overline{M} is again a subspace of L . Then by the definition of soft subspace topology and the proposition 5.2, $(\overline{M}, \tau^*|_{\overline{M}}, A)$ is a soft subspace topology of (L, τ^*, A) . ■

5. Soft pq – functions in a VSTS

Definition 5.1. A soft zero element E_α^0 is the soft element given by $E(\alpha) = \{0\}$ and $E(\beta) = \phi$, $\forall \beta (\neq \alpha) \in A$.

Result:

$$E_\alpha^0 + E_\alpha^x = E_\alpha^x, \forall x \in X.$$

Proposition 5.2. Let (X, τ, A) be a VSTS and τ^* be the enriched topology derived from τ . Let $(M, A) \in N_{\tau^*}(E_\alpha^0)$. Then $(M, A) + E_\alpha^x \in N_{\tau^*}(E_\alpha^x)$.

Proof. Since $(M, A) \in N_{\tau^*}(E_\alpha^0)$, there exists $(H, A) \in \tau^*$ such that $E_\alpha^0 \in (H, A) \sqsubseteq (M, A)$. Then $\{0\} \subseteq H(\alpha)$. So $\{x\} \subseteq \{x\} + H(\alpha)$. Hence $E_\alpha^x \in (H, A) + E_\alpha^x$. Since (H, A) is soft open, $(H, A) + E_\alpha^x$ is soft open since $H(\beta)$ is open for each $\beta \in A$ and $H(\alpha) + x$ is open by the continuity of addition. Also $(H, A) \sqsubseteq (M, A) \Rightarrow (H, A) + E_\alpha^x \sqsubseteq (M, A) + E_\alpha^x$. Thus $(M, A) + E_\alpha^x \in N_{\tau^*}(E_\alpha^x)$. ■

Theorem 5.3. Let (V_1, τ_1^*, A_1) and (V_2, τ_2^*, A_2) be two enriched vector soft topological spaces. Let $q : V_1 \rightarrow V_2$ and $p : A_1 \rightarrow A_2$ be two mappings in which q is linear and $T_{pq} : (V_1, \tau_1^*, A_1) \rightarrow (V_2, \tau_2^*, A_2)$. Then $T_{pq}(E_\alpha^0) = E_{p(\alpha)}^0$.

Proof. Since q is a linear map $q(0) = 0$.
By definition of pq –soft mapping,

$$\begin{aligned}
T_{pq}(E_\alpha^0)(y) &= \begin{cases} \bigcup_{x \in p^{-1}(y)} q(E(x)) & \text{if } p^{-1}(y) \neq \phi \\ \phi & \text{otherwise} \end{cases} \\
&= \begin{cases} q(\{0\}) & \text{if } p(\alpha) = y \\ \phi & \text{otherwise} \end{cases} \\
&= \begin{cases} \{0\} & \text{if } p(\alpha) = y \\ \phi & \text{otherwise} \end{cases}
\end{aligned}$$

Thus $T_{pq}(E_\alpha^0) = E_{p(\alpha)}^0$. ■

Corollary 5.4. T_{pq} is soft pq -continuous at E_α^0 if for each neighbourhood (M, A) of $T_{pq}(E_\alpha^0) = E_{p(\alpha)}^0$, \exists a neighbourhood (L, A) of E_α^0 such that $T_{pq}(L, A) \sqsubseteq (M, A)$.

Theorem 5.5. Let (V_1, τ_1, A_1) and (V_2, τ_2, A_2) be two VSTS. Let $q : V_1 \rightarrow V_2$ and $p : A_1 \rightarrow A_2$ be two mappings in which q is linear and $T_{pq} : (V_1, \tau_1^*, A_1) \rightarrow (V_2, \tau_2^*, A_2)$. Then T_{pq} is linear in the sense that $T_{pq}[\alpha(L, A) + \beta(M, A)] = \alpha T_{pq}(L, A) + \beta T_{pq}(M, A)$.

Proof. Since p is one-one

$$T_{pq}(L)(y) = \begin{cases} q(L(x)) & \text{when } x = p^{-1}(y) \\ \phi & \text{when } p^{-1}(y) = \phi \end{cases}$$

So

$$\begin{aligned}
T_{pq}[\alpha(L, A) + \beta(M, A)](y) &= T_{pq}[\alpha(L, A) + \beta(M, A)](y) \\
&= \begin{cases} q(\alpha L(x) + \beta M(x)) & \text{when } x = p^{-1}(y) \\ \phi & \text{when } p^{-1}(y) = \phi \end{cases} \\
&= \begin{cases} \alpha q(L(x)) + \beta q(M(x)) & \text{when } x = p^{-1}(y) \\ \phi & \text{otherwise} \end{cases}, \text{ since } q \text{ is linear}
\end{aligned}$$

Now

$$\begin{aligned}
&\alpha T_{pq}(L)(y) + \beta T_{pq}(M)(y) \\
&= \alpha \begin{cases} q(L(x)) \text{ when } x = p^{-1}(y) \\ \phi \text{ when } p^{-1} = \phi \end{cases} + \beta \begin{cases} q(M(x)) \text{ when } x = p^{-1}(y) \\ \phi \text{ when } p^{-1} = \phi \end{cases} \\
&= \begin{cases} \alpha q(L(x)) + \beta q(M(x)) \text{ when } x = p^{-1}(y) \\ \phi \text{ otherwise} \end{cases}
\end{aligned}$$

Thus $T_{pq}[\alpha(L, A) + \beta(M, A)] = \alpha T_{pq}(L, A) + \beta T_{pq}(M, A)$. ■

Theorem 5.6. Let (V_1, τ_1^*, A_1) and (V_2, τ_2^*, A_2) be two enriched vector soft topological spaces. Let $T_{pq} : (V_1, \tau_1^*, A_1) \rightarrow (V_2, \tau_2^*, A_2)$ be linear. Then T_{pq} is soft pq -continuous at E_α^x if and only if for each $(M, A) \in N_{\tau_2^*}(E_{p(\alpha)}^0)$, there exists $(L, A) \in N_{\tau_1^*}(E_\alpha^0)$ such that $T_{pq}[(L, A) + E_\alpha^x] \subseteq (M, A) + T_{pq}(E_\alpha^x)$.

Proof. Addition is a homeomorphism in a VSTS. Hence by Proposition 6.1 (F, A) is a soft neighbourhood of a soft point E_α^x if and only if $-E_\alpha^x + (F, A)$ is a soft neighbourhood of E_α^0 . Thus any neighbourhood of E_α^x is obtained from a neighbourhood of E_α^0 and vice versa.

Hence $(L, A) + E_\alpha^x$ is a soft neighbourhood of the soft point E_α^x for any $(L, A) \in N_{\tau_1^*}(E_\alpha^0)$.

Now $T_{pq}[(L, A) + E_\alpha^x] = T_{pq}(L, A) + T_{pq}[E_\alpha^x]$, by the linearity of T_{pq} .

This shows that any neighbourhood of $T_{pq}[E_\alpha^x]$ can be obtained from the image of the neighbourhood (L, A) of E_α^0 . Also if (L, A) is a neighbourhood of E_α^0 , $T_{pq}(L, A)$ is a neighbourhood of $T_{pq}(E_\alpha^0) = E_{p(\alpha)}^0$.

Let $(M, A) \in N_{\tau_2^*}(E_{p(\alpha)}^0)$. Then $(M, A) + T_{pq}(E_\alpha^x) \in N_{\tau_2^*}(E_{p(\alpha)}^0)$.

T_{pq} is soft pq -continuous at E_α^x if and only if there exists a neighbourhood of E_α^x say (D, A) such that

$$T_{pq}(D, A) \subseteq (M, A) + T_{pq}E_\alpha^x$$

And corresponding to (D, A) we may find $(L, A) \in N_{\tau_1^*}(E_\alpha^0)$ such that

$$(L, A) + E_\alpha^x = (D, A).$$

$$\Rightarrow T_{pq}[(L, A) + E_\alpha^x] \subseteq (M, A) + T_{pq}(E_\alpha^x)$$
■

6. Soft β kernel of a soft pq -linear map

Definition 6.1. [14] Let (X, τ, A) be a soft topological space. If for the soft elements E_α^x, E_β^y with $E_\alpha^x \neq E_\beta^y$, there exists,

1. $(F, A) \in \tau$ such that $E_\alpha^x \in (F, A)$ and $E_\beta^y \notin (F, A)$ or $E_\alpha^x \notin (F, A)$ and $E_\beta^y \in (F, A)$, then (X, τ, A) is called a soft T_0 -space.
2. $(F, A), (G, A) \in \tau$ such that $E_\alpha^x \in (F, A)$ and $E_\beta^y \notin (F, A)$ and $E_\alpha^x \notin (G, A)$ and $E_\beta^y \in (G, A)$, then (X, τ, A) is called a soft T_1 -space.
3. $(F, A), (G, A) \in \tau$ such that $E_\alpha^x \in (F, A)$, $E_\beta^y \in (G, A)$ and $(F, A) \cap (G, A) = \phi_A$, then (X, τ, A) is called a soft T_2 -space.

Proposition 6.2. [14] A soft topological space (X, τ, A) is soft T_1 space if and only if all soft elements E_α^x is soft closed.

Definition 6.3. Let $T_{pq} : (V_1, \tau_1, A_1) \rightarrow (V_2, \tau_2, A_2)$ be a soft linear map. Then the soft- β kernel of T_{pq} denoted by $K_\beta(T_{pq})$ is the pre-image of the soft zero-element E_β^0 for some $\beta \in A_2$.

Note:

$$K_\beta(T_{pq}) = \{(F, A_1) \in SS(V_1, A_1) | T_{pq}(F, A_1) = E_\beta^0\}$$

$$\text{Since } T_{pq} \text{ is soft linear, } T_{pq}(F)(y) = \begin{cases} q(F(x)) & \text{if } x = p^{-1}(y) \\ \phi & \text{if } p^{-1}(y) = \phi \end{cases}$$

$$\text{and } T_{pq}(F, A_1) = E_\beta^0 \Rightarrow$$

$$K_\beta(T_{pq}) = \{(F, A_1) \in SS(V_1, A_1) | F(p^{-1}(\beta)) \subseteq \text{Ker } q \text{ and } F(\alpha) = \phi \forall \alpha (\neq p^{-1}(\beta)) \in A_1\}.$$

Proposition 6.4. Let $T_{pq} : (V_1, \tau_1, A_1) \rightarrow (V_2, \tau_2, A_2)$ be a soft linear map between the VSTS (V_1, τ_1, A_1) and (V_2, τ_2, A_2) and $K_\beta(T_{pq})$ be the soft β - kernel of the mapping. Then $K_\beta(T_{pq})$ is a vector space under addition of soft sets and scalar multiplication of a soft set.

Proof. Since $\text{Ker } q$ is a subspace of V_2 , if (F, A_1) and $(G, A_1) \in K_\beta(T_{pq})$, $F(p^{-1}(\beta)) + G(p^{-1}(\beta)) \subseteq \text{Ker } q$ and $F(\alpha) + G(\alpha) = \phi \forall \alpha \neq p^{-1}(\beta)$. Thus $(F, A_1) + (G, A_1) \in K_\beta(T_{pq})$. Similarly $\lambda(F, A_1) \in K_\beta(T_{pq})$, $\forall (F, A_1) \in K_\beta(T_{pq})$.

$E_{p^{-1}(\beta)}^0$ acts as the zero vector for addition and for any $(F, A_1) \in K_\beta(T_{pq})$, $-(F, A_1) \in K_\beta(T_{pq})$, which is the additive inverse of (F, A_1) . ■

Remark 6.5. The soft union of all soft sets in $K_\beta(T_{pq})$ is the soft set (K_β, A_1) given by

$$K_\beta(x) = \begin{cases} \text{Ker } q & \text{if } x = p^{-1}(\beta) \\ \phi & \text{otherwise} \end{cases}.$$

Remark 6.6. If q is one-one, T_{pq} is one-one and then

$$K_\beta(T_{pq}) = T_{pq}^{-1}(E_\beta^0) = E_{p^{-1}(\beta)}^0$$

Proposition 6.7. If (V_2, τ_2, A_2) is a soft Hausdorff space and T_{pq} is soft-continuous, then each soft set in $K_\beta(T_{pq})$ is soft closed and if A_1 is finite (K_β, A_1) is soft closed.

Proof. If (V_2, τ_2, A_2) is a soft Hausdorff space, E_β^0 is soft closed and if T_{pq} is soft-continuous, then the inverse image of the closed set E_β^0 is soft closed set. That is each soft set in $K_\beta(T_{pq})$ is soft closed.

Then if A_1 is finite (K_β, A_1) is soft closed being finite union of closed sets. ■

Definition 6.8. Let (V, τ, A) be a VSTS. Let W be a subspace of V . Then V/W is the quotient space and $Q : V \rightarrow V/W$ given by $Q(v) = v + W$ is the quotient map. The soft quotient topology, τ_Q on V/W is defined such that a soft set, (E, A) in V/W is soft open if and only if the inverse of (E, A) under the quotient map is soft open. $(V/W, \tau_Q, A)$ is called the vector soft topological quotient space.

Proposition 6.9. A soft pq -function T_{pq} on V/W is continuous (open) if and only if the composition $T_{pq} \circ Q$ is soft continuous (open).

Proof. By the definition of the soft quotient topology the map $Q : (V, \tau, A) \rightarrow (V/W, \tau_Q, A)$ is soft open and soft continuous. Now consider the map $T_{pq} : (V/W, \tau_Q, A) \rightarrow (X, \nu, B)$. If T_{pq} is soft continuous (open), then clearly the composition $T_{pq} \circ Q$ is soft continuous (open). Assume that the composition $T_{pq} \circ Q$ is soft continuous (open). Let (Y, B) be soft open in (X, ν, B) . $T_{pq}^{-1}(Y, B)$ is soft open if and only if $Q^{-1}[T_{pq}^{-1}(Y, B)]$ is soft open, by the definition of τ_Q . And $Q^{-1}[T_{pq}^{-1}(Y, B)] = [T_{pq} \circ Q]^{-1}(Y, B)$. But since the composition is continuous $[T_{pq} \circ Q]^{-1}(Y, B)$ is soft open and hence $T_{pq}^{-1}(Y, B)$ is soft open, showing that T_{pq} is soft pq -continuous. Let (F, A) be soft open in $(V/W, \tau_Q, A)$. Since Q is soft continuous $Q^{-1}(F, A) = (G, A)$ is soft open in (V, τ, A) . Since the composition $T_{pq} \circ Q$ is soft open $[T_{pq} \circ Q](G, A) = T_{pq}[Q(G, A)] = T_{pq}(F, A)$ is soft open, showing that T_{pq} is soft pq -open. ■

7. Conclusion

The study of soft sets and soft topology has wide applications in classical and non-classical logic. The notion of soft mappings have been applied to medical diagnosis in medical expert systems [5]. We hope that our study connecting vector spaces, soft topology and soft mappings can be applied to many problems in several fields of uncertainty.

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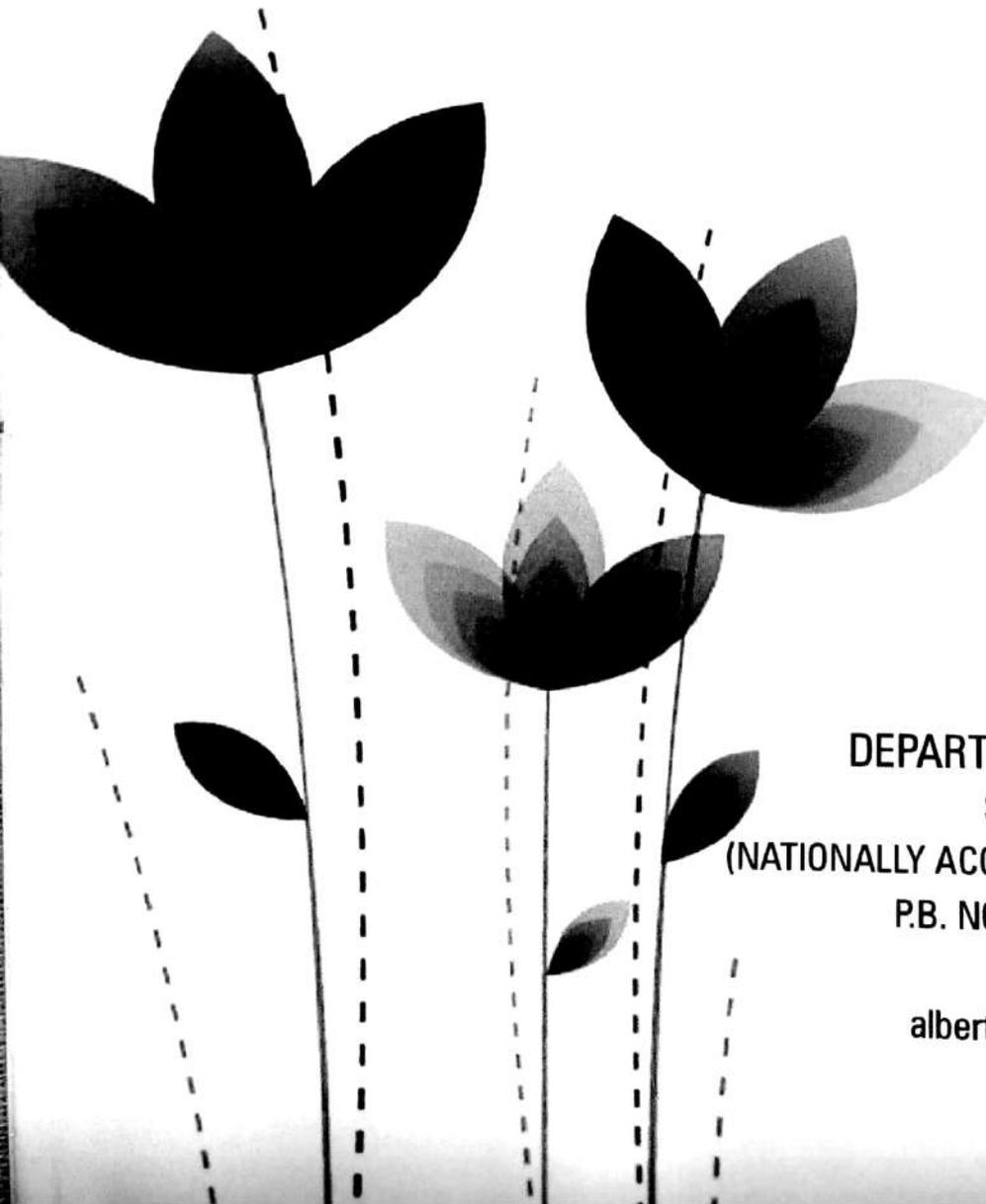
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Traumatic Experiences in *I am Vidya and The Truth about Me*

Basil Thomas

Autobiographies are the means to reveal oneself to the public. It contains all the life events of a person, her joys, sorrows, plights, pleasantries, curses, blessings, tortures, harassments, teasing, lamentation, etc. Everything that he or she experienced or have been experiencing is explored through the autobiographies. We can understand a person or a clan that he represents, through these writings. There are many autobiographies which are written on behalf of particular tribes, clans, or socially marginalised people. Their intention is to make aware the common about those particular groups and their problems. Their frustrations, desperations, pains, experiences everything that they have been facing may be depicted in those autobiographies. Those pains make them alive.

The autobiographies *I am Vidya* and *The Truth about Me* depict the life stories of two transgendered people, namely Vidya and Revathi. These autobiographies reveal the plight of transgendered people in the societies especially in India. It explores the miserable conditions of the transgendered people and shocks the common, by tearing the real face of the so called 'highly elite' and 'cultured' main stream people. The real face of the so called people is very nasty. Though it shows an innocent, smiling face outward, inside it has another cruel face which has a bloodletting eyes and annihilating tongue. The common people intentionally marginalise the transgendered people on account of their sexual orientation, identity and behaviour. They "forget that the transgendered people are also human beings" (Revathi 87). "They have been struggling a lot to live and confronting physical and mental torture from other people" (ibid 206).

Both the authors were born in middle class Tamil families. Their families were poor and working hard for the daily bread. They were named

Comparative Analysis of the Antifungal Activity of Different Solvent Extracts of *Uvaria narum* (Dunal) Wall. Against *Fusarium moniliforme* and *Corynespora cassiicola*

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ABSTRACT

The antifungal potential of one of the lesser known members of Annonaceae, *Uvaria narum* (Dunal) Wall. prominently found in Western Ghats of Kerala and Mangalore, were tested against two important plant fungal pathogens, *Fusarium moniliforme* that causes Leaf Rot in Coconut, and *Corynespora cassiicola*, the causagent of Leaf Fall in Rubber. The leaves of *Uvaria narum* were subjected to sequential soxhlet extraction in four solvents, ie, Petroleum Ether (PE), Chloroform (Chl), Acetone (Ac) and Methanol (Me). The extracts thus obtained were subjected to antifungal tests by Poison Food Technique. The inhibition percentage was noted for every extract. A very good antifungal potential was exhibited by the Petroleum Ether and Chloroform extracts of *U.narum* against both the tested fungus while acetone and methanol extracts showed no inhibition at all. The hot soxhlet extractions of PE showed better inhibition to the growth of both the fungi than cold extraction in PE thereby proving that the compound with antifungal potential was better extracted by soxhlet method than the cold method of extraction. It could also prove that the bioactive compound was thermally stable.

Key words: Sequential Soxhlet Extraction, Inhibition, Thermally stable, Poison Food Technique, Causagent

INTRODUCTION

The Annonaceae family has been recognized as a potential source of insecticidal substances. There are a large number of chemical substances in different species. The group of chemical substances that have grabbed the maximum attention is the class of substances called as acetogenins. Also called ACGs, these compounds are a series of naturally occurring

secondary metabolite products (C-35/C-37) derived from long chain fatty acid and combined with a 2-propanol unit.¹ A great deal of work in several members of Annonaceae has been done for which a lot of literature is available. But there are still members that are unexplored and unexploited and whose bioactivities or phytochemical properties remain unknown.

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Uvaria narum is one such plant whose phytochemistry, though worked out to a great extent, remains ambiguous in terms of bioactivity. The following work was undertaken to evaluate the antifungal potentialities of various extracts of *Uvaria narum* obtained by sequential method of Soxhlet extraction. The fungi used were '*Fusarium moniliforme*' that causes Leaf Rot in Coconut, and *Corynespora cassiicola*, the causagent of Leaf Fall in Rubber.

Fusarium moniliforme, belonging to order Hypocreales of Phylum Ascomycota is the anamorph of *Gibberella moniliforme* (fujikuroi) and is a soil residing fungus. It produces toxins called Fumonisin.² While *Fusarium* species are mainly associated with the root and stem rots, in coconut palm they have been found to be important causagents of Leaf Rot Diseases (LRD). Though several agents were responsible for causing leaf rot in coconut palm it was established by Srinivasan et al, that *Fusarium* spp. were instrumental in developing this LRD disease during high temperature, less humidity conditions prevalent during the months of January-March³.

Corynespora cassiicola, (Berck. & M.A.Curtis) C.T.Wei, which is a common causagent for *Corynespora* leaf fall, (CLF)⁴ is one of the most economically significant fungal diseases on cultivated rubber trees *Hevea brasiliensis* in Asia and Africa. It is a member of mitosporic Ascomycota, the Deuteromycetes or imperfect or asexual fungi that is to say, like *Fusarium*, it lacks a sexual or a teleomorphic state. Both these fungi are of great economic importance to a state like Kerala, which cultivates rubber as its main cash crop and coconut as its main plantation crop⁴.

Uvaria narum is a woody climbing shrub, with solitary flowers, bearing scarlet fruitlets. Also known as Kooril and Narumpanal in Malayalam dialect, this plant though proclaimed to be abundant in the plains and deciduous forests of Western Ghats in Kerala and Karnataka at lower altitudes, is now being removed from its prominent areas

due to vast scale constructions. The number of this species has come down to such an extent that this member has got confined only in the protected areas of campuses, or temples or sacred groves. Though this plant has not been subjected to a thorough screening for insecticidal properties, some reports have been available endorsing its significance as an effective antifungal by the virtue of presence of abundant acetogenins, isolated primarily by Hisham and his team,⁵. The acetogenins found in *Uvaria narum* include uvariamicins I,II and III,⁶ squamocin, squamocin-28-one and Panalycin,⁷ isodesacetylvaricin, narumicin I and II,⁸ in addition to known compounds, glutinone, glutinol, taraxerol, and β -sitosterol and benzyl benzoate.

In a study conducted by Padyana Subrahmanya on the Antibacterial and Antioxidant properties of *Uvaria narum* (Dunal) Wall. the root extract in various solvents showed inhibitory properties against both Gram positive and Gram negative bacteria, *Staphylococcus aureus*, *Escherichia coli*, *Bacillus* species and *Lactobacillus fermentum*, thereby justifying its use as a cure against skin ailments by certain tribes.⁹ It is used for gastro intestinal ailments by traditional medicinal practitioners from Kalrayan Hills of Villupuram district in Tamil Nadu.¹⁰ Roots and leaves used in intermittent fevers, biliousness, jaundice, also in rheumatic affections; and is used in skin diseases. A decoction of the root bark is given to women to control fits at the time of delivery.¹¹

Objectives of the chapter:

- To conduct an in depth study of the antifungal activity of various extracts of *Uvaria narum* obtained by sequential Soxhlet extraction in various solvents of different polarities.
- To confirm whether the antifungal compound is thermolabile by conducting experiments in both hot (Soxhlet) and cold extraction, in at least one solvent

MATERIALS AND METHODS

The *Uvaria narum* leaves were collected in the month of November, 2015 from Kottayam

district of Kerala. The material was identified as the desired plant from S.B College, Changanacherry, Kerala. Some specimen were dried and prepared as herbarium. The soxhelet extraction of the *Uvaria narum* air dried and powdered leaves were done in four solvents viz, Petroleum ether, chloroform, acetone and methanol, sequentially as well as individually. To confirm whether the soxhelet extraction gave better results than the cold ones, the growth of the *Fusarium moniliformis* and *Corynesporium* fungi were tested both on cold pet ether extract and hot Pet ether extracts. The fungus *Fusarium* was kindly obtained from CPCRI, Kayamkulam, Kerala, and *Corynespora cassicola* was obtained from Rubber Research institute, Puthuppally. The medium used for culturing and subsequent subculturing of the fungi was Potato Dextrose Agar (PDA). 24 gm of readymade Potato Dextrose Broth (PDB) (Merck.), was dissolved in one litre of distilled water and 15gms of agar was dissolved to prepare the required PDA medium.

The extracts were dissolved in various solvents and acetone was found to be the best solvent to dissolve all forms of extracts¹². It was preferred at 2% of the total media strength. The inhibition studies were conducted by using poison food technique as suggested by Nene and Thapliyal¹³. A specific amount of extract (max.5mg/ml) was added to the PDA and after swirling nicely was poured into the petriplates. Once it solidified, discs of 5mm diameter from the periphery of 5 to 7 day old fungal plates were cut and kept on the solidified PDA at the centre and plate covered. Control plates were also set with the respective solvents as +ve and distilled water as the

negative control. The growth of hyphae was measured by scale in cm. at right angles till the last but one day when the hyphae fully covered the plate and compared to the standard. % growth was taken with the formula:

$$I\% = C-T/C \times 100$$

Where C= radius of hyphae in control

T= radius of hyphae in extract

I= Inhibition %

If the extract showed an inhibition more than 50%, it was said to be effective in nature.

The statistical analysis of testing the significance was done by MSEXcel. All the experiments were repeated six times and significance tested at $p < 0.05$ level.

RESULTS

The yield of the Petroleum Ether extract by Cold Extraction method was 0.470gms/35gms and it was 0.750gms/35gms by soxhelet method of extraction. There was a significant difference in the percentage inhibition of activity between the two extracts at 5% significance level, with the soxhelet extract of PE showing a better activity than cold extract of PE against both the fungi tested. The controls both positive and negative showed the minimum inhibition, and the maximum growth. (Table 1.) Also among the sequential extracts, the sequentially extracted PE extract and the chloroform extract derived thereafter inhibited the fungus growth by 65% and about 49% in case of *Fusarium* and 70% and 45% in case of *Corynespora*. The acetone and the methanol extracts derived sequentially did not exhibit any inhibition to the fungi tested. (Table 2.)

Table 1: Comparison of inhibition activities of hot and cold PE extracts of *Uvaria narum* leaves against *Fusarium* and *Corynespora*

	Mean±SE	STD.DEV	df	t-stat
Fu(Hot) PE	65.833±0.86	2.12	9	10.65*
Fu (Cold)	49.866±1.22	2.99		
Co(hot)	70.91±1.87	5.2	10	8.8*
Co(cold)	45.94±5.2	5.2		
Fu(water)	-			
Fu(acetone)	-			
Co(water)	-			
Co(acetone)	-			

Table 2: Comparison of inhibition activities of Sequential Soxhlet extracts of PE, Chl, Ac and Me of *Uvaria narum* leaves against *Fusarium* and *Corynesporium*

	<i>Fusarium</i>				<i>Corynesporium</i>			
	(PE)	(Chl)	(Ac)	Me	(PE)	(Chl)	(Ac)	Me
Mean±SE	63.84±0.11*	47.97±1.01*	0	0	61.84±0.11**	53.68±0.49**	0	0
Std.Dev	0.744	1.01	0	0	0.7	2.98	0	0
t-stat	5.155							
t-stat					6.52			

- Both acetone and water showed zero inhibition and a maximum growth.
- ‘*’ Significance at p<0.05

DISCUSSION

The extracts prepared in Petroleum Ether by soxhlet method of extraction gave a better inhibition of the tested fungus than the extracts prepared by cold method of extraction. This could be because the active compound got extracted more in the soxhlet form of extraction (2.4% of yield), than in the cold extract (1.28% yield). Also, it proved that the active compound was not thermolabile in nature. This rightly goes with the statement that “extraction of compounds from the plants is an empirical exercise where different solvents are utilized under a variety of conditions such as time and temperature of extraction”.¹⁴ Thus it was concluded that the Soxhlet method of extraction was the apt method to extract maximum amount of bioactive compounds from this plant for its antifungal studies. It was found that the maximum activity was shown by the PE and Chl extracts (sequentially obtained). Also, it was noted that there was absolutely no inhibition activity in the acetone and methanol extracts derived sequentially. This could only mean that the bioactive compound was completely extracted by the petroleum ether and chloroform solvents and no antifungal activity containing compounds were present in the remaining extracts.

CONCLUSION

Among all our agricultural produces, around 10 to 20% of staple food and cash crops are currently being destroyed by plant

pathogens¹⁵. It’s imperative that we try to find out a long term solution to all these problems. Leaf rot of Coconut and Leaf fall of Rubber are two persistent fungal problems of cash crops Kerala has to face. Annonaceae family is a family of tropics, with several unexploited species still remaining to be explored. *Uvaria narum* happens to be one such plant that is still underexploited. Its antifungal potentialities against the above mentioned fungi were tested using extracts obtained from four different solvents of different polarities. While the petroleum ether and chloroform extracts gave satisfactory results, no inhibitions were shown by the acetone and methanol extracts. The antifungal component present in the PE and chloroform extracts was not thermolabile in nature too. Bioactivity guided fractionation studies are going on to find out whether the antifungal compound is acting alone or its synergistic action of a group of compounds. Also efforts are going on to isolate and purify this compound and characterise it to find out its true chemical nature.

Acknowledgements

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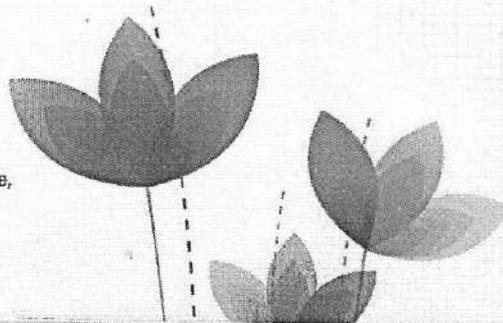
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The Trauma of The Family Members of Mentally Ill People: A Study on Selected Works of Timothy Findley

Leena Liz Mathew

Mental illness is a traumatic problem that occurs in some families. Everyone in the family are affected by the ill person's sickness and the behaviour that results from it. The society views the issue of mental illness in a derogatory manner. A social taboo is placed on the family of a mentally ill person. No one offers a helping hand or pays heed to the problems of the family members of these ill people. The overall societal attitude towards mental illness makes the caregiver's burden much heavier. The problems that caregivers of people with mental illness face today are complex and profound. These problems arise from inside the family as well as from outside. Caregivers face a broad array of problems and experience many emotional responses to them. Early onset of mental illness has a catastrophic impact on all members of the family. Before the family members can become even remotely effective at coping with their own feelings, they need to start by recognizing and accepting that their relative is mentally ill. This is inevitably a painful experience for the family. Although not all caregivers react in the same way, common reactions include self-blame, grief, feeling overloaded and guilt. Many families deny for a long time that there is a problem at all, because it is too painful to believe. They may also suffer physical reactions such as headaches, stomach aches and other medical problems. Parents, siblings, spouses and children struggle to make sense out of the tragedy by searching for the plausible reason for the illness of their loved one.

Timothy Findley, in full Timothy Irving Frederick Findley, a Canadian author, is known for his intelligent writing and storytelling. His subject matter is often the lives of troubled individuals. Mental illness is one of his recurring themes as seen in many of his works. His characters often carry dark personal

secrets, and psychosis. The illness on far Findley's life overlook- the Findley most

In Time Hooker Winsl and their trou trouble took p heard arguing was crying. A by Iris who w But he heard and saying wo the house they was isolated fr his mentally ill of his house. There were no Jessica's door laughter and Hooker's brot had withdraw considered He Hooker went r and brought b Gilbert and N Little Hooker's they called 'cra seemed to kno his family was at Gilbert, "Mc the library. Ros with his back says we're crazy loses his ment and ends up in

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Girish Karnad's *Wedding Album*: A Dismantling of Patriarchy

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Abstract

One of the most prominent dramatists of contemporary India, Girish Karnad, has always voiced the concerns of women in his plays. A brief survey of his works, leading up to *Wedding Album*, reveals that they have evolved through various stages. From myths, folklore, and historical subjects to that of modern day tech-savvy Indian society, he has tackled various issues of contemporary Indian society. His female characters have portrayed issues concerning woman's sexuality, her innermost aspirations, her struggles for an independent identity and the ordeals she goes through to survive in the context of a patriarchal society. Whether it be the plight of Chithralekha in *Yayati*, Padmini in *Hayavadana*, or Rani in *Naga-Mandala*, his characters have always highlighted the female psyche with exceptional brilliance. This study looks at *Wedding Album*, a hilarious take on the traditional patriarchal Hindu institutional marriage. His women characters belong to the contemporary world even when they voice the emotional pain they endure. It is on a subtle level that patriarchy is questioned in the play. There is no direct war cry and the female characters are no champions of freedom except when Vidula turns a tigress to defend herself from the Hindu fundamentalist vigilante youth out on moral disciplining.

Keywords

Patriarchy, feminism, marriage, anxiety, resentment, harassment, sexual freedom.

Introduction

In the words of K. K. Ruthven, "feminism claims to be much more than a perspective, and the growing volume, sophistication and acuteness of feminist literary criticism – together with its strategic alliance with the most disruptive critical theories of our time – have placed it at the centre of critiques of English Studies as traditionally conceived" (Ruthven, 1984, 7). As a critical discipline feminism has definitely made

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Role of Early Christian Missionaries in the Growth and Development of Kiswahili in Kenya

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Abstract

Most historical linguists argue that the Kiswahili is one of the widely spoken languages in the 21st century. It is estimated that there are more than one million speakers of the language spread all over the world, but concentrated in the Eastern Africa region. Over the years, the language has attracted many scholars who have carried out an extensive research to determine its origin and usage globally. Many visitors who touched base in the East Coast of Africa beginning from the 8th century influenced Kiswahili in one way or other, more particularly its vocabulary, grammar, and lexicography studies. The visitors were categorised into three groups depending on their mission: colonialist, settlers, and missionaries. The focus of this paper is on missionaries and how they influenced Kiswahili. The paper therefore examines the role of early Christian missionaries in the spread, growth, and development of Kiswahili in Kenya during the 18th and 19th century.

Assertion of Dravidian Identity and the Retellings of the *Ramayana* in South India

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Abstract

The Dravidian Movement evolved in South India in the post-independent era as an anti-Aryan, anti-Brahmin, anti-Sanskrit, anti-Hindi, and anti-nationalist struggle to create a counter public. Leaders of the movement like Periyar retold the *Ramayana* from the antagonist's perspective, identifying Rama's conquest over Lanka as a distorted representation of the Aryan invasion over Dravidian land. The "demythologization" of the epic, as Richman calls it, valorised the Dravidian identity as the "other" of the Aryan-Brahmin-Hindu identity. The political implications of the act were far greater than the other modes of resistance. The paper is an attempt to review how the works of Malayalam writers like Vayalar Ramavarma, Sara Joseph, and V. N. Sreekandan Nair sprang from the same ideological premises.

Emotional Trauma in the Selected Works of Timothy Findley

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Abstract

Mental illness is a traumatic problem that occurs in some families. Everyone in the family is affected by mental sickness and the behaviour that results from it. The society views the issue of mental illness in a derogatory manner. A social taboo is placed on the family of a mentally ill person. No one offers a helping hand or pays heed to the problems of the family members of these people. The overall societal attitude towards mental illness makes the caregiver's burden much heavier. The problems that caregivers of people with mental illness face today are complex and profound. Mental illness is one of the recurring themes as seen in many works of Timothy Findley. This paper is a study on how different family members respond to the issue of the mental illness of their dear ones as seen in some of Findley's works.

Animating Childhood: Questions of Selfhood and Identity

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Abstract

The animation genre is well-suited for capturing the idiosyncrasies and fantasies of childhood. However, identity crises and quests for selfhood figure prominently in the animation of childhood. This paper compares the representation of childhood across a crosssection of animated films by mainstream American studios as well as by Studio Ghibli and other independent productions to study how ideology structures the above concerns. The child goes through a phase of maturation in a pseudo society where he/she must come to terms with the expectations and the socio-gender roles by the end of the process, or the film. While Ghibli highlights the child's identity quest as a process that never quite ends, the Western mainstream caters to a formulaic, traditional structure that represents childhood and identity struggles as phases easily terminated when the child reaches adulthood.

Mahasweta Devi's Story "Draupadi" in Subaltern Perspective

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Abstract

Subaltern historiography gives representation to politically, socially, and culturally marginalised groups who fall outside the periphery of hegemonic power structure. This paper is an attempt to read Mahasweta Devi's short story "Draupadi" in the light of subaltern historiography. Through Draupadi Mejhren's tale, Devi forces readers to listen to the voice of those landless peasants who rebelled against ruthless and suppressive political and social paradigm during the Naxalite movement. As member of a lower class Santal community and then as a woman, Draupadi's intervention in the political spectrum to undo class containment makes her culpable of state punishment. Hence, she is arrested and subjected to gang rape by officials in the process of her "making." Her reformulation is ordered by Senanayak who stands for patriarchy as well as state machinery in the tale. Instead of taking over the role of a hapless rape victim, Draupadi challenges authority with her undaunted spirit and maimed body. Draupadi, a tribal woman, rejects third world woman's portrayal as a "blank" and "empty" space in the epistemological narration of her time. With the help of Gayatri Spivak's translation, Devi intervenes in history to capture the voice of a subaltern woman who can speak not only for herself, but also on behalf of those innumerable females who remain silent in the face of their exploitation and forceful marginalisation in the pages of history.

Shifting Paradigms in Haryana: An Overview

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Abstract

Haryana is one of the most prosperous states not only in India but also among the countries of South Asia. The state has a glorified past and a bright future. This paper is an effort to pen down the glory of the state, being the cradle of Indian culture and civilisation. With the recognition of Haryana on 1 November, 1966, it has carved out a special niche of distinction for itself, whether it is agricultural or industrial sector, rural electrification or canal based irrigation. Haryana keeps marching towards modernity, that brings a social and cultural change in the state. But behind this forefront, there is a hidden face which is always neglected, and no one is ready to expose it. This paper discusses many recent issues of the state such as cultural and political division, social division on the basis of caste, role of local social judiciary, land acquisition, unequal distribution of property, increasing gender ratio, and uplifting status of women.

Condition of Women Workers in Tea Plantation: A Case Study on Harrisons Malayalam Plantation, Arappetta Estate, Kerala

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Abstract

The agro-based, low mechanisation of tea plantation industry suits the physical strength of women. So majority of the workers in tea plantations are women. They are not provided with enough facilities in the workplace as well as in the settlements as per Plantation Labour Act recommendations. Working and living conditions of women workers in tea plantations raise questions of human rights and give a clear picture about the violation of Constitutional provisions and Labour Acts. The article tries to study the working and living conditions of women in Harrisons Malayalam plantation, Arappetta Estate, Wayanad, Kerala.

Emerging Issues of Political Empowerment of Women

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Abstract

India heralded the new millennium by pronouncing the year 2001 as women's empowerment year. In terms of political empowerment, nearly seven lakh women occupy positions as member and chairpersons of grassroots democratic institutions in India, following the reservation clause in 73rd and 74th amendments of the Constitution. Providing one-third seats at district, taluk, village and municipal elections has enabled substantial entry of women in public life and large numbers of women have come forward to tackle the challenge of leadership at all levels of panchayats. In fact, right from the days of freedom struggle, Indian women have been consistently encouraged to take part in active politics. But the political milieu, resulting from increasing politicisation and criminalisation of politics, has vitiated the level of political participation of women. It is recognised that the goals of poverty alleviation are difficult to achieve without the full and active participation of women, who constitute a large section of the work force in the process of development of the community, and therefore bringing them into the mainstream of development has been a major concern of the government.

Relevance of SAARC in the New Millennium

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Abstract

In the face of increasing importance of regionalism, SAARC stands as an unavoidable and significant organisation in South Asia. Since its formation in 1985, it has played an important role by bringing the member countries closer together by holding many meetings and summits at various levels. Though overall development of this organisation is marred by internal disputes and several other factors, its establishment and the sense to develop regional integration have created hope for its future progress. This paper analyses the role of SAARC in the new millennium.

National Rural Employment Guarantee Act and Women's Empowerment: An Overview

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Abstract

National Rural Employment Guarantee Act is a unique employment opportunity for rural women. It is the first expression of the right to work as an enforceable legal entitlement in India. This act says that “priority” should be given to women in the allocation of work in such a way that “at least one-third of the beneficiaries shall be women.” Women’s participation in the *gramsabha* might change the male-dominated character of decision making process at the grass root democratic institutions. The analysis is to discuss how the women are empowered by this act and its the effects on the society. Moreover this act gives “dignity” to the rural women and right to work, as their right and not as the favours done to them by the state, gives them an independent voice.

Recent Trends in Administrative Practices in Indirect Taxation: An Analytical Review on Kerala Value Added Tax (KVAT)

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Abstract

In a time of global economic uncertainty, business is increasingly paying close attention to the challenges posed by tax regimes all over the world. Tax regimes are rarely, if ever, popular with taxpayers. Yet, the Indian tax system did not fare too well with only one percent of respondents viewing it as being very conducive to economic growth. Several respondents identified the lack of certainty in both tax policy as well as administration as contributing to this perception. The proposed reforms in the tax system also drew a mixed response, with the GST generating more optimism than the DTC. However, the consultative approach of the Government in pursuing this reform agenda was appreciated. While e-governance initiatives in the tax system were lauded, several respondents felt that the benefit of improved systems had not yet resulted in quick processing of refunds. The Indian Government has been working on replacing the current indirect tax regime with a comprehensive GST. In its current form the GST proposes to be a “dual” GST, consisting of Central GST (CGST) and State GST (SGST). The current proposed date for introduction is April 2017. The introduction of GST requires amendment to the Constitution of India.

**THERAPEUTIC POTENTIAL OF THE PHYTOCHEMICALS IN CASSIA
OCCIDENTALIS-A REVIEW**Rekha U.¹, Thomas J.², Thomas V.³, Tiju J. M.³, Prakash P.² and Latha M. S.*⁴¹Department of Chemistry, Christian College Chengannur, Kerala India.²Department of Chemistry, Thiagarajar College, Madurai, India.³Department of Physics, Christian College Chengannur, Kerala India.⁴Department of Chemistry, Sree Narayana College Chengannur, Kerala India.**Corresponding Author: Dr. Latha M. S.**

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ABSTRACT

This article reviews the therapeutic potential of various phytochemicals present in *Cassia occidentalis* Linn, a perennial plant of leguminosae family, which has been traditionally used as a medicine against various diseases. It is commonly found in India and in many tropical countries. This plant has many pharmacological applications which are attributed to the presence of active phytochemicals in leaves, stem, roots and seeds. Phytochemicals present in *Cassia Occidentalis* Linn such as anthraquinones, anthraquinone glycosides, flavanoids and phyosterols show analgesic, antipyretic, antimalarial, antioxidant, anticancer activity etc. These phytochemicals are good reducing agents in the formation silver nano particles also. However, the presence of trace elements demands attention due to their toxicity on continuous use.

KEY WORDS: *Cassia occidentalis* Linn, Phytochemicals, silver nano, trace metals.**INTRODUCTION**

Cassia is a genus of flowering plants in the legume family, Fabaceae and the subfamily Caesalpinioideae. Species are known commonly as cassias. There are hundreds of Cassia species^[1]. Among them, *Cassia occidentalis* Linn is an annual or perennial plant which is used in several traditional medicines to cure various diseases^[2]. It is distributed throughout India and in most tropical countries^[3]. It is known by different names^[4] such as, Badikanodi, Chakunda and Kasonda in Hindi, Coffee Senna, Foetid Cassia, Negro Coffee, Rubbish Cassia, and Stinking Weed in English, Kasamarda in Sanskrit, Chakundra Talka in Rajasthani, Payaverai, and Nattam Takarai, Payaveri in Tamil.

It is worth to mention that, different parts of the plant have similar properties such as purgative, tonic, febrifugal, expectorant and diuretic property. The plant is used to cure sore eyes, haematuria, rheumatism, typhoid, asthma and disorders of hemoglobin. Its effective use for curing leprosy has also been reported. A decoction of the plant is used in hysteria, in dysentery and other stomach troubles and also as an application to sores, itch and inflammation of the rectum. The plant is employed in dropsy and as a vermifuge, anticonvulsant and used against chicken pox[5-6]. Along with other plants, it is made into an ointment used for skin diseases. The herb is reported to be used as condiment and in perfumery.

The herb forms an ingredient of the patented indigenous herbal drug Liv 52[®](produced by Himalayan Drugs, India) which shows marked effect in the early cases of hepatic cirrhosis having steatorrhoea. Liv 52 reduced the toxicity of cadmium and beryllium in experimentally infected rats with SFV (Semiliki Forest Encephalitis Virus)^[5]. In Unani and Ayurvedic medicine, the pods and leaves are used as great tonic as an infusion. Women who nurse develop milk in copious quantities after consuming extracts of this plant. Besides this, it is used to treat colitis and constipation. Cloves and ginger is added to mark the odor that is disagreeable. It is effective in treating vomiting, hiccups, cholera, gout, biliousness, and jaundice. To dye the hair black, it is used with henna leaves^[7]. The young leaves are eaten alone or cooked along with unripe pods and eaten with rice. The leaf when eaten is reported to act as a prophylactic against leucorrhoea. Fresh leaves pounded with salt and onions are applied as a poultice to guinea worm sores to extrude the worms. They are used in the inflammatory swelling, rheumatism, wounds, sprains and wrenches and also given in jaundice pleurisy, head ache and toothache. A paste of the leaves with calcium hydroxide is applied on abscesses for quick opening and pus clearance. The leaf paste is also applied externally for bone fracture. The leaves are used in foot and mouth disease of cattle. Their extract exhibits activity against earthworms^[5].

In Senegal, the leaves are used to protect cowpea seeds, *vigna unguiculata* Linn (walpers) against *callosobruchus maculates* (coleoptera: Bruchidae). Both fresh and dry leaves as well as whole and ground seeds had no contact toxicity on the cowpea beetle. In contrast, seed oil induced an increase in mortality of *C. maculates* eggs and first larval in star at the concentration of 10ml/kg cowpea.^[8]

The seed is bitter and has tonic, febrifugal and purgative properties. It is considered as blood tonic and excellent diuretic. Seeds are useful in cough and whooping cough, convulsions and in heat diseases. Their powder is externally applied in cutaneous diseases and eruptions. The extracts showed positive response on guinea pig-ileum, rat uterus, rabbit-heart and depress or effect on blood pressure of dogs and also activity against earthworms^[5] and are used to treat hypertension^[9]. The seeds are used as a cure of convulsion in children and are used in West Africa to prepare a beverage which serves as a substitute for coffee^[10].

The roots are also bitter, purgative, anthelmintic and diuretic. Roots are given with lime to treat dysentery and diarrhoea associated with malaria. They are used for relief in cramps, itches and sore throat. The root bark is also used to cure malaria. Root bark decoction is an effective remedy against gonorrhoea and hepatic malfunction. The Indians use the roots to treat fungal infections of the skin^[11]. The medicinal activity of this plant is due to the presence of phytochemicals whose properties are analyzed in pharmacological investigations. Pharmacological investigations have revealed the presence of several herapeutic activities - antioxidant, analgesic, antipyretic, anti-inflammatory, hepatoprotective, anti-malarial, anti-diabetic, anticancer, antidepressant^[11], nephroprotective^[12], antimicrobial^[13], anti-fertility^[14], anti-plasmodial^[15], anti-mutagenic^[16,17], anti-allergic and anti-lipid peroxidation^[18] activities. These activities are mainly due to the presence of organic compounds. The presence of inorganic substances were reported to enhance the activities of these natural organic compounds^[19]. The presence of trace elements at low concentrations in leaves increased attention due to their toxicity^[20].

Phytochemical constituents in leaves, seeds, stem and flowers are^[13,21-32]

Anthraquinones and their glycosides: Chrysophanol, Chrysophanic acid, Chryso-obtusin, Aurantio-obtusin, Chrysoeriol, Obtusifolin, Obtusin, Emodin, Physcion, 4,4',5,5'-tetrahydroxy-2,2'-dimethyl-1,1'-bianthraquinone, germichryson, Occidentalins A&B, 1,8-dihydroxy-2-methyl anthraquinone, Rhein, Aloe-emodin, Occidental-I, Occidental-II, α -hydroxy anthraquinone, Pinselin or Cassiallin, Islandicin, Helmithosporin, Xanthorine, Matteucinol-7-rhamnoside, Jaceidin-7-rhamnoside, Questin, Torosachryson, Germitorosone, methyl germitorosone,

Helmithosporin, N-methyl morpholine, Singueanol I and Sennosoides A,B,C, and Chrysarobin.

Glycosides: 7-O Methyl-quercetin and 3,5,3'-trimethoxy quercetin,: O-alpha-d-galactopyranosyl-(1-6)-beta-d-mannopyranosyl,O-alpha-d-mannopyranosyl- (1-4)-o-beta-d-mannopyranosyl

Flavonoids: Torosa flavon B, Cassia Occidentalins A, B, C, Apigenin, Kaempferol

Poly Saccharides: Galactomannan, galactopyranosyl

Fatty acids: Lignoceric acid, Linoleic acid, Oleic acid

Phenanthracene derivative: Campesterol

Phytosterol: Sitosterols such as β -sitosterol- α -glucoside, Alpha-3-sitosterol,

Sugar alcohol: Mannitol

Essential Oils

Trace metals identified are Calcium, Copper, Iron, Magnesium, Manganese, Potassium, Sodium, Zinc, Chromium, Nickel, Cobalt, Lead, Aluminium, Rubidium, Lanthanum, Scandium, Samarium, Thorium^[20,33] and Silver^[19].

Toxic Effects

Acute toxicity test was conducted on *Cassia occidentalis* Linn and found that this plant did not show any hazardous symptoms or death^[34]. But the following symptoms occur in animals when fed on excessive amounts of the plant: lack of coordination, reluctance to move, anorexia, muscle weakness, diarrhea, muscle tremors, body weight loss and death. Those ingesting the seeds show profound skeletal muscle degeneration also degenerative myopathy of the cardiac muscle, congestion and pulmonary oedema and necrosis. In human indigestion of raw seeds will cause gastro-intestinal symptoms. Roasted seeds do not seem to cause these symptoms^[35]. The toxic compounds implicated for poisoning are chrysarobin (3-methyl-1,8,9-anthracenetriol), emodin (6-methyl-1,3,8-trihydroxyanthraquinone) and a lectin (carbohydrate-binding proteins).

The study of sub-acute oral administration of *Cassia occidentalis* Linn during pregnancy in female wistar rats found that there was no statistically significant changes between control and test groups with respect to fetuses, placenta and ovaries weights; number of implantation and resorption sites; number of corpora lutea in the ovaries and pre- and post-implantation loss rates, in both does of (250 and 500mg/kg) *Cassia occidentalis* Linn. This is enough to put a cautionary note on its use during pregnancy^[36].

Pharmacological Activities

Analgesic and Antipyretic activities: Ethanolic and aqueous extract of leaves (150 and 300 mg / kg) exhibited significant dose - dependent antinociceptive and antipyretic effects in rats/mice models. Highest inhibition dose was found to be 300 mg/kg. The report clearly mentioned that both the ethanolic and water

extracts of *Cassia occidentalis* Linn showed significant effect on pyrexia induced by yeast^[37].

Antioxidant Activity: The antioxidant and free radical scavenging activities of ethanolic extract of *Cassia occidentalis* Linn leaves (COLEX) is compared with with the standard antioxidants BHA and BHT using four different methodologies including total reducing capability, total antioxidant activity, DPPH radical and hydrogen peroxide scavenging assays. In addition the effect of COLEX on the sodium arsenate induced hepato toxicity in the male wistar rats are determined. This study revealed that ethanolic extract of *Cassia occidentalis* Linn leaves possesses potent antioxidant and free radical scavenging activities^[38].

The antioxidant potency of sequential organic and aqueous leaf extract of *Cassia occidentalis* Linn was investigated employing various established in vitro systems such as nitric oxide scavenging (NOS) activity, β -carotene linoleic acid model system hydroxyl radical scavenging (iirs) activity, reducing power, metal chelating activity (MCA) and super oxide radical scavenging (SRS) activity. The aqueous extract of the

leaves of *Cassia occidentalis* Linn was found to be most effective against free radical followed by methanolic, chloroform, petroleum ether and benzene extracts respectively^[39].

The phytochemical screening of *Cassia occidentalis* Linn. was performed in petroleum ether, chloroform and methanolic extracts. The chloroform and methanolic extracts of both flower and seed were found to contain flavonoids, alkaloids, phenolics/tannins, steroids, glycosides and anthraquinones. The antioxidant potential of flowers and seeds in different solvent extracts were evaluated by various biochemical assays namely, DPPH (2, 2'-diphenyl-1-picrylhydrazyl) radical scavenging activity, reducing power activity. Their SC50 and EC50 values were determined to evaluate the therapeutic potential, in which seeds were found to have higher antioxidant activity revealed by lower SC50 and EC50 value. The total phenol, flavonoid, flavonol and tannin content were determined for both parts to study the free radical scavenging property. The seeds were found to have higher antioxidant activity when compared to flowers in various solvent extracts indicating their pharmacological property(Figure 1, Figure 2)^[40].

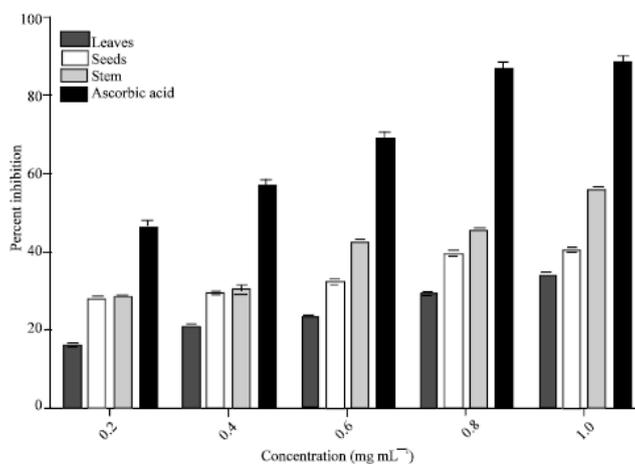


Figure 1. Nitric oxide radical scavenging activity of methanol extracts of leaves, stem and seeds of *Cassia occidentalis*^[40]

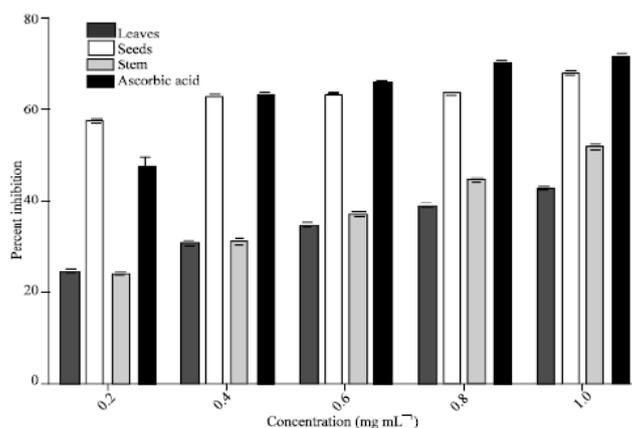


Figure 2. Hydroxyl radical scavenging activity of methanol extracts of leaves, stem and seeds of *Cassia occidentalis*^[40]

In vitro antioxidant activity of methanol extract of *Cassia occidentalis* Linn seeds was determined by DPPH free radical scavenging (Figure 1), FRPA, Lipid peroxidation by thiobarbituric acid assay methods (Figure 3). The analysis had shown the maximum percentage inhibition in case of DPPH method as 66.53% at 160 μ g/ml and 61.07% in lipid peroxidation at 1000 μ g/ml. Total phenolic content estimation was done by using Folin-Ciocalteu reagent and was found to be 0.75% w/w. Their study revealed that the methanol extract of seeds has antioxidant potential and represent a potential source of medicine (Figure 3, Figure 4, Figure 5)^[41].

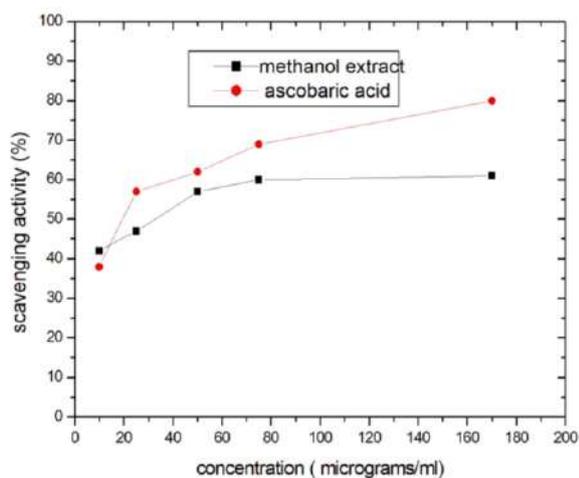


Figure 3. Free radical scavenging activity of methanol extract of *Cassia occidentalis* seeds at different concentrations^[41]

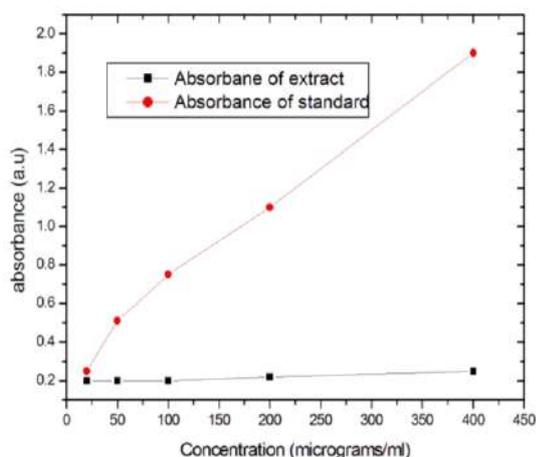


Figure 4. Reducing power assay of methanol extract of *Cassia occidentalis* seeds at different concentrations^[41]

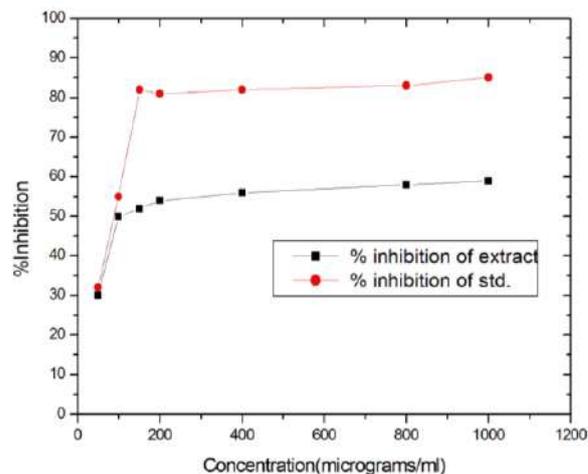


Figure 5 Lipid peroxidation inhibition activity of methanol extract of *Cassia occidentalis* seeds at different concentrations^[41]

Anticancer activity: Aqueous and hydro-alcoholic extracts of whole plant had been shown to cause growth inhibition of eight human cancer cell lines viz. HCT-15, SW-620, COLO-205 (colon); OVCAR-5 (ovary), PC-3 (prostate), HOP-62 (lungs), MCF (breast) and SiHa (cervix)^[42].

Anti-inflammatory and Anti-allergic activities: The anti-allergic, anti-inflammatory and anti-oxidant properties of *Cassia occidentalis* Linn whole plant was investigated^[18]. Effects of *Cassia occidentalis* Linn on rat mast cell degranulation inhibition and human red blood cell membrane stabilization were studied in vitro following standard methods. The anti lipid peroxidant effect was also studied in vitro. Results of this study indicated that *Cassia occidentalis* Linn inhibited HRBC membrane thereby alleviating immediate hyper sensitivity besides showing antioxidant activity^[18]. The extract of the leaves of *Cassia occidentalis* Linn obtained by cold extraction using a mixture of equal proportions of petroleum ether, ethyl acetate and methanol was chosen for pharmacological screening. Carrageenan-induced rat hind paw edema was used as the animal model for inflammation study and the inhibition of carrageenan-induced inflammation by the extract could be due to the inhibition of the enzyme cyclooxygenase and subsequent inhibition of prostaglandin synthesis. This study on extract of *Cassia occidentalis* Linn has demonstrated that this plant has significant analgesic and anti-inflammatory properties^[43].

The anti-inflammatory and antipyretic activities of the methanol fraction and its pure compound chrysophanol of *Cassia occidentalis* Linn was analysed in male albino wistar rats. Paw edema was produced by subplantar injection of carrageenan, cotton pellet granuloma was produced by implantation of 30mg sterile cotton in groin region. The results showed that the extract and chrysophanol significantly inhibited inflammation and

reduced the temperature of the rats which was similar to paracetamol treated group^[44,45].

Antimalarial activity: The isolated phytochemicals of *Cassia occidentalis* Linn was evaluated and characterized by using various chromatographic techniques and spectroscopical analysis. The in vitro antimalarial assay was carried out in 96 well microtitre plates according to the microassay protocol of Rieckmann and co-workers with minor modifications. The results showed that the leaves have anti-malarial activity due to the presence of quinones^[46].

The ethanolic, dichloromethane and lyophilized aqueous extracts of *Cassia occidentalis* Linn root bark, Morinda morindoidesleaves and whole plants of Phyllanthus niruri were evaluated for their antimalarial activity in vivo, in 4-day, suppressive assays against Plasmodium berghei ANKA in mice. The extracts produced significant chemo suppressions of parasitemia with 200 mg/kg dose when administered orally. *Cassia occidentalis* Linn was found to be potential with 60% chemo suppression. They also found that the ethanolic extract is more active than the lyophilized aqueous extract cassia occidentalis leaf extract with ethanol and chloroform was found to possess better antimalarial activity^[47,48].

Anti-bacterial activity: The ethanolic and aqueous extract of the leaves of *Cassia occidentalis* Linn revealed the presence of tannins, saponins, cardiac glycoside, terpenoids and anthraquinones. The extracts were used to carryout anti microbial screening in vitro on staphylococcus aureus, E-coli, salmonella typhi and pseudomonas aeruginosa. These phytochemicals make the extract anti-bacterial anti-fungal^[49].

Leaves of *Cassia occidentalis* Linn were extracted with ethanol and water. The extracts were used to carry out antimicrobial screening in vitro on staphylococcus aureus, pseudomonas aeruginosa, Escherichia coli, salmonella typhi, shigella spp. Chromatographic separation was carried out on the active extracts, and the efficacy of the resulting fractions was tested against the susceptible organism. Some of the extracts indicated significant inhibitory activity against the tested organisms. General phytochemical screening was done on the ethanol, water extracts and fractions. Ethanol extract revealed the presence of tannins, saponins, cardiac glycoside, terpenoids and anthraquinones. This result might explain the ethnobotanical use of the plant for the treatment of dysentery, gastro internal disorder, constipation and Typhoid fever^[50].

The flower extract of the *Cassia occidentalis* Linn is used to evaluate the in-vitro antibacterial activity. The clinical bacterial isolates, Klebsiella pneumoniae, Staphylococcus aureus, Streptococcus pneumoniae and Pseudomonas aeruginosa were subjected to antibacterial susceptibility test using agar well diffusion method. The

phytochemical analysis of the flower extracts revealed the presence of tannin, flavonoid, anthroquinone, saponin, carbohydrates, and cardiac glycoside. *Cassia occidentalis* Linn flower extract might therefore be used to treat Klebsiella associated illness such as pneumonia and bronchitis^[51].

Minimum Inhibitory Concentration (MIC) of the extracts was performed and the zone of inhibition was studied to evaluate the plant's antibacterial and antifungal activities. The results of MIC study revealed the antimicrobial activity of the extracts against the strains of microorganisms between concentration ranges of 25 and 450ug/ml. The results of zone of inhibition study revealed that the plant possess antimicrobial activity, more susceptible to gram positive than gram negative bacteria in a concentration dependant manner^[52].

Different organic and aqueous extracts of leaves of *Cassia occidentalis* Linn (Caesalpinaceae) were screened for their antimicrobial activity against seven human pathogenic bacterial and two fungal strains by disk diffusion assay. The pattern of inhibition varied with the solvent used for extraction and the microorganism tested. Among these extracts, methanol and aqueous extracts showed significant antimicrobial activity against most of the tested microbes. The most susceptible microorganism was P. aeruginosa (18mm zone of inhibition in aqueous extract) followed by P. mirabilis (15 mm zone of inhibition in methanol extract) and Candida albicans (8 mm zone of inhibition in methanol extract)^[53].

The methanol portion was subsequently partition with chloroform, ethyl acetate and n-butanol. The phytochemical studies of the partition portion were done using standard protocols.

The bacteria used for the research work include Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella spp, Escherichia coli, Bacillus subtilis and the fungi used for the research work was Candida albicans. The zone of inhibition (ZI), Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) were determined. The antimicrobial screening revealed that the extract exhibited varying activity against different microbes. These activities observed could be attributed to the presence Active metabolites contained in the extract^[54].

Anti-diabetic and Hepatoprotective activities: The methanol fraction of *Cassia occidentalis* Linn leaves was tested against streptozotocin-induced diabetic rats. Experiment group rats were induced diabetes by a single intraperitoneal injection of streptozotocin (STZ). Treatment with COLMF at different doses and times following in normal and diabetic rats significantly reduced the blood glucose level to normal in diabetic rats^[55].

Aqueous extract of *Cassia occidentalis* Linn exhibited significant antihyperglycemic activity in normal and alloxan-induced diabetic rats. They also showed improvement in parameters like body weight and serum lipid profiles as well as histopathological studies showed regeneration of β -cells of pancreas and so might be of value in diabetes treatment^[56].

Acute and chronic treatment of the aqueous extract of aerial parts (leaves, stem and seeds of the plant) of *Cassia occidentalis* Linn in alloxan-induced diabetic rats resulted in a significant decrease in the elevated blood glucose levels as compared to the control, there was significant reduction in blood glucose level in the group treated with glibenclamide. The results showed that blood glucose level gets decreased after varying the dose level. Thus the findings confirmed that level of blood glucose gets normal in dose-dependent manner^[57].

The hepatoprotective effect of the *Cassia occidentalis* Linn is analysed in carbon tetrachloride induced liver damage in albino rats. The roots were found to be rich in antioxidants. Liver damage in rats were induced by carbon tetrachloride. To find out the hepatoprotective activity, the aqueous extract of the plant root samples were administrated to rats for 15 days. The serum marker enzymes Aspartate transaminase, Alanine transaminase and Gama Glutamyl were measured in experimental animals. The increased enzyme levels after liver damage with carbon tetrachloride were nearing to normal value when treated with aqueous extract of the root samples^[58].

The hepato-protective potentials of aqueous leaf extract of *Cassia occidentalis* Linn on paracetamol-induced hepatotoxicity in adult Wistar rats is examined. Hepatotoxicity was induced in the test groups via oral administration of paracetamol. Using standard laboratory procedures, the livers were harvested, histologically processed, and examined. The results showed that the aqueous leaves extract of *Cassia occidentalis* Linn may be hepato-protective against hepatotoxicity^[59].

The hepatoprotective effects and anti-oxidant activities of methanol leaf extract of *Senna occidentalis* was examined against acetaminophen-induced hepatic injury in rats. Acute toxicity test was done in rats orally. Hepatoprotective activity of the extract was investigated in rats challenged with acetaminophen. Silymarin was used as positive control. Serum (alanine aminotransaminase) ALT, (aspartate aminotransferase) AST, (alkaline phosphatase) ALP, total bilirubin and total protein levels were assayed. The findings suggest that the methanol leaf extract of *cassia occidentalis* may be useful in the protection of the hepatocytes from toxins^[60].

Anti-fertility activity: Traditional physicians in and around Kotagiri village near Ootacamund, use a mixture of powdered roots of *Cassia occidentalis* Linn, *Derris*

brevipes variety *coriacea* and *Justicia simplex* to control female fertility. A mixture of powdered roots of these three plants, powdered root of *Derris brevipes* variety *coriacea* and its ethanolic extract were screened for antifertility activity in proven fertile female rats. The rats, which continued their pregnancy, did not deliver any litters after their full term. Hence, the combined antifertility (anti-implantation and abortifacient) activity of the ethanolic extract was 100%. The results suggest that the ethanolic extract possesses more abortifacient type effect than the anti-implantation activity^[14,61].

Nephroprotective Activity: Lipid peroxidation may occur in the course of gentamicin administration, giving rise to free radicals which are highly toxic to tissue. The nephroprotective activity of the hydroalcoholic extract of *Cassia occidentalis* Linn was tested against gentamicin induced nephrotoxicity in rats. The degree of protection was determined by estimating urinary creatinine, urinary glucose, urinary sodium, urinary potassium, blood urea, serum creatinine levels and body weight of the animals. The In-vivo antioxidant activity was determined by estimating the tissue levels of GSH, SOD, catalase and lipid peroxidation. The treatment with the extract markedly reduced gentamicin induced elevation of urinary sodium, potassium electrolytes, urinary glucose, blood urea and creatinine levels^[12].

Wound-Healing activity: Chrysophanol extracted from the leaves of *Cassia occidentalis* Linn had shown a wound healing effect in albino Wistar rats. This compound was able to cause decrease in the period of epithelialization and increase rate of wound contraction^[62].

Trace metals such as chromium, copper, nickel, cobalt, iron, manganese, zinc, and lead were determined using atomic absorption spectroscopy(AAS) after ashing the samples in a muffle furnace at 550^oC at 4 hours. Their concentration in different sites had showed that the medicinal plants should be regularly monitored and checked before use for medication as net accumulation can be detrimental to health^[20].

Assessment of oxidative stress levels and tissue concentrations of elements in these plants growing wild on fly ash basins is critical for realistic hazard identification of fly ash disposal areas. Plants growing on the fly ash basin had significantly high foliar concentration of As, Ni, Pb and Se and low foliar concentration of Mn and Fe compared to the plants growing on the reference site. The plants inhabiting the fly ash basin showed signs of oxidative stress and had elevated levels of lipid peroxidation, electrolyte leakage from cells and low levels of chlorophyll a and total carotenoids compared to plants growing at the reference site. The levels of both protein thiols and nonprotein thiols were elevated in plants growing on the fly ash basin compared to plants growing on the reference site^[63].

The 5 minerals namely; lead (Pb), cadmium (Cd), aluminum (Al), mercury (Hg), and arsenic (As) in 10 common medicinal plants (*Alchornea cordifolia*, *Alstonia boonei*, *Cassia alata*, *Cassia occidentalis*, *Cymbopogon citratus*, *Moringa oleifera*, *Ocimum gratissimum*, *Paullinia pinnata*, *Rauwolfia vomitoria*, and *Taraxacum officinale* leaves) are analyzed used in the treatment, prevention, and management of diseases and sampled from 5 different geographical locations in Ghana. This may help understand the importance of location in collection and ultimately heavy metal toxicity of medicinal plants^[64].

The contents in *Senna occidentalis* Linn can be assessed using neutron activation analysis (NAA). The analysis shows that, Al, Ca, Fe, Na and K are the major components, followed by Mn, Zn and Rb. The traces of Co, Rb, La, Sc, Sm and Th are also identified. As it contains, toxic metals (such as As) at low levels, prolonged consumption of the plant may lead to their bioaccumulation. The pattern of bioaccumulation of the elements does not follow any particular trend among the different parts of the plant^[65].

CONCLUSION

Cassia occidentalis Linn plant has remarkable medicinal applications due to various active phytochemicals present in it, which are experimentally verified. However, prolonged consumption of the plant is not advised because of the presence of toxic metals at low levels, which may lead to its bioaccumulation.

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Research Notes

Right to Fishing: A Need of 21st Century

Manikandan A.D*, Jisha John** and V. Mathew Kurian***

Introduction

This is a historic and well recognized fact that fishing is a birth right of fisherfolk. Even today the right of fishing of the fisherfolk legitimized as a customary right not as the constitutional or legal right. Historically the social and institutional rights and entitlements of the fishing entrusted in the fisherfolk. Due to various interventions like government interventions and modernization, the old rules and customs that acted as a strong bond vanished. As a result, the fisherfolk give us a dismal picture of their livelihood. A sharp decline in fishery (marine) resources resulting in deterioration of income, nutrition, and livelihood security of the fisherfolk in India. Optimum exploitation of fish resources and in some cases the overexploitation of fish resources, especially marine fish resources of water upto 200 meters depth, has adversely affected not only the livelihoods of this community, but also marine ecology. The lack of fishing assets, technology, housing assets, institutional supports, financial problems and job uncertainty placed the fishers in poverty. Physical assets including fishing assets and technology are accessed by a few. Access to assets, clean drinking water, sanitation and clean living conditions are vital to improve the health and educational levels of the fisherfolk. For individuals, households and society, access to the above is one of the foundations for progress in human (socio) and economic development. Denial of these assets undermines productivity and economic growth. People need dissent physical environment to sustain their health and to maintain their dignity. We found that vulnerability of the fisherfolk with regard to assets, health, education, and sanitation, drinking water would result in the relative deprivation and will constrain their choices and freedom which will lead to poverty and lack of human dignity. What to do to ensure the livelihood of the fisherfolk and sustainability of marine ecology? The paper tries to resolve the problem of the livelihood issues of the fisherfolk and marine ecology threats with a solution of Right To Fishing (RTF) or Fishing Right Act (FRA). But question remains as to whether government has the will?

Methodology

Qualitative research methodology was used as modes of inquiry for the study since it

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reflects on social phenomena, natural settings, context, interactive and humanistic and complex reasoning. Fisherfolk interview was conducted using the standardized, open-ended interview method. That is, asking specific questions in a specific sequence to get a correct experiences and views of the fisherfolk who engaged in traditional marine sector. Samples of fisherfolk were selected through mixed methods (MM) sampling techniques i.e., samples were taken purposively and randomly from marine fishing villages in Kannur, Thrissur, Alappuzha, and Thiruvananthapuram districts in Kerala. Group discussions were conducted in order to understand the views of fisherfolk on the Right To Fishing (it is also known as Fishing Right Act) and to know how fisherfolk can work out for the implementation of the Right To Fishing.

Results and Discussion

Kerala has an extensive coastline over 590 km with the Arabian Sea in the west. The coastal line spread over nine districts of Kerala what we called nine marine districts are Thiruvananthapuram Kollam, Alappuzha, Ernakulam, Thrissur, Malappuram, Kozhikkode, Kannur, and Kasaragod (Table: 1). It means that nine out of fourteen districts in Kerala is marine districts, showing that fishery sector plays an important role in the state. According to the available estimates of the potential fishery resources of the west coast, particularly in south west coasts, Kerala occupies the richest fishing grounds. The state exports fish products worth approximately Rs. 1,200 crore and has domestic sales worth Rs.600 crore annually accounting for roughly 3 percent of the state revenue. Kerala's share in the national marine fish production is about 20 percent. Kerala has achieved it by using 23,129 motorised crafts, 2,986 mechanised and 1673 non-motorised crafts. The present level of fish production in Kerala was 5.53 lakh metric tonnes (Marine Fisheries, Government of Kerala, 2011-12). It is to be noted that fisherfolk have been playing an important role in Kerala economy by catching fish or by working hard for fish production, even though fisherfolk's socio-economic conditions are pitiable. It was estimated that 79 percent of fish worker/ active fisherfolk families are poor because of earning less than Rs. 6000 annually. This is what happened to fisherfolk. But what happened to marine ecology? It is polluted and destroyed. Marine pollution does not have a long history because it began since industrialization, especially after mechanization. Traditional fishing style was changed from subsistence fishing to non-subsistence fishing after the arrival of non-fisherfolk community in fishery sector with motorised and mechanised crafts. It was inferred from focus group discussion that non-fisherfolk have played a lead role in destruction of marine resources and marine ecology. How does government ensure marine ecology and livelihoods of fisherfolk sustainable? But question remains as to whether government has the will to implement the right to fishing or fishing right act? Or in other words, most important question remains as to whether we have the will?

Table 1: Fisherfolk Population, Density and Coastal Length in Kerala

District	Coastal Length (km)	Fisherfolk Population (*000)	Fisherfolk Population per km Length (Density)
Thiruvananthapuram	78	163.5	2096
Kollam	37	89.47	2418

(Contd. Table: 1)

District	Coastal Length (km)	Fisherfolk Population (*000)	Fisherfolk Population per km Length (Density)
Alappuzha	82	107.2	1307
Ernakulam	46	70.96	1543
Thrissur	54	70.95	1314
Malappuram	70	77.9	1113
Kozhikkode	71	94.86	1336
Kannur	82	53.99	658
Kasaragod	70	44.42	606
Total	590	771.25	1307

Source: Kerala Fisheries Statistics: At a Glance, 2016.

The reasons behind the sustainability issues of fisheries sector may be attributed to the mode of exploitation through different technological modes, resulting in overcapacity and overfishing, institutional failures, pollution, discards, climatic changes, shocks and seasonality, increase in demand and population, etc. Traditional explanations of overfishing emphasize the open-access nature of the fisheries. Technological improvements or new technology brings the problem of overcapacity and overfishing. Too many boats for fishing result in "Tragedy of the Commons"¹. Also pollution and discards affect the sustainability of fish and other marine resources. The dragger technology (trawling) affects the marine ecosystem considerably. The policy promoting exports also results in overfishing, discards and pollution. So, the new institutional framework erodes the base of traditional rules and customs, and local community management system.

Overfishing can happen due to the impacts of human activity on marine sector and is the principle cause of the decline of fish, including other living marine resources of the world (Pauly et al., 2002). Other factors like pollution, climatic changes and habitat loss can also have an effect but, overexploitation often has a greater impact (Rosenburg, 2003). There is still the problem of overfishing and overcapacity along the Kerala coast at varying levels in different parts of the state. Foreign vessels (foreign investments in fishery sector, especially in marine sector) are one important reason of overfishing.

According to fishers. *"Foreign vessels of enormous size and power from developed countries are depleting the fish stocks, causing harm to the marine environment by disrupting the food chain. Foreign vessels are doing indiscriminate damage to the ecosystem by way of day and night catch for months and also the seafood industry is largely market driven, exporting as value added products, and processed products, reaping profits. They are dumping waste into the ocean and also destroying the fishing equipments such as net."*

It is surprising to notice that marine fish production is decreasing continuously while inland fish production is increasing steadily during the period 2006/07 - 2015/16. As against the estimated maximum sustainable yield (MSY) of about 7.50 lakh metric tonnes, the present level of marine fish production in Kerala was about 5.53 lakhs metric

¹ "The Tragedy of the Commons" is a seminar work of G. Hardin (1968: 1243-48).

tonnes (2011-12). At present, one can infer that there is no chance of achieving this estimate because of marine fish resource depletion and marine ecosystem deterioration. One could also infer from Table: 2 that the livelihood of 2.3 lakh active marine fish worker families is deteriorating since 2006-07.

Table 2: Yearwise Inland and Marine Fish Production in Kerala

Year	Marine Fish Production (lakh metric tonnes)	Inland Fish Production (lakh metric tonnes)
2006-07	5.98	0.76
2007-08	5.86	0.91
2008-09	5.83	1.02
2009-10	5.70	1.16
2010-11	5.60	1.21
2011-12	5.53	1.40
2012-13	5.31	1.49
2013-14	5.22	1.86
2014-15	5.24	2.02
2015-16	5.17	2.11

Source: Various Issues of Kerala Fisheries Statistics: At a Glance, 2016.

In Kerala, more than 90 per cent of the mechanized boats operating along the Kerala coast are bottom trawlers which use nonselective fishing gear that can be quite destructive to the sea floor environment in addition to harvesting level of by-catch. A study of 375 bottom trawlers operating from six major harbors in 2002 found that 2,40,000 tonnes of low fish are thrown back into the sea due to lack of on-board storage, markets, etc. 94 per cent of bottom trawlers were using mesh sizes below regulations. About 232 non-targeted species were being harvested as by-catch. Destruction of eggs and juveniles was alarming (Chandrapal, 2010).

Around the world, problems persist with the high levels of unwanted and often unreported by catch, including the capture of ecologically important species and juveniles of economically vulnerable species. The latest estimate of global discards² from fishing is about 7 million tonnes per year.³ The problem related to discarding catch areas are many, fish are not of the targeted species, fish of wrong size, lack of space on the board and no way of marketing. Usually the fishers will discard small fish entangled in the net, due to lack of demand and due to marketing problem. If there

² In the fisheries context, "discard" means fish that are thrown away after being taken aboard the fishing vessel or slipped from the net in the water. However, quantifying fisheries discards on a global scale is not simple either, because of incomplete information for many fisheries and countries. Nevertheless, in 1994, global discards from fishing were estimated at about 27 million tonnes.

³ *ibid.*

is bulk catch, those fishers who have access to the landing centres first will get high price. The basic demand supply theory in economics works, if there is more supply the price offered in the market will be low. Since fish is a perishable quantity and there are no storage facilities in the landing centres the catch is either discarded or offered at very low price. Local fishers noted the reasons for discarding catch – there are no facility of marketing and storage, and lack of demand of fish due to inadequate size. If there is a preservation unit they can dispose the fish in the coming days even though there is a low catch. Thus, there is the need for processing and preservation units and strengthening the marketing facilities.

Though technology has improved a lot there are problems relating to overfishing and overcapacity resulting in threats to the livelihood of fisherfolk and marine ecosystem. The open-access nature of the seas, institutional factors, pollution and other unpredictable events like climatic changes had exacerbated the sustainability issues in marine sector and cause threat to marine ecosystem and livelihood security. Also the change in government policies allowing foreign fleets affects the livelihood of fishers. As a result of the developments the catching of juveniles and sub-adults is a problem and the study reported that the discarding of catch is comparatively low in the region, as they give the discard for manufacturing feeds. This may cause ecosystem damage in the future.

A substantial portion of fisherfolk are not happy with two recent reports such as “Report of the Expert Committee Constituted for Comprehensive Review of the Deep Sea Fishing Policy and Guidelines” (Dr. B. Meenakumari Committee Report) and “Report of the Technical Committee to Review the Duration of the Ban Period and to Suggest Further Measures to Strengthen the Conservation and Management Aspects” (Dr. A. Gopalakrishnan Technical Committee Report) submitted to the Government of India on August and September 2014. Fishers said that there is an interesting similarity between these reports and notoriously declined to protect the interests of 1.44 crore fisherfolk in India. First report is heartily welcoming foreign investments in marine fishery sector to explore fish resources in buffer zone and second report is demanding the extension of trolling ban from 47 days to 61 days in marine fishery sector. These two reports, in essence, are against the interest of the fisherfolk and fishery sector of the country.

Major issues emerged from the interviews with the fisherfolk are summarized as follows: 1) Over capacity and overfishing leads to depletion of fish resources. There is an increasing trend in the oil sardine catch and the increase may be attributed to intense motorization and mechanization of boats. Due to bulk landings by the trawlers they do not get good price. When the fish is supplied for the manufacturers of poultry and fish feed, they get a minimum price of Rs. 400 to Rs. 600 for a box of sardine which results in the exploitation of fish resources. If the present uncontrolled exploitation continues it will result in the decline of stock. In the words of Abdulla from Kannur district of Kerala: “Now we are living on the mercy of Sardine which fetches a price of minimum 400 for a box. We know that this is not good for the ecosystem. Though we don't catch the low priced sardines, the trawler boats from Pondicherry and Mahe catch and they supply to the manufacturers of poultry feed. So if we want responsible fishing, sustain the fishing by methods

of strict licensing, by monitoring the boats and trawlers by other states and stop night fishing." In the case of Mussels in the earlier days they got 15 baskets and now they get a few baskets. As the collection of mussels is a risky job, only a few are interested. There are no sentimental attachments in plucking small mussels among fishers. 2) Pollution is an important problem. No catch is available due to pollution of riverbeds and high use of fertilizers. Big ships dispose the waste in the Arabian Sea and plastic waste and domestic waste are the biggest problems. Sand mining for land filling purpose is causing threat to marine ecosystem. 3) In Kannur and Thiruvananthapuram still there is slavery/bondage of labour. No mechanism for pricing of species by fishers and they are under the clutches of middlemen and money lenders. Those who have boats and nets are eligible for government funds for buying nets and safety equipment. In the northern Kerala, it was found that there are no caste barriers for fishing. Due to open access nature upper caste people are also engaged in these activities. Also in Kerala fishing is done by workers from other states for daily wages just like in construction work. It is to be noticed that workers from other states like Bengalis, Assamese, etc., do not have an emotional attachment to fishing activities. Marketing facilities and processing units are a few. Moreover other job alternative for fishers in slack season. Political bias badly affects distribution of schemes of Fisheries Department to fisherfolk. 4) Factors such as climatic change, habitat loss, etc. can also have an impact on the sustainability of marine resources. On the whole, the livelihoods of the traditional fisherfolk and sustainability of marine ecosystem are under severe threats (John, 2011).

Way Out

The Araya Samajam, an organisation of fisherfolk in Azhikode panchayat in Kannur district, plays a significant role in fisherfolk activities. In the words of Adithiyana a fisher from Azhikode: Here we have strict rules enforcing the fishermen to avoid ecosystem damage. Fisherfolk do not allow for devastate both inland and marine ecology. We put sign boards warning not to pluck the small mussels (*Kallumeka*). If someone dies in their region they won't go to sea and if any one violated the rules of this informal social institution they are fined. This institution besides protecting ecosystem has programmes for health protection, a legal redressal cell to hear the family issues and other petty cases. In this area at the time of marriage, samajam will pool the money for marriage. The basic infrastructure like roads and electric lights are maintained by samajam "We can say we are self-equipped than the other coastal villages nearby" Though they have a community management system they complained that due to indiscriminate exploitation by trawlers and foreign vessels, the coastal bays are polluted and exploited. That is, the pollution from the dyeing unit causes threat to marine ecosystem and marine resources which cannot be controlled by the local community management system. It is in this context, fisherfolk or fishing community across India need to have right to fishing (fishing right act) "to protect the local community management system, the livelihood of the fisherfolk, marine ecosystem and to restrict foreign vessels along the coast of the country" (John, 2012, 2014).

Right to Fishing

Right to fishing is a statutory power of the fisherfolk to catch fish from a specified area in inland and marine sector whereas non-fisherfolk community are not allowed to catch fish. Right to fishing should be commenced as Forest Right Act 2006. That is right to fishing is an act to recognize and vest the fishing rights and fishing activities in inland and marine sector in fisherfolk and other people who have been living along the coast for generations. Fisherfolk have every right to use both inland and marine fish resources sustainably for their endurance and existence. It is responsibility of fisherfolk and authority to catch, utilize and conserve marine ecosystem. Fisherfolk have every right to ensure livelihood and food security from fishing. Right to fishing should be guaranteed some specific rights and entitlements to the fisherfolk in fishery sector that are as follows: fishing is a birth right of fisherfolk, fisherfolk has only right to catch marine fish resources of waters upto 500 meters depth, if fisherfolk do not have technology to catch fish of waters from 200 meters depth to 500 meters depth, government should provide technology and vessels to the fisherfolk, there is no need of ban on trawling for fisherfolk who go to catch fish from waters upto 500 meters depth, fisherfolk do not need licence but, those who belong to non-fisherfolk should be given licence to fishing, fisherfolk have the right to follow local community management system, Fisheries Department must act in accordance with this and act as a facilitator instead of regulator and fisherfolk have every right to live in coastal areas and to use inland and marine resources sustainably for their survival and existence. The paper calls for a nation-wide debate on the right to fishing.

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Website

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An Empirical Analysis of Tamil Nadu Economy during 2005-2014

S. Srinivasan*

Introduction

Tamil Nadu holds the second-largest economy in India after Maharashtra. It is the most industrialized state (World Bank, 2014). As of 2010-11, Tamil Nadu had a per capita GDP of \$1,622, the sixth highest in India. Tamil Nadu's gross state domestic product for 2011-2012 was \$145,868 million. The state had a growth of 9.4 percent in 2011-2012. According to the 2011 census, Tamil Nadu is the most urbanized state

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Child molestation is a form of child abuse in which an adult or older adolescent uses a child for sexual stimulation. Mahesh Dattani's three Act play, "Thirty Days in September," is a dramatization of this heinous issue and its horrendous effect on the psyche of the victims. Hegemony, according to Gramsci, is a process through which a class or a group in dominance stays in power by "generating" or as Chomsky says "manufacturing" consent. Dattani's play "Thirty Days in September" is a psycho-analysis endeavour into the lives and minds of the victims of child abuse, and an attempt to sensitize the audience to lend a helping hand to such victims.

Key Words: Child Molestation, Hegemony, Anagnorisis, Catharsis

Child molestation is a form of child abuse in which an adult or older adolescent uses a child for sexual stimulation. Forms of sexual abuse include - asking or pressurizing a child into sexual activities, indecent exposure to a child intending to gratify one's own sexual desires, physical sexual contact with the child, or even using a child to produce child pornography. In a shocking revelation, a government commissioned survey has found that more than 53% of the children in India are subjected to some form of sexual abuse, yet in most cases they do not report the assaults to anyone (Child Sexual Abuse," 2013). Parents, relatives, persons known to the child, or persons in a position of trust and responsibility are mostly found to be the perpetrators of child sexual abuse. While releasing the survey, Women and Child Development Minister Renuka Chowdhury said, "Child abuse is shrouded in secrecy and there is a conspiracy of silence around the entire subject" ("Child Sexual Abuse," 2013). Child abuse leads to psychic wounds which are harder to heal than bodily injuries. The American Psychiatric Association

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Aluminum Doped ZnO Thin Films Using Chemical Spray Pyrolysis

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Abstract

Aluminum doped ZnO thin films were grown using chemical spray pyrolysis. The doped films showed only blue and UV photoluminescence at room temperature. The position of the near band edge emission was found to agree with the theoretical value of ZnO nanocrystal band gap. The full width at half maximum for the near band edge emission at room temperature was found to be ~ 100 meV, which indicated films to be of very good device quality. The presence of a weak photoluminescence at 3.08 ± 0.02 eV in the films was assigned to defect related emission. We had shown in this report that it was possible to increase the efficiency of the photoluminescence by increasing the substrate temperature used for film growth. The optimized films showed resistivity of $1.5 \times 10^{-2} \Omega \cdot \text{cm}$.

Keywords

Thin films, Chemical Spray Pyrolysis, ZnO, Photoluminescence, Excitons

Subject Areas: Analytical Chemistry

1. Introduction

The past decade has witnessed a significant improvement in the quality of zinc oxide (ZnO) single-crystal substrates and epitaxial films as result of revival and rapid expansion of research on ZnO as a semiconductor [1]-[5]. The high electron mobility, high thermal conductivity, wide and direct band gap and large exciton binding energy make ZnO ideal for a wide range of device applications like transparent thin-film transistors, photodetectors, light-emitting diodes and laser diodes that operate in the blue and ultraviolet region of the spectrum [6]-[12]. The free-exciton binding energy in ZnO is 60 meV [11] [12]. This large exciton binding energy indicates that efficient exciton emission in ZnO can persist at room temperature and higher [11] [12]. Since the oscillator strength of excitons is typically much larger than that of direct electron-hole transitions in direct gap semiconductors, the large exciton binding energy makes ZnO a promising material for optical devices that are

based on exciton effects [13]. Due to a strong luminescence in the green-white region of the spectrum, ZnO is also a suitable material for phosphor applications. The emission spectrum has a peak at 495 nm and a very broad half-width of 0.4 eV [14]. The origin of the luminescence center and the luminescence mechanism are not really understood, being frequently attributed to oxygen vacancies or zinc interstitials, without any clear evidence [14].

Most of the current technological applications of ZnO, such as varistors, transparent conductive electrodes for solar cells, piezoelectric devices and gas sensors, have made use of polycrystalline films that are grown by a variety of deposition techniques, mostly on glass substrates [15]. These techniques include chemical spray pyrolysis, screen painting, electrochemical deposition, sol-gel synthesis and oxidation of Zn films, which are characterized by requiring relatively low temperatures for film growth [5] [8]-[14]. However, for electronic and optoelectronic applications, high-quality single-crystal epitaxial films with minimal concentrations of native defects and controlled impurity incorporation are required [16]. For these, optimized growth and processing environments (partial pressures and temperature) are necessary. Current techniques that are recognized for this level of control include pulsed laser deposition (PLD), chemical vapor deposition (CVD), metal-organic CVD (MOCVD) and molecular-beam epitaxy (MBE), and to a lesser extent sputtering [17]-[22]. Magnetron sputtering is recognized to be the most scalable technique, at the expense of lower crystalline quality, often resulting in columnar structures [15].

We have been optimizing Chemical Spray Pyrolysis (CSP) technique for the growth of different binary and ternary semiconductor thin films for solar cell applications [23] [24]. The (002) plane in ZnO is considered to be the most ideal growth plane for opto-electronic device fabrication [25]. In the present work, we report on the effect of optimizing the substrate temperature, while maintaining the doping concentration and the spray rate to grow ZnO thin films with preferential orientation along the (002) plane using this technique. The optimized doping concentration is obtained through a detailed investigation reported earlier by us [5]. In the present work, we report on how we are able to improve the efficiency of near band edge (NBE) PL emission at room temperature on optimally doped ZnO thin films. The full width at half maximum of the PL spectra gives characteristic information, which can be used to judge the sample quality [24]. Our results prove that CSP technique can be used to grow device quality ZnO films.

2. Experimental

ZnO thin films were prepared by spraying a solution containing a mixture of zinc acetate (99.9%) dissolved in distilled water, propanol and acetic acid in the ratio 50:47.5:2.5 on to glass substrates maintained at a suitable temperature. All chemicals used were from Sigma Aldrich of AR grade. In our previous report we had concluded that Al doped ZnO thin films can be grown using CSP technique with preferential orientation along (002) plane when the spray rate was maintained at 1 ml/min and the doping concentration was 1% [5]. There, however, the films were of poor crystalline quality. The spray rate of 1 ml/min was hence used for injecting the precursor solution onto the substrate for all trials reported in this report. Doping of ZnO films was carried out by mixing suitable quantity of Al (NO₃)₃·9H₂O (99.90%) solution to the spray precursor solution. Al (NO₃)₃·9H₂O solution was prepared in the same molarity as the spray precursor solution and 1% volumetric doping of the spray precursor solution was carried out for preparing all of the samples. Chemical Spray Pyrolysis was carried out using a unit developed in-house. The details of the experimental set up have been reported in detail by us [5] [24]. In each trial a sample was loaded with a mask so as to obtain a step profile. Then the thickness of the films was measured using a stylus surface profilometer (Dektak 6 M).

Structural analysis was done using X-ray diffraction (XRD) with a Rigaku (D.Max.C) X-ray diffractometer, having Cu K_α (λ = 1.5405 Å) radiation and Ni filter operated at 30 kV and 20 mA. Optical absorption and transmission studies were carried out using UV-Vis-NIR spectrophotometer (Hitachi U-3410 Model). Photoluminescence studies were performed in an in-house assembled PL scanning system, by exciting the samples with 325 nm line of a He-Cd laser (Kimmon) and the emission spectrum was recorded using a USB2000 spectrophotometer. Details of the PL system were reported by us [26]-[28]. Electrical measurements were carried out using silver contacts separated by a distance of 1 cm. In this study, the sheet resistivity is calculated by the following equation:

$$\rho = R_s d \quad (1)$$

where ρ is the resistivity, R_s is the sheet resistance (Ω/sq) and d is the sample thickness.

3. Results and Discussion

Figure 1 shows the X-ray diffraction (XRD) spectra for samples prepared by varying the substrate temperature from 723 K to 873 K. The peaks of the XRD pattern correspond to those of the theoretical ZnO patterns from the JCPDS data file, with a hexagonal wurtzite structure of the bulk and lattice constants: $a = 3.24982 \text{ \AA}$, $c = 5.20661 \text{ \AA}$ [20]. The analytical method was used to calculate the lattice constants ($a = 3.00 \text{ \AA}$, $c = 5.20 \text{ \AA}$) for the films [29]. The full width at half maximum (FWHM) of the (002) peak varied from 0.236° to 0.265° for the films. Another major orientation present is (101) with comparatively lower intensity. Therefore, we could conclude that the crystallites are highly oriented with their c -axes perpendicular to the plane of the substrate.

The volume of the spray solution was varied for each case so as to obtain thin films of the same thickness. The thickness of the samples was between $850 \pm 100 \text{ nm}$. As the substrate temperature was increased it was observed that the films deposited exhibited improved growth along the (002) and (101) plane. It was observed that the preferential growth along the (002) plane for the films occurred in all cases as temperature was raised up to 848 K. Beyond this temperature the growth along this plane was not preferred. We assume that as the substrate temperature is increased lesser amount of oxygen is accommodated into the lattice which result in decrease in growth along the (002) plane. The grain size of the films from the XRD data was calculated using the Debye-Scherrer formula [29]:

$$d = \frac{0.9\lambda}{\beta \cos \theta} \quad (2)$$

where “ d ” is the grain size, $\lambda = 1.5405 \text{ \AA}$, β is the broadening of diffraction line measured at the half of its maximum intensity in radians and θ is the angle of diffraction. **Table 1** summarizes the effect of variation in substrate temperature on the grain size of the ZnO thin films. It is observed that films grown at 848 K have the smallest grain size.

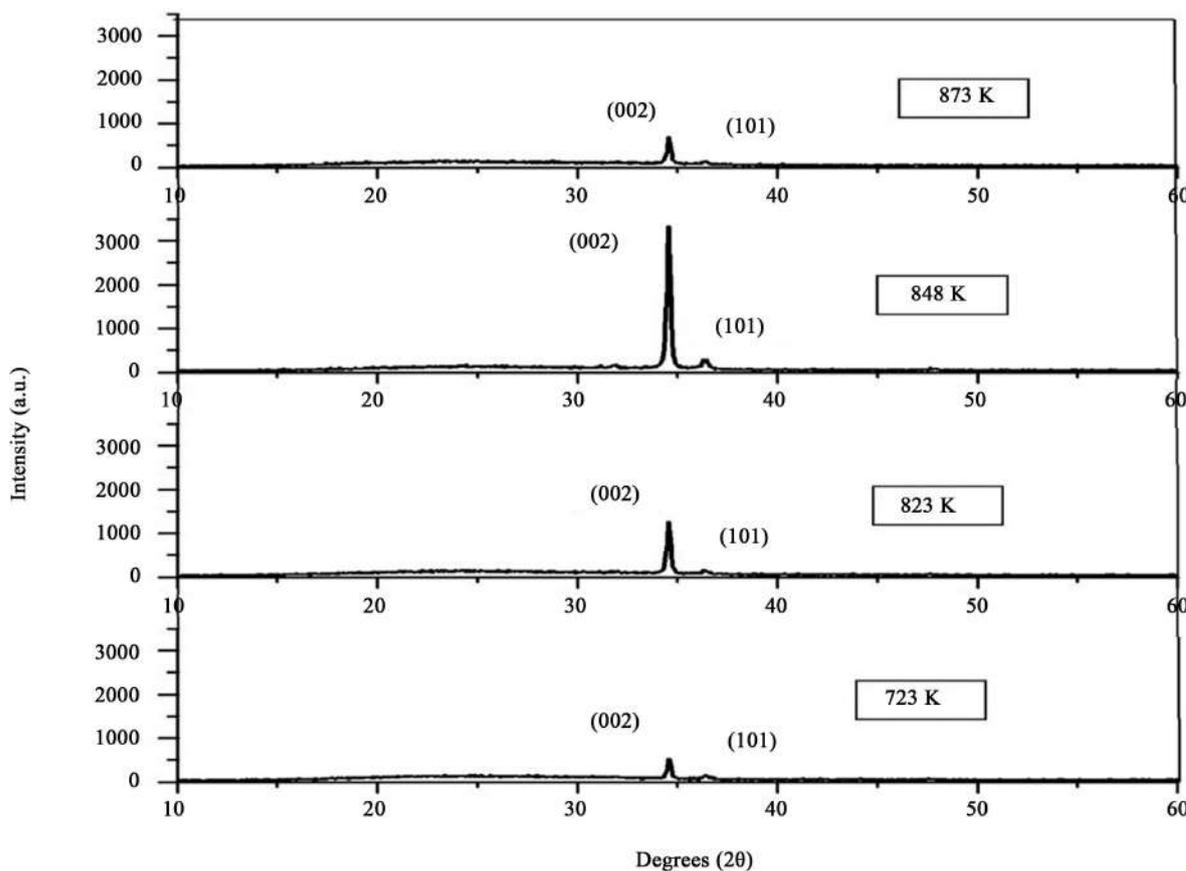


Figure 1. XRD spectra for samples prepared by maintaining the substrate temperature at 723 K, 823 K, 848 K and 873 K.

Table 1. The variation in grain size, texture coefficient, thickness, theoretical band gap and band gap based on Tauc plot are tabulated with respect to the substrate temperature.

Substrate Temperature (K)	Grain Size from XRD (nm)	TC (002)	Thickness (nm)	Band Gap Energy (eV)	
				Theoretical Estimation*	Tauc Plot
723	31.6	1.11	762	3.19	3.16
823	32.2	1.83	759	3.19	3.17
848	28.7	2.84	898	3.19	3.15
873	28.9	1.21	854	3.19	3.2

The texture coefficient (TC) represents the texture of a particular plane, whose deviation from unity implies the preferred growth. Quantitative information concerning the preferential crystallite orientation was obtained from another texture coefficient $TC(hkl)$ defined as:

$$TC(hkl) = \frac{\frac{I(hkl)}{I_o(hkl)}}{\left[\frac{1}{n} \sum \frac{I(hkl)}{I_o(hkl)} \right]} \quad (3)$$

where $I(hkl)$ is the measured relative intensity of a plane (hkl) and $I_o(hkl)$ is the standard intensity of the plane (hkl) taken from the JCPDS data [30]. The value $TC(hkl) = 1$ represents films with randomly oriented crystallites, while higher values indicate the abundance of grains oriented in a given (hkl) direction. The variation of TC for the peaks of the wurzite lattice is presented in **Table 1**. It can be seen that the highest TC was in the (002) plane for ZnO thin film grown on substrate maintained at 848 K.

Figure 2 shows the transmission spectrum for the samples. Good surface quality and homogeneity of the films were confirmed from the appearance of interference fringes in the transmission spectra. Interference fringes occur when the film surface is highly reflecting, without much scattering/absorption in the bulk of the film. It is well established that in transparent metal oxides, metal to oxygen ratio decides the percentage of transmittance [31]. Optical constants were evaluated using the “envelope method” originally developed by Manifacier *et al.* [32]. If we assume that the film absorbs weakly and the substrate is completely transparent, then using the envelope method the refractive index (n) of the film on a transparent substrate can be evaluated from the transmission spectra. The refractive indices n at various wavelengths were calculated using the envelope curve for T_{\max} (T_M) and T_{\min} (T_m) in the transmission spectra [32]. The expression for the refractive index is given by:

$$n = \left[N + (N^2 - n_s^2)^{1/2} \right]^{1/2} \quad (4)$$

where

$$N = 2n_s \left(\frac{T_M - T_m}{T_m T_M} \right) + \frac{n_s^2 + 1}{2} \quad (5)$$

and n_s is the refractive index of the substrate ($n_s = 1.52$ for glass). **Figure 3** shows the variation of the refractive index n in the range 300 - 2000 nm for the film prepared at 848 K. The thickness of the film was calculated using the equation:

$$t = \frac{\lambda_1 \lambda_2}{2(\lambda_1 n_2 - \lambda_2 n_1)} \quad (6)$$

where n_1 and n_2 are the refractive indices corresponding to the wavelengths λ_1 and λ_2 respectively [32]. The thicknesses of the films are given in **Table 1**.

The PL of the ZnO thin films was measured at room temperature (**Figure 4**). There is an improvement in the radiative efficiency of the UV emission as substrate temperature is increased up to 848 K as evident in **Figure 4**. The high energy sides of the spectra are steep while the low energy side tail slowly. The emission spectra of all

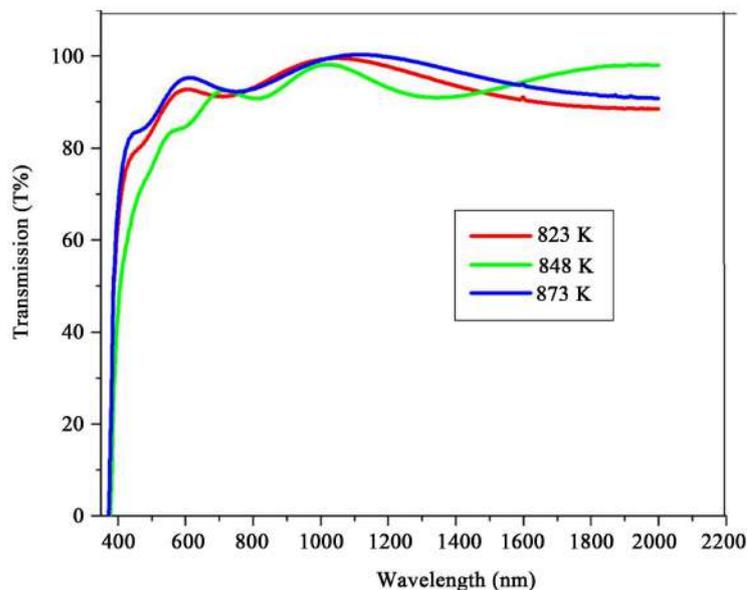


Figure 2. Transmission spectra for samples prepared by maintaining the substrate temperature at 823 K, 848 K and 873 K.

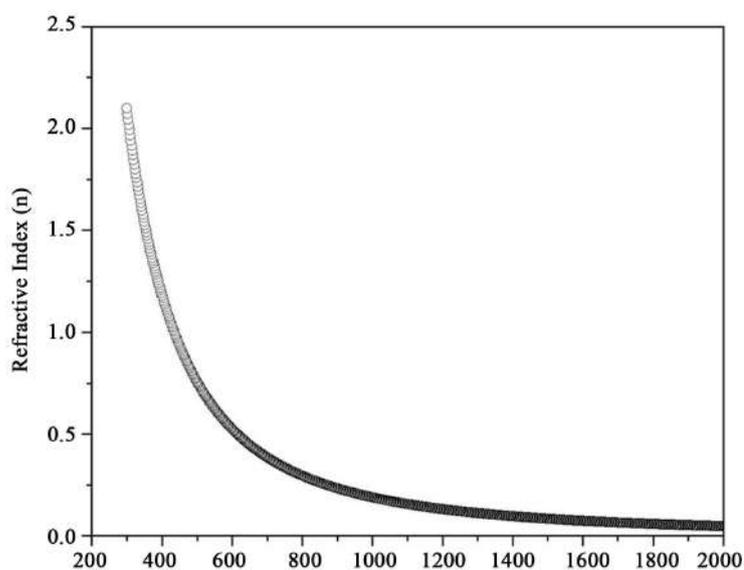


Figure 3. Plot of simulated values of refractive index n versus wavelength.

samples have full width at half maximum ~ 100 meV at 300 K. The emission ranges from 3.27 to 2.96 eV for the samples indicating them to be unresolved UV emission. The emission for all samples could be fitted well with two peaks located at 3.20 ± 0.02 eV and 3.08 ± 0.02 eV. The emission at 3.20 ± 0.02 eV could be assigned to the near band edge emission (NBE). The FWHM of the NBE emission in our films are of the same order as that in ZnO nanocrystals and quantum dots grown using magnetron sputtering and MBE [33]-[35]. The mechanism of NBE emission at low temperature is well understood owing to the sharp and intense emission peaks [36]. Broadening of the NBE peak at higher temperature make it difficult to identify the emission mechanism. In majority of the published works, NBE emission has been attributed to free-exciton annihilation from the position of peak energy [37] [38]. When the exciton dissociates it creates a free electron and a free hole. Recombination of the electron-hole pair results in emission of photon with energy:

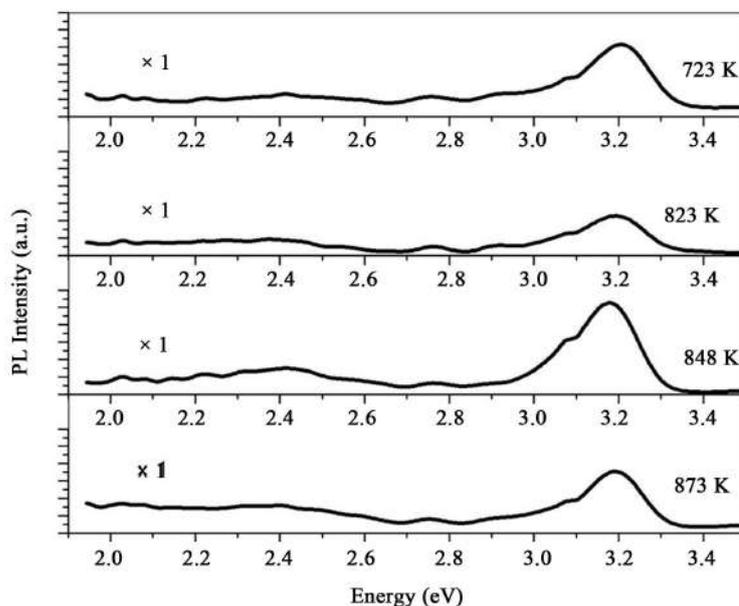


Figure 4. PL spectra for samples prepared by maintaining the substrate temperature at 723 K, 823 K, 848 K and 873 K.

$$h\nu = E_g - \varepsilon_{ex} \quad (7)$$

where E_g is the band gap and ε_{ex} is the exciton binding energy. The band gap is calculated using Equation (7) and is shown in **Table 2** along with the substrate temperature and the position of the NBE emission. A level at 3.06 eV below the conduction band was identified corresponding to the acceptor level V_{Zn} [38]. So we assume that the emission at 3.08 ± 0.02 eV might be due to the transition from the conduction band to the level due to V_{Zn} . Appearance of the emission at 3.08 ± 0.02 eV was observed only in optimally Al doped ZnO [5]. Hence the possibility of formation of a defect level due to zinc vacancy was more due to Al doping.

The emission by the nanocrystalline structure will have quantum size effect similar to that of quantum dots and can be described by the following equation [39]:

$$E_{gap}^{nanocrystal} = E_{gap}^{bulk} + \frac{\hbar^2 \pi^2}{2r^2} \left(\frac{1}{m_e} + \frac{1}{m_h} \right) - 0.248 E_{Ry}^* \quad (8)$$

The bulk band gap E_{gap}^{bulk} is taken as 3.2 eV, and the bulk exciton binding energy E_{Ry}^* can be taken as 60 meV [40] [41]. The electron and hole effective masses are taken as $m_e^* = 0.24m_0$ and $m_h^* = 2.31m_0$, respectively [42]. Additionally, h is Planck's constant and R is the radius of ZnO nanocrystals. **Figure 5** shows a plot of the nanocrystal band gap $E_{gap}^{nanocrystal}$ versus the nanocrystal radius R . The solid curve is the theoretical fit of Equation (8), while the symbols are the grain sizes estimated from XRD result (**Table 1**) and their corresponding optical band gaps determined by applying the Tauc model [43]. The band gap does not show much variation with the crystallite size, which corresponds to various growth temperatures. This is mainly because the crystallite size is not small enough to show a distinct variation of the band gap. The inset in **Figure 5** relates the NBE emission for the samples and the respective substrate temperature at which the films were grown. From **Figure 5** and the inset, it can be seen that the position of the NBE emission in PL agrees with the theoretical curve. Hence we conclude that the PL measurement demonstrates that the emission comes from ZnO nanocrystals.

Table 2 shows the variation in resistivity of the samples prepared. Resistivity was observed to be the least for sample prepared at 848 K. The decrease in resistivity might be naturally due to the donor action of Aluminum. Since in all cases we used the same doping concentration we assume that on increasing substrate temperature, zinc might be progressively replaced by Al atom and since it belonged to group III, it could supply an additional electron contributing to the conductivity. Also Al could occupy interstitial position, again promoting conductivity. Generally it is expected that resistivity may increase due to the decrease in grain size and also due to the in-

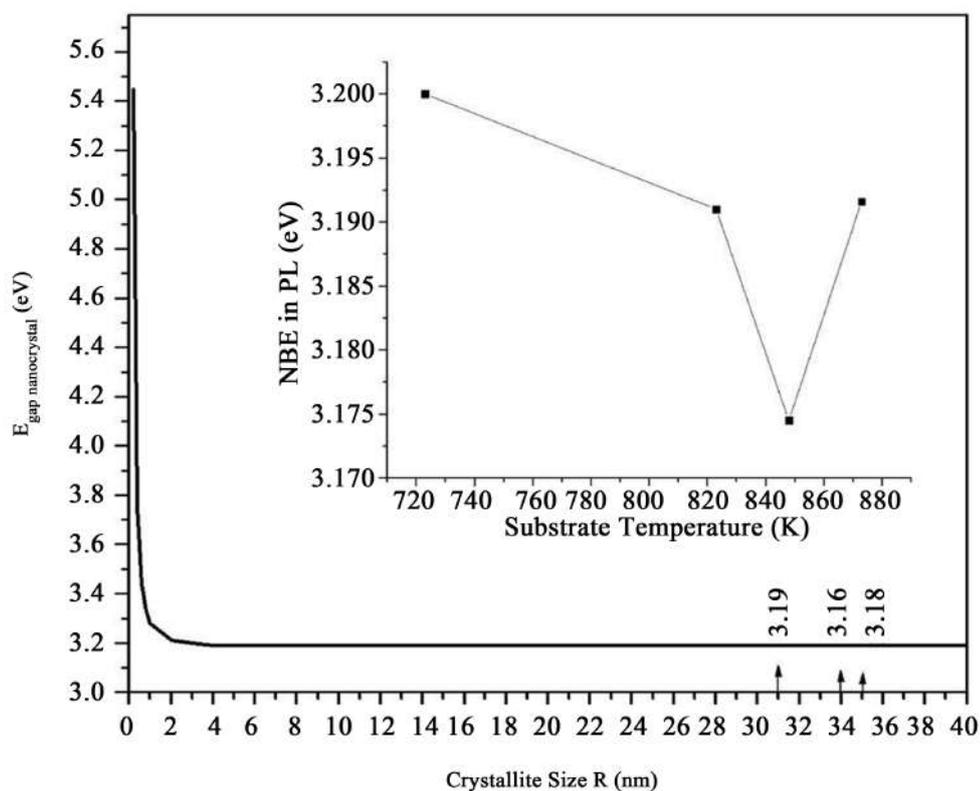


Figure 5. Theoretical simulation on the effect of grain size on band gap for ZnO. Inset shows variation in position of the NBE emission with substrate temperature.

Table 2. The variation in resistivity of the samples, the position of the NBE emission and band gap calculated based on PL as a function of substrate temperature are tabulated.

Substrate Temperature (K)	Position of NBE Emission (eV)	Band Gap E_g from PL (eV)	Resistivity $\times 10^{-2}$ (Ωcm)
723	3.20	3.26	18
823	3.19	3.25	8
848	3.17	3.23	1.5
873	3.19	3.25	4.8

crease in the grain boundary scattering. Since there was no appreciable decrease in grain size with Al doping the grain-boundary scattering effect might be less prominent in our results. We conclude that 848 K is the optimum temperature for 1% Al doping of ZnO when the spray rate is maintained at 1 ml/min.

4. Conclusion

In conclusion, we have demonstrated the improvement in efficiency of UV emitting, ZnO thin films using chemical spray pyrolysis technique. Defects are compensated to a high degree in Al doped ZnO thin films grown by this method. These doped films exhibit UV emission when excited with above band gap energy photons. It is possible to improve the radiative efficiency of the UV emission by optimizing substrate temperature. Energy of the near band edge emission agrees well with the theoretical band gap estimated for nanocrystals. Under optimized conditions, we can develop thin films with resistivity of $1.5 \times 10^{-2} \Omega\text{cm}$. The samples prepared at optimum condition show UV emission with FWHM of ~ 100 m eV at room temperature confirming their device quality comparable to films grown using MBE and sputtering. Based on our results we conclude that chemical spray pyrolysis is an economic and user friendly technique for the growth of device quality thin films.

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Time Evolution of chlorophyll content in *Ocimum Tenuiflorum*

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Abstract

Ocimum Tenuiflorum locally known as “Tulsi” is a widely used indigenous remedy to several ailments in our households. We have studied the evolution of chlorophyll content in the leaves of this plant over time in a day. We observe that the chlorophyll content reaches its maximum during noon time. This suggests that the leaf extract may be of higher medicinal value when extracted during the noon time. This also provides a scientific explanation to the age old practice in our homes of not using the Tulsi leaves for any purpose after sunset.

I. Introduction

Chlorophyll is a green pigment found in all plants, algae and cyanobacteria (blue-green algae). Vital for photosynthesis, chlorophyll allows plants to obtain energy from light by converting the sun's rays into chemical energy. Chlorophyll is built around a structure known as a porphyrin ring, common to a variety of naturally occurring organic molecules. Chief among these is hemoglobin, the substance in human and animal blood which carries oxygen from the lungs to the other tissues and cells of the body. The main difference between heme (the oxygen carrying portion of hemoglobin) and chlorophyll is that the porphyrin ring of hemoglobin is built around iron (Fe) and the porphyrin ring of chlorophyll is built around magnesium (Mg).[1]

Scientific evidence has shown that chlorophyll and the nutrients found in green foods offer protection against toxic chemicals and radiation. In 1980, Dr. Chiu Nan Lai at the University of Texas Medical Center reported that extracts of wheatgrass and other green vegetables inhibit the cancer-causing effects of two mutagens (benzopyrene and methylcholanthrene).[2] Chlorophyll-rich plant extracts, as well as water solutions of a chlorophyll derivative (chlorophyllin), dramatically inhibit the carcinogenic effects of common dietary and environmental chemicals.[14, 15] Reports have shown that certain vegetables significantly reduced mortality in rats exposed to lethal doses of X-rays. [6] In a later study, some vegetables were shown to reduce the damage caused by radiation. [7] Chlorophyll also has many therapeutic uses. Among these are wound healing, (3) intestinal regularity, (4) reducing cholesterol, (5) detoxification and deodorization have been reported and established. Chlorophyll provides a unique way to address these issues because, through experiments and trials on humans and test animals, chlorophyll therapy has always been shown to have no toxicity (absolutely zero toxic side effects) — whether ingested, injected or rubbed onto your skin.(3)

In India, Hindus have long cultivated Tulsi (*Ocimum tenuiflorum* L) as a religious plant. It is said to aid meditation and is believed to be endowed with the spiritual power to transform souls. It can be found in homes and temples, where its leaves are a common part of worship routines. Botanically, it belongs to the mint family (*Lamiaceae*). The leaves are also a major ingredient for

local medicines that bring relief to – fever, sting from insects, itching of skin etc. In India, there also exists the practice that the leaf of this plant is not taken for any purpose after sunset. This intrigued us to study the effect of sunlight on the chlorophyll content in the leaf of *Ocimum tenuiflorum* L which is a plant of very significant cultural value to India.

II. Experimental

Ocimum tenuiflorum leaf was collected from different plants at 07:00 am, 9:30 am, 11:30 am, 12:30 pm, 02:30 pm and 04:30 pm. The leaf was cleaned and then grinded with a mortar without addition of any water till a paste form was obtained. The paste was then diluted so as to be available in sufficient quantity to be taken in the cuvette of 3 ml.

III. Results and Discussion

Absorption spectrum of the extract from *Ocimum* leaf taken at different times of a day is shown in figure 1. We have measured the leaf extract of *Ocimum* taken at 07:00 am, 9:30 am, 11:30 am, 12:30 pm, 02:30 pm and 04:00 pm in the present study. We have observed only one peak in the extract collected centered around ~ 665 nm. As is evident from the figure, one can reason that there is a progressive time dependence on the magnitude of optical absorption for the extract upto 02:30 pm and after which the magnitude decreases.

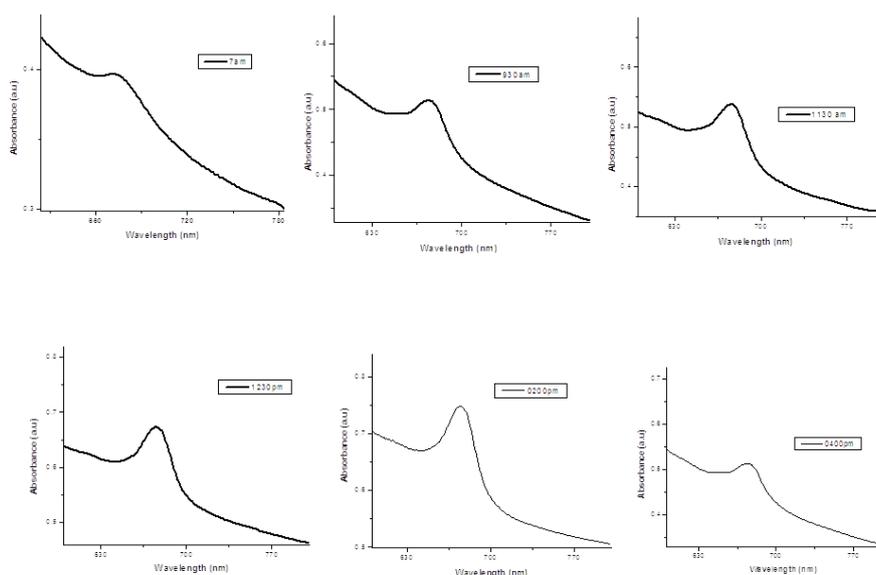


Figure 1: Optical absorption of extract collected at different time of the day.

Figure 2 shows a plot of area under the absorption peaks for the leaf extract. It clearly proves the time dependence of the absorption spectrum of the pigment. The observations provided direct evidence on the controlled release of chlorophyll pigment by the leaf. One of the variables during the collection of the extract was the intensity of the incident sunlight.

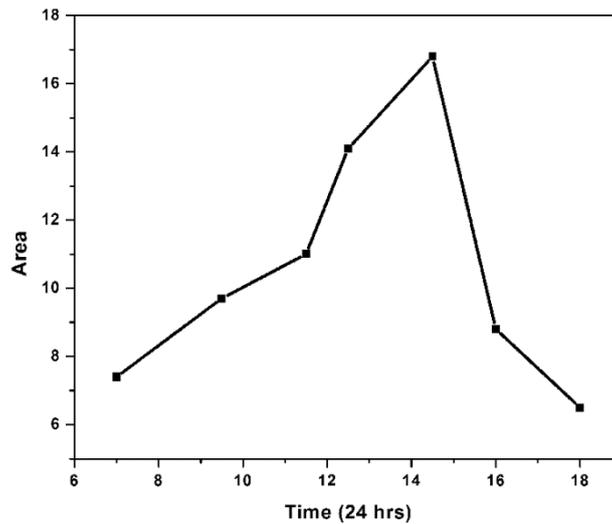


Figure 2: Area under the curve calculated from figure 1.

IV. Conclusions

We have observed only one peak in the extract collected centered around ~ 665 nm. This corresponds to the pigment chlorophyll A. There is a temporal dependence in the concentration of the pigment. This can be related to the amount of sun shine available. It is known that sunlight is essential for photosynthesis and as the available amount of sun light changes during day time there is a proportionate change in the amount of chlorophyll A pigment in the extract collected.

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Nurturing Nature: Dissolving and Disrupting the Nature/Culture Dualism in Commercial Advertisements

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ABSTRACT

There is a greater range of interest in the people and media regarding green marketing and green consumption. Eco-friendly and pro-environmental products have begun to attract more number of customers. The fact remains that only the labels and packages have changed, the contents are still the same, or worse. Whatever the truth/reality regarding the authenticity of these eco-friendly products may be, the intentions of the producer/company are communicated through advertisements catering to the interests of the eco-friendly customer. Appealing to the general public, the advertisements run along umpteen numbers of themes romanticizing the whole idea of protecting and admiring nature. The issue concerned in the paper is to analyse a commercial advertisement by Haier to expose the attempt made by man to break the nature/culture binary and merge the two with each other. In other words, man encroaches into the limits laid by nature by dissolving the natural into the cultural and disrupting the equilibrium.

We live in a time flooded with campaigns giving awareness on the environmental issues, threats, steps to be taken etc. It is upon man's limitless exploitation of natural resources that the blame for the endangering of nature rests. The consumption patterns of the industrialized nations is thought to be the initial reasons behind the increased frequency of pollution and thereby the environmental issues. With them emerged a plethora of pro-environmental activists, pleading to save nature. The irony is that among these saviours of the environment are the companies that claim to be producing eco-friendly products, promising minimal threat to the environment.

There is a greater range of interest in the people and media regarding green marketing and green consumption (Dobscha 36). Eco-friendly and pro-environmental products have begun to attract more number of customers. The fact remains that only the labels and packages have changed, the contents are still the same, or worse. Even in supermarkets and retail shops, the so-called eco-friendly bags supplied are actually

variants of plastic and ironically the eco-friendly customers rarely give it a rational thought. Surveys reveal the fact that the percentage of people purchasing products which are tagged eco-friendly has increased compared to yesteryears. Thanks to globalization, customers now have a variety of options to choose from, with the backing of the eco-friendly labels, and most of all, brilliantly crafted advertisements.

Whatever the truth/reality regarding the authenticity of these eco-friendly products may be, the intentions of the producer/company are communicated through advertisements catering to the interests of the eco-friendly customer. Appealing to the general public, the advertisements run along umpteen numbers of themes romanticizing the whole idea of protecting and admiring nature.

A concept central to eco-criticism involves the dichotomy between nature and culture. While the former is raw, original and hence natural, the latter is a social construct, and hence an artifice, made at some point of

Silica nano particles synthesized from boiler spent ash: Value addition to an industrial waste

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Abstract

Large quantities of biomass ash are generated everyday by the spice industries and are currently disposed off as landfill. However, this could transform into an environmental pollutant unless alternative techniques are developed for its disposal or value addition. Here in this study, the waste ash from biomass combustion was successfully converted into silica nanoparticles with potential for application in several fields. The highly alkaline nature of the ash and presence of unburned carbon warrants a pretreatment which includes digestion and acid treatment. The synthesized silica was characterized in terms of morphology, specific surface area, crystallinity, surface functional groups and size. Alkaline extraction of the pretreated ash followed by acid precipitation yielded an amorphous structure with minimum mineral contaminants, high surface area, and a narrow size distribution (8-10 nm range) characteristic of nano silica. Studies thus indicate that the waste ash and the extraction process could be fine tuned for the large scale production of amorphous silica and could be of use to solve the problem of boiler ash pollution.

Keywords: biomass ash, boiler ash, nano silica, value addition to waste, amorphous silica

1. Introduction

Spent biomass obtained after extraction of color and oleoresin from spices like chilli, turmeric, pepper, coriander, ginger etc. is used as boiler fuel in the spice industries. Boiler ash which is a solid waste has become a matter of concern due to the very large volumes produced daily and difficulty in disposal. India being a major player in global spice trade the number of such industries is expected to increase in future owing to greater interest in natural colours and flavours. The ash contain about 10-20% silica [1] along with potassium, calcium and magnesium salts and their oxides, which are the major components. Due to the alkaline nature of the ash the silica contained in it could be easily solubilized and extracted. Though there are several studies on the extraction of fine silica from various sources like rice hull, rice husk ash, bagasse ash [2,3] oil shale ash [4,5], in most cases the presence of crystalline phases like cristobalite and tridymite and silanol groups in the ash renders the silica less active [6].

Silica (SiO₂) in nano dimension also known as silica nanoparticles or nanosilica are materials with a wide array of interesting applications. They make excellent heterogeneous catalysts and catalyst supports due to their high surface area and porous nature [7], as reinforcing agents in concrete [8], as additives for rubber and plastics [9,10] in paints [11] in coatings [12,13] and as promising materials for experimental dental nanocomposites [14]. Silica nano particles are also the basis for a great deal of biomedical research due to their stability, low toxicity and ability to be functionalized with a range of molecules and polymers. These could be used as a stable non toxic platform for biomedical applications such as drug delivery [15]. Though nanoscale silica materials are at present prepared using methods which include vapour phase reaction, sol-gel and thermal decomposition techniques [16] their wide spread use is limited by high cost and energy. It is in this context that methods of preparation of silica from biomass ash need to be considered as viable alternative green methods due to the relatively low cost, low energy consumption and ease of extraction.

In continuation of our studies [1] on the value addition of this waste material we investigated the potentiality of using biomass ash from the oleoresin industry as a source for amorphous nano silica. The synthesized silica particles were studied by X-ray diffraction, surface area measurements, SEM, EDAX, TEM and FTIR techniques.

2. Experimental

2.1 Materials and methods

The ash used in this study was obtained from Akay Flavours and Aromatics, an oleoresin industry in Kochi, India. The ash was refluxed with water (1:1 ratio) for the removal of water soluble salts, filtered and dried. The dried ash was then suspended in water (1: 9 ratio), pH adjusted to be in the acidic range (pH=5) by addition of

6N/1N HCl or H₂SO₄ and refluxed. The treated ash was filtered, washed and dried overnight in an air oven and later activated at 600°C for one hour in a muffle furnace.

2.1.1. Preparation of silica from the pretreated ash

100 g of the pretreated ash was refluxed in 2N NaOH (300 ml) for 2-3 hours and filtered while hot. Silica is precipitated from this sodium silicate solution using sulphuric acid. For this, the filtrate is heated to 80-900C and stirred continuously while adding 6N H₂SO₄ slowly dropwise (otherwise chemistry of reacting mass may change along with physical properties) until acidic conditions indicate approximately complete precipitation of silica from sodium silicate. This silica is separated from the colloidal solution by repeated centrifugation and washing till the centrifugate tests negative for sulphate ions (using 0.1N BaCl₂ solution). The silica was dried in an air oven and later activated at 600 C for one hour. Silica obtained from ash pretreated with hydrochloric acid and sulphuric acid are hereinafter referred to as silica A and silica B respectively.

2.2 Characterization of the synthesized silica particles

Powder X-ray diffraction measurements were done on a diffractometer model Bruker AXS D8 Advance using Ni K filter and Cu K α ($\lambda = 1.5406 \text{ \AA}$) radiation at room temperature. Nitrogen adsorption analyses were carried out in a Micromeritics TriStar 3000 V6.07A instrument. Experiments were performed isothermally at -195.800°C. Samples (ca 80 mg) were previously degassed under vacuum at 300°C for 4-5 hours. Data were processed by the BET equation. Scanning electron microscopy was carried out on a Jeol JSM-6390 LV instrument with an accelerating voltage of 20kV and elemental analysis was carried out on a Jeol Model JED-2300 EDS system coupled with the scanning electron microscope. Samples were mounted on double sided carbon tape on the SEM stub. Several fields of view were selected and carefully analyzed and the surface composition within selected area was analysed by EDX. Fourier Transform infrared spectroscopic measurements were done using a Thermo Nicolet Avatar 370 model with a resolution of 4cm⁻¹ in the spectral range 4000-400 cm⁻¹ using KBr disc method. Further confirmation of morphology and particle size was done by transmission electron microscopy using a Philips make transmission electron microscope CM 200 model.

3. Results and Discussion

A pretreatment of the ash was done to remove the metallic compounds present in the ash to the maximum extent possible. This pretreatment step is necessary as metallic impurities are reported to substantially influence the quality of silica from the ash [17]. The ash has a high content of potassium which melts on the surface and accelerates the crystallization of amorphous silica and carbon fixation in the ash. Interaction between the metallic ions and silica could also lead to a considerable decrease in surface area. Hydrochloric acid and sulphuric acid were used for pretreatment of the ash as they could react with metallic impurities effectively and these dissolved compounds leached out of the solution during filtration. The pretreated ash was digested and the digested ash had a lighter colour compared to the undigested ash. Burning of carbon in the ash or removal of other volatile impurities could be the reason for this change of colour.

X-ray powder diffraction is the most used technique for identification of crystalline phases in a sample. X-ray diffractograms of silica obtained from HCl pretreated ash (silica A) exhibits a broad peak ranging from a 2θ value of 15° to 33° (Figure 1). This broad peak or hump as it is usually referred to, is a characteristic of amorphous silica. The amorphous nature of silica also implies a high pozzolanic activity [18] because of much higher solubility in water compared to crystalline forms like quartz and higher surface area. That no other peaks are seen in the diffractogram confirms the absence of any ordered crystalline structure in the material. The XRD pattern of silica obtained from sulphuric acid pretreated ash (hereinafter referred to as B) on the other hand contains several peaks corresponding to different mineral impurities present. The effect of HCl and H₂SO₄ pretreatment in removing the metallic impurities is thus evident. Sulfuric acid pretreatment is not adequate in removing the metallic oxides while HCl does the job more efficiently. For the silica A the maximum of the broad peak is at 23.56 radians; this relates to an average Bragg distance of $d = 0.3773 \text{ nm}$. (For ground quartz powder $2\theta = 26.5^\circ$ and $d = 0.336 \text{ nm}$). This

enlargement of the average atom distance reveals markedly disordered atom arrangement of the SiO₄ units in silica [19].

The reactivity of silica as a catalyst or as a concrete additive depends on its surface area and porous nature and hence surface area is an important parameter of the material. BET method was adopted for the surface area analysis of the samples which gave a value of 432 m²/g for surface area of A and a value of 15m²/g for surface area of B. Such a high surface area corresponds to decreased particle size for silica A while the low surface area of sample B corresponds to the presence of mineral species which could not be washed off by sulphuric acid pretreatment. The particle size could be calculated from the specific surface area [18] by taking into consideration the well known relationship $SA \times d_s \times \rho = 6 \times 10^3$, where SA is the surface area, d_s = average particle diameter and ρ , the density of silica. Taking the density of silica as 2.2 gram/cm³, which is the density of amorphous, anhydrous nonporous silica, a value of 6.3 nm is obtained for d_s .

Scanning electron micrographs show a difference in the surface morphology of the two samples. Micrographs at different optical magnifications were analysed. Differences in the tendency of particles to clump together could be seen at lower magnifications (figures 2a & 2b), while variations in size and morphology become clear at higher magnifications (figures 3a & 3b). Surface morphology indicative of a high surface area which seems adequate for specific applications such as special ceramics material, catalyst support or construction material could be traced from scanning electron microscopic studies of sample A. SEM of silica B on the other hand shows a non porous surface morphology. An EDX analysis (Fig.4) of silica A shows the presence of traces of Al which could be present as an oxide along with silica. This aluminium oxide naturally present in the silica could be also acting as a stabilizer for the silica. Excess oxygen percentage is attributed to the associated water molecules or “free” water (moisture) present. EDX analysis of silica B shows a higher percentage of C, Na and S. Repeated washing of the precipitated failed to remove these surface adsorbed species. Presence of mineral species even after pretreatment of the ash could have accelerated the fixation of carbon and other species on the surface making its removal difficult.

Further substantiation of size and morphology of silica A was obtained from transmission electroscopic studies. TEM images (Fig. 5) show the size and morphology of the synthesized particles. The particles seem to be mono disperse in the narrow range of 8-10 nm, a diameter slightly higher than that calculated from specific surface area. In general, the particle diameter calculated from specific surface area will be smaller than the diameter that would be judged by eye from transmission electron micrographs, because smaller particles may remain unobserved yet contribute substantially to the specific surface [18]. The morphology observed is as expected for amorphous silica particles as the sol particles often have a tendency to adopt the spherical shape so as to reach a minimum of interfacial surface area.

The FTIR spectrum shown in figure 6 agrees well with the spectrum for standard silica. Increase in line width is due the amorphous nature of the material. Amorphous silica has broad peaks compared to the narrow lines observed for crystalline silica. The strong absorption bands at 1087 cm^{-1} and 463 cm^{-1} originate from the asymmetric stretching of Si-O and flexural vibrations of Si-O-Si bonds while that at 800 cm^{-1} could be attributed to the vibrations of (SiO₄) tetrahedrons [20]. The peaks at 3447 cm^{-1} and 1642 cm^{-1} corresponds to water molecules adsorbed on the hydrophilic surface silanol groups of the silica bands [17]. It is the silanol groups that contribute to the pozzolanic activity. Use of colloidal silica nano particles with pozzolanic activity, high surface area and fine particle size in concrete mixtures is said to increase the strength of concrete remarkably

4. Conclusions

Extraction of amorphous silica nano particles from the biomass spent ash of the oleoresin industries were successfully done after pretreatment of the ash with hydrochloric acid. The particles have an excellent surface area as indicated by BET method and a porous surface from SEM images. XRD studies indicated amorphous nature of the material while the transmission electron microscopic image exhibited mono dispersed particles with ~10 nm size. The amorphous nature of the silica, high surface area and fine particle size combined with its low production cost makes it an ideal candidate for use in high performance concrete and other applications in construction. High surface area silica nano particles also find use as a support in catalysis. This study thus provides a route to value addition or utilization of the spice industry waste.

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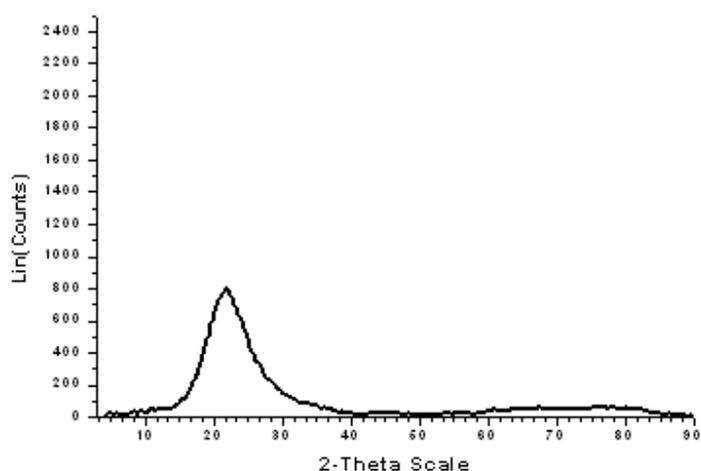


Figure 1. X-ray diffraction pattern of the silica synthesized from waste boiler ash showing a broad hump characteristic of amorphous silica

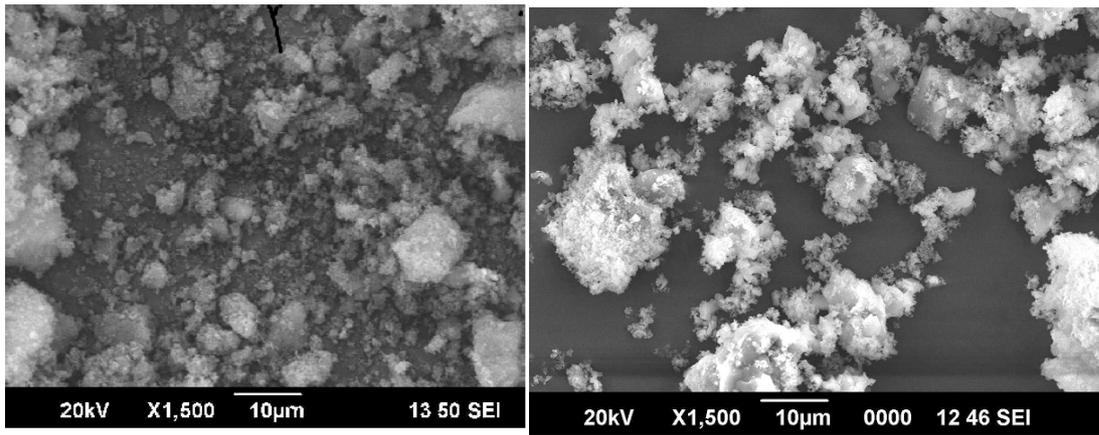


Figure 2 SEM images of the silica derived from (a) HCl pretreated ash and (b) H₂SO₄ pretreated ash at low magnification

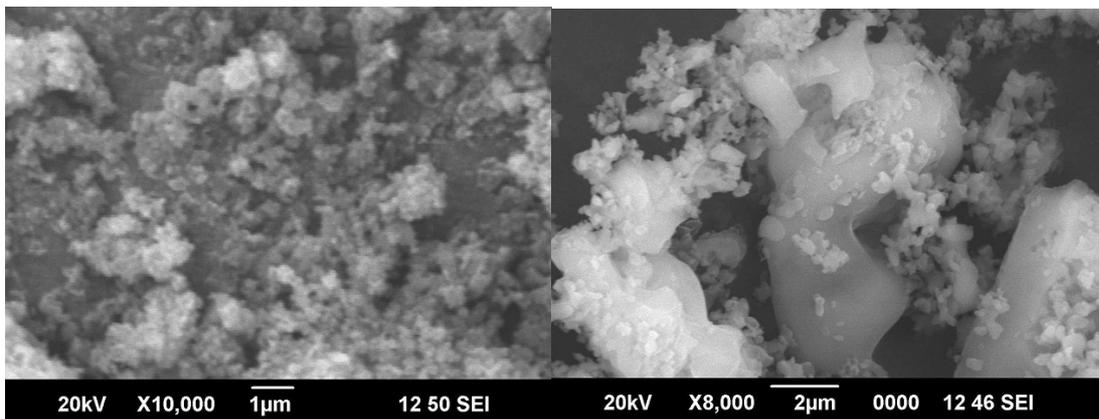


Figure 3. SEM images of the silica derived from (a) HCl pretreated ash and (b) H₂SO₄ pretreated ash at higher magnification

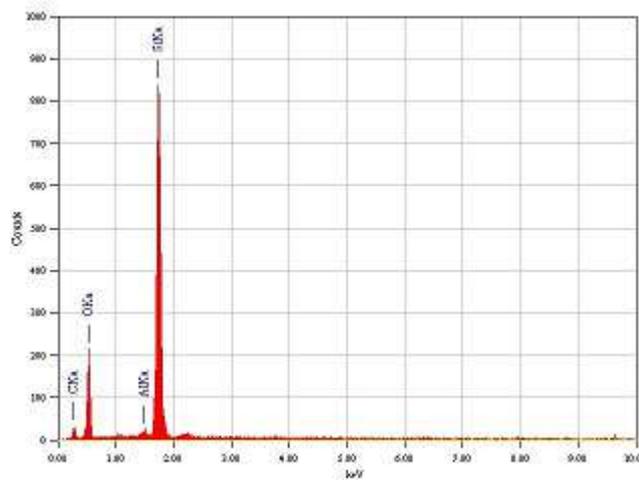


Figure 4. EDX of silica nano particles synthesized from waste boiler ash showing the surface and near surface composition

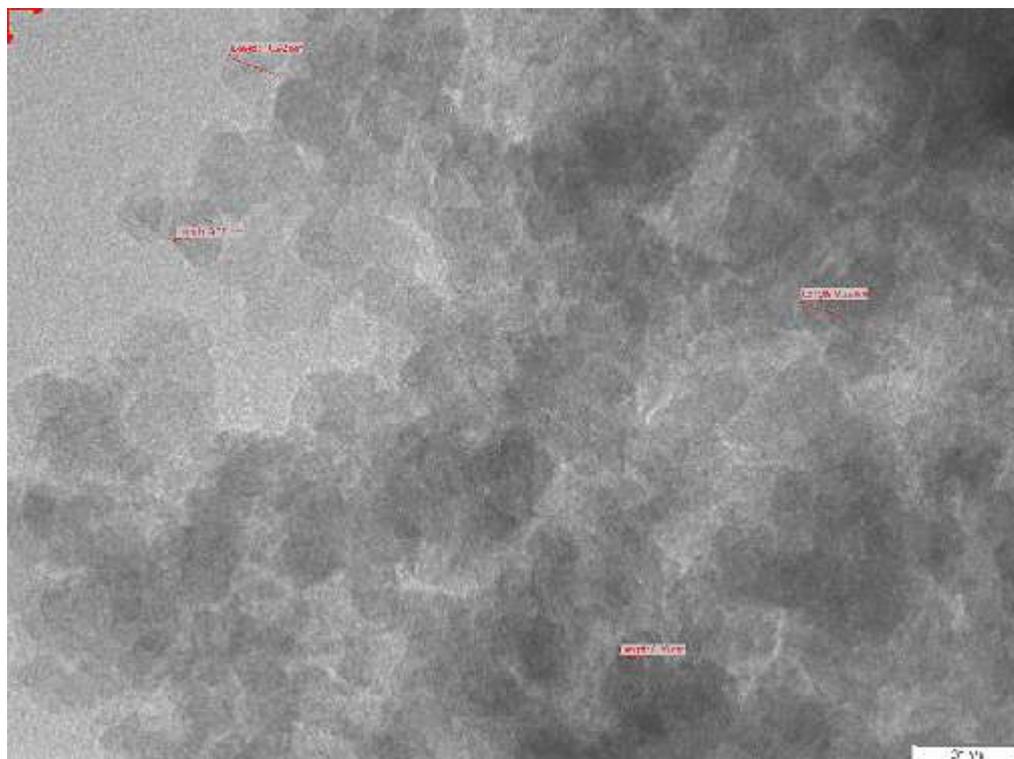


Figure 5. TEM image of silica synthesized from waste boiler ash showing nano sized particles

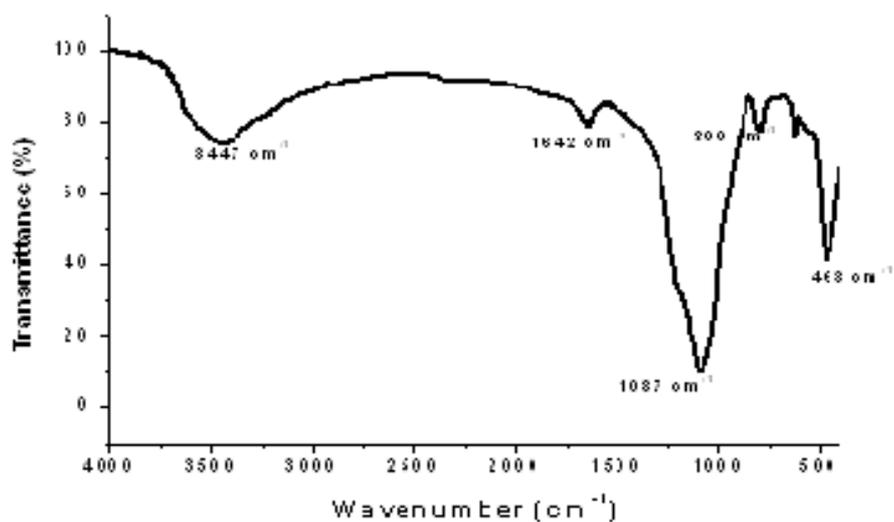


Figure 6 FTIR spectra of the silica synthesized from waste boiler ash exhibiting bands characteristic of silica

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Degradation of Dyestuff Pollutant Sudan I Using Advanced Oxidation Process

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Abstract

Due to an increasing environmental pollution, a search for the cost effective treatment and disposal of the dyes from the textile effluents is getting more and more importance. Oxidation and reduction processes play important roles in the degradation treatments of the azo dyes. The latter process is more effective and in consequence its mechanism is also better understood. The mechanism of the oxidation processes, the intermediates involved in these reactions and their role in the effectiveness of the oxidative degradation of the azo dyes, viz, phenyl azo β -naphthol (PAN), Sudan I. On exposure to sunlight at 2 ½ hours for various samples in different concentrations of PAN mixed with Fenton reagent, when the reactive intermediate reacted with the colour, the pH vs. absorbance generally showed significant degradation in between pH 5 and 6. The results were compared with the same samples on exposure to uv-light of 254 nm and irradiated at 20 minutes. The degradation occurred in samples of relatively high concentrations, viz, 10^{-3} and 5×10^{-4} mol-dm⁻³ at near neutral pH 6 whereas. Low concentration samples such as 10^{-4} and 5×10^{-5} mol-dm⁻³ showed degradation towards more acidic range of pH 2 to 4. In advanced oxidation process (AOP), generally reactive, strongly oxidizing $^{\circ}\text{OH}$ radicals play a main role in destruction of the dye molecules. The proposed mechanisms and the rate coefficients for the reactions of $^{\circ}\text{OH}$ intermediates with the dye molecules and with model compounds are summarized.

Keywords

Azo Dyes, Degradation, Advanced Oxidation Process, Textile Effluent, Phenyl Azo β -Naphthol

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Theme: Application of ICT in Developing the Listening and Speaking Skills of Undergraduate Learners

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Enhancing Employability by Augmenting the Newly Designed CBCSS Syllabus of University of Kerala

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Abstract

The paper proposes to develop a module that would help bridge the gap between employability and University education at the Degree level by augmenting the current CBCSS syllabus of University of Kerala through an analysis of General English paper of first year students of University of Kerala. The proposed module would enable the development of the requisite skills which can enable students to become adept at getting jobs and retaining the same.

ELT in India, has been largely associated with the process of transferring knowledge from the teacher to the students, a process akin to emptying water from a jug to a number of glasses. Going by this premise, we are faced with a situation where the average student who comes out after more than a decade of English teaching failing to be functional in English. He or she is unable to 'function' using English language. In the last few years, the classrooms have also seen a change as regards the objectives they seek to achieve. The role of the 'Teacher' and the 'taught' have seen radical changes in the last few years with the evolution of technology and the 'expectations' the learners have from their course of learning. It is in this context, the paper seeks to look at the current syllabus of University of Kerala, specifically its role played, in skill development of the learners.

The paper proposes to lay out a set of parameters which the syllabus prescribes and through its analysis, arrive at a 'bare minimum' that aspires to enhance the employability of students assuming that all learners have a certain amount of inherent employability. The paper proposes to develop a skill development module that can be used to augment the effectiveness of skills development in the learners with a focus on developing practical language skills that go a long way in making education meaningful and market-oriented, thereby making them 'job-creators', instead of becoming conventional 'job seekers'.

The need for skills development is felt more acutely in today's world more than ever before with the development of the IT and ITES sectors. The present period is marked by a confluence of technology, skill development, pedagogical inputs and a myriad of educational paradigms. The conventional classroom has been reinvented with the shift in the focus from inward-looking to outward-looking where the onus is on the learners and their needs instead of a standard one-size-fits-all. The focus is on making the curriculum relevant to the needs of

the present day market. The paper will try to analyse how the present syllabus of university of Kerala measures up to the needs of the present generation of students who have come to expect greater things in contrast to the previous generations.

The newly designed syllabus of University of Kerala is a product of the increasing demand from the students as well as the teaching community to change the syllabus by making it more in sync with the development of skills in contrast to being a means to getting a certificate. A reason for this could be the 'disconnect' experienced by the students who felt alienated by the lack of avenues for 'trying out' their language skills acquired in the classroom. A serious lacuna of the old syllabi was its inability to cater to the changing needs of the market economy that had replaced the economic system of the Pre-Liberalization period where the focus was on 'performing-in-examinations' where the goal was solely to get a certain percentage in an examination which had little or no connection with ground realities and the demands of the present day job markets where the onus is on 'delivering the goods' or 'walking the talk'.

The general demand for the need to update the syllabus of the BA/BSc program under the CBCSS in the FDP in English had led to many sweeping changes in the newly designed syllabus of University of Kerala. To understand the implications of the present situation and its future implications which are specific to the national interest and even more typical to Kerala, it is necessary to analyze the limitations of the newly developed syllabi and to augment the same by incorporating the elements of Skill develop-

ment so as to become job ready when they exit the university with their degree certificates.

To put things into perspective let us have an analysis of the scenario in India which has a large population which is in the age group of 25 and 35 years. At present the estimate is that there are almost 400 million individuals who constitute the current labour force. The estimate is that by 2022 the total number of youth in the category of employable workforce is likely to be more than 700 million. The 'breakup' of the same workforce is estimated to be in the tune of 200 million graduates and the remaining 500 million trained in vocational education. Thus people who are thus a part of the national economic activity need to be skilled to tackle the demands of the marketplace. What needs to be highlighted is the fact that estimates indicate that there is a global requirement of skilled labour force. The estimates of the National Skill Development Council state that in twenty high growth sectors, there would be a demand for more than 300 million trained manpower by the year 2022. Other sectors are likely to have a demand for 37.6 million with an additional 46 million jobs in various non formal sectors.

On analyzing the demands of the marketplace, a major drawback of the traditional syllabus was that it only produced graduates who were largely unemployable and lacked 'employability'. NASSCOM estimates that for every 100 graduates that come out of the universities, only 25 of them are employable. The problem it highlights is the 'disconnect' between the world of education and the world of education. While the scenario described so far is similar to the daysday scenario

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The Transfiguration and Metamorphosis: Analysis of the Newly Designed Syllabus of Film Studies of University of Kerala

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Abstract

The process of teaching has evolved to be facilitating and that of learning, acquiring. The role of teacher is being diminished as the age old deductive and inductive methods lost their effectiveness. The present target group is running ahead of the trainers. They excel in handling the new techniques and the gadgets and surpass the instructors in that. They can remain active participants only if they are involved in a world of virtual reality designed by the application of ICT (Information Communication Technology).

When compared to other genres, films are rated the favourite medium of common mass who are the majority. It has already been established that film is unequalled in its ability to hold and direct the attention of the viewer. Hence this screen medium can be used as an effective tool to enhance language learning, communication development, creative thinking and critical analysis. This paper intends to study the theoretical, philosophical and technical aspects of the application of films in teaching. As part of the new CBCSS (Choice Based Credit and Semester System), University of Kerala has launched film studies as one of the core course in the fifth semester of B.A. English Language and Literature. It is a study on the competence and relevance of the current syllabus of University of Kerala for Film studies by comparing the syllabus to the national and international parameters.

As part of the new CBCSS, University of Kerala has launched film studies as one of the core course (main paper) in the fifth semester of B.A. English Language and Literature. The formulation or design of this paper as core subject might be because of the influence of the visual media on the current generation. When compared to other genres, films are rated the favourite medium of common mass who are the majority. This piece of writing analyses the importance of films in the learning of English language and literature.

Film studies is comparatively a new branch of study as it was evolved in the beginning of the twentieth century. Film studies, or even studies with films, is that one in which the role of the teacher is usurped by the film itself that is, the film itself does the role of the primary educator. The narration, description, presentation and the explanation are made by the running images.

Film tells its story with its own grammar, its own syntax. Camera movement, camera position, framing, lighting

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Journal of Studies in Dynamics and Change

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Environment, Economy and Society

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Technological Changes in Marine Fishing and Livelihood Threats of Fisher Folk

Jisha John

ABSTRACT

The growing demand for fish in the developed and developing countries and the recognition of its place as a balanced diet to the rapidly growing population ensuring food security and as a foreign exchange earner are creating immense pressure on the world of fisheries. In the context of stagnating/depleting catches, sustainable development of fisheries sector and the livelihood of fishers become problems. The concern over the sustainability of fisheries resources and the resulting threat on the livelihood of the traditional fishers in Kerala form the subject matter of the present study. The study includes descriptive, exploratory and confirmatory research. It reveals that technological developments resulted in the stagnation/declining of marine landings in Kerala. It also identifies the sustainability issues which are directly or indirectly related to technology. Institutional and human conditions like open access, greed and competition make the situation more insecure. Pollution, discards and other institutional factors cause ecosystem damages and the fishers face livelihood threat and insecurity. Apart from these the fishers are deprived of livelihood assets. The threats faced by the fishers are related to work, environment, financial requirement, marketing difficulties and administration. It concludes that the policies adopted to ameliorate the livelihood conditions of the fishers must be based on the specificity of the need in each particular region. Further studies should be undertaken at the local level emphasizing the concept of sustainable development technology and Place Suited Community Centered Co-management where the principle of subsidiarity should be followed.

Keywords: *sustainability, over fishing, discards, livelihood threat, and place based community Centered co-management.*

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The paper is based on the PhD Thesis submitted to Mahatma Gandhi University on November 2012 and Awarded in September 2013.

Introduction:

Marine sector helps the nations and their people to share resources and to accelerate the social and economic development. In India this sector has been recognised as a powerful source of foreign exchange. The sector generates employment and it stimulates the growth of a number of subsidiary industries and also ensures food and nutritional security. The application of modern technology acts as a powerful instrument for understanding the marine ecosystem. At the same time the application of modern technology is linked to its deterioration and overexploitation. As a result of modernisation and developmental process the sustainability of the resource and the livelihood of the fishers are

threatened. The issues related to technological developments, institutional and policy failure affect the livelihood of fishers with the stagnating and declining marine resources. The study attempts to deal with the above issues along the coast of Kerala. Increased competition for fisheries resources has resulted in 'over fishing' and 'destructive fishing methods'. The technologies which were supposed to enhance the production and productivity cause threats and warned that the exercise of policy formulation should ensure not merely growth, but growth that promotes the human development and sustainability between ecology and development. The concern over the sustainability of fisheries resources and the resulting threat on the livelihood of the traditional fishers is the subject matter of the present study.

Research Problem of the Study

The fisheries resources in Kerala are on the threshold of stagnation and a collapse of fisheries will affect the livelihood of fishers and other stake holders who largely depend on fisheries. In India we can't have moratorium on catching as the population who depend on fisheries resource is high. Focusing the issues on technological changes, sustainability of ecosystem and livelihood aspects the researcher finds the need of a collaborative work linking technology, conservation and livelihood. And there is the need of an interdisciplinary work. So the interdisciplinary approach by Tony Charles is adopted to understand "what the fishery is about," linking conservation, economics and community. As noted by The World Commission on Environment and Development (Brundtland et al.1987) for development to be sustainable, it requires a combined focus on society, economy and ecology. This idea of sustainability has later been refined by the World Bank into the triple P concept: people (social issues), planet (ecological issues), and profit (economic issues) (Seregeldin 1996; Seregeldin and Steer 1994). So the primary concern of the study is to address the social, ecological, economic and institutional issues related to fisheries resources for human welfare and the need for conservation of resources for use by future generations. In particular an attempt has been made to look into the technological changes and its consequence on ecosystem and the livelihood of the marine fishers in Kerala.

Research Questions

1. What are the important technological changes that have occurred in the fisheries sector?
2. Do the technological changes constitute a threat to the marine ecosystem and whether there is overfishing?
3. What are the problems associated with modernisation and what is the present condition of livelihood?
4. What is the role of institutions – governmental, non-governmental and civil society to strengthen the livelihood base of the fisher folk?

Objectives of the Study

1. To discuss the evolution of fishing technology with special reference to marine fisheries of Kerala.
2. To analyse the economics of fishing in the marine sector.
3. To analyse the trends in marine fisheries landings in Kerala and to synthesise the sustainability issues in the sector.
4. To explore the reasons behind the sustainability issues in marine sector.
5. To investigate the livelihood assets of coastal fishing communities in Kerala.
6. To examine the threats to the livelihood security of fishers.

Hypothesis

The main hypothesis of this study is that technological changes resulted in the stagnation/depletion of marine landings which affected the livelihood of fishers.

Methodology of the Study

The study was carried out by using survey method, selecting a representative sample from the population considered. Districts Thiruvanthapuram from southern region, Alappuzha from Central region and Kannur from the northern region were selected and from these districts fishing villages were identified. Thayyil in Kannur, Arthunkal in Alappuzha and Adimalathura in Thiruvanthapuram were chosen in order to get the representation of three regions. The selection was in concurrence with the divisions based on the different technological aspects also. After conducting the pilot study the sample size was decided as 620. For the collection of primary data, in-depth interview was conducted with the help of schedules. Group discussions were also conducted in order to understand the perceptions, awareness and knowledge about fishing activities and livelihood. Secondary sources of information were used to know the general trend of fisheries and species wise trend along with answers to questions related to the research. Analyses range from simple descriptive techniques to high end methods involving some multivariate and non-parametric methods. The researcher has made use of Microsoft Excel spread sheets and the statistical package SPSS for carrying out the analysis. The study includes simple cross tables for description as well as to validate observed

dependence among attributes. The validation is done using Chi square tests for independence. More hypotheses involving other variables are analysed using methods including multi-dimensional scaling and factor analysis. Depending upon the research requirements other statistical methods were also used.

Summary and Findings of the Study

The study attempts to examine the problems holistically by linking various issues relating to technology, economic, social and ecological aspects. Literature of the study was reviewed theoretically and empirically which help to lay a sound base and also to know the previous areas of related works and their methodology.

The major technological developments and their diffusion transformed the fisheries sector of many third world nations. Bilateral and multilateral agencies have been instrumental in promoting fisheries development which resulted in the adoption of capital-intensive fishing technology.

In India before independence, fishing was an entirely artisanal occupation with, little intervention from the outside world. The modern technological change that occurred in India was with the inception of the five-year plans. Mechanisation became rampant in the fisheries sector of Kerala. The lucrative profits by mechanised sector led the traditional sector into abject misery. This resulted in motorisation and outboard motor boats were introduced which gave a new face to the traditional fishing sector. A comparison of actual and estimated optimal marine fishing fleet showed excess capacity in India and also in Kerala.

Recent advances in gear and engine technology helped the fishers. The technology like Global Positioning System provided fishermen with equipment to reach the potential fishing ground accurately. Even though these technological changes increased fishing capacity it resulted in overfishing, catching of juveniles and damage to ecosystem thus questioning the sustainability of the sector.

The work culture, income and marketing details give a disturbing picture of economics of fishing and the livelihood activities carried out by fishers.

The trend analysis is done to check whether there is compatibility with the perceptions and the data regarding landings. The perceptions regarding selected species across regions lead to concern over

sustainability of marine fisheries. Trend for the last 30 years shows fluctuations in landings and the opinion of fishers shows that the species are declining. For the last 10 year period (2001-02 to 2010-11) the trend for all the selected varieties of species, landings are declining. A particular point to be noted is that all the landings of the selected species are stagnant or declining toward the end period though there is a massive technological improvement and innovations in the catching sector. The sustainability issues identified by the researcher include overfishing, institutional factors, pollution and the problem of discards which are directly or indirectly related to technology.

The findings of Multi-Dimensional Scaling (MDS) technique reveal that the two main reasons for discarding the catch are lack of marketing and storage facilities and small size of the fish. The findings of MDS reveal that disposal problems and activities near the sea are important reasons agreed to by the sample at different levels for pollution. Due to the above sustainability issues of the ecosystem the livelihood of the fishers are under threat.

The livelihood assets of fishers are classified as natural assets, physical assets including fishing, housing and durable assets, technological assets, social assets including health and education, financial assets and institutional assets. The researcher enquired about the benefits they received from government, NGOs and the community. The findings reveal that the benefits given by the government are not received in the grass root level and they are not satisfied with the present level of institutional set up.

On this context they are asked whether the living standard is low when compared to the main stream class and they unanimously have the opinion that the standard is low. Also the researcher identified thirteen related variables, which are supposed to measure the low standard of living and by conducting factor analysis the important factors related to threats were identified. The new factors identified are work to earn, environmental factors, financial requirement, marketing difficulties and administrative problems. Using these measurements, further analysis was done to determine the possible directions of variation among the three regions of Kerala and the result shows that there exists region wise variation in these determinants.

Conclusion and Suggestions

Modern technology competes with the traditional, depriving of the livelihood and depleting resources. Owing to inadequate opportunities for modern employment and inadequate access to basic human rights majority of fishers are marginalised from the mainstream social, political, economic processes of the societies they live. To solve this lopsided development we should strengthen the societies with secure and satisfying livelihoods along with the sustainable use of ecology and natural resources

The concept of community based co-management approach is of great relevance where the principle of subsidiarity should be followed. This stewardship should be carried out at the local level. Policies adopted to ameliorate the livelihood conditions of the fishers must be based on the specificity of the need in each particular region. For carrying out this, place suited community centered co-management should be adopted.

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First record of *Granulifusus poppei* (Mollusca: Fasciolaridae) from Indian coast

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The fasciolariid snail Granulifusus poppei was collected for the first time from the Kerala coast, India. The record of the specimen from the Arabian Sea shows the extended distribution of the species from Somalia to India in the western Indian Ocean.

Keywords: Fasciolaridae, Kerala, *Granulifusus*, distribution, Indian Ocean

Submitted 15 May 2014; accepted 2 August 2014

INTRODUCTION

Fasciolarids, the tulip snails or spindle snails, represented in the molluscan family Fasciolaridae, constitute an important component of the molluscan fauna in shallow coastal waters (Petuch, 1987), especially on sandy substrates. These carnivorous snails are widely distributed in tropical and temperate waters of oceans at sub-tidal depths (Harasewych, 1998; Snyder, 2003). The family comprises more than 100 genera grouped under three main subfamilies: Fasciolarinae, Fusininae and Peristerninae (Bouchet, 2014). Kuroda & Habe (1952) described the genus *Granulifusus* and it currently accommodates 27 valid species worldwide (Bouchet, 2014). The exact range of geographical distribution of all the species is not known and the genus *Granulifusus* is thus far not reported from the Indian coast. This paper records the occurrence of *Granulifusus poppei* Delsaerd, 1995 from the Indian coast and provides the sequence data of the mitochondrial gene cytochrome c oxidase 1 (CO1) of the species.

MATERIALS AND METHODS

Three specimens (shell length 35–41 mm; shell width 13–16 mm; aperture length 11–12 mm; aperture width 4–6 mm) were collected by bottom trawlers at an average depth of 100 m off the Kerala coast (9°31'N and 75°33'E), India. Morphometric measurements were recorded to the nearest millimetre using a digital Vernier calliper. Two specimens are deposited in the museum collections of the Department of Aquatic Biology and Fisheries, University of Kerala, India (Voucher Numbers DABF-UOK/GAS 2-3). The third specimen was preserved in 95% ethanol for molecular analysis. The material was identified following the criteria of Delsaerd (1995) and Robin (2008).

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Total DNA was extracted from the muscle tissue of *G. poppei* using DNeasy Blood and Tissue Kit (QIAGEN). The mitochondrial gene CO1 was amplified using the universal primers (Folmer *et al.*, 1994) in a 25 µl reaction volume with Taq PCR master mix (QIAGEN) and template DNA using the thermal cycler (Eppendorf). The PCR products were purified with ExoSAP-IT (USB) and sequenced in forward and reverse directions using the corresponding PCR primers and Big Dye Terminator V.3.1 Cycle Sequencing Kit (Applied Biosystems, Inc.) in an ABI 3730 capillary sequencer. Intra-specific distance between the species of the *Granulifusus* genus was estimated using the Kimura 2-parameter distance model of MEGA (Version 6.0) Package (Tamura *et al.*, 2013).

RESULTS

SYSTEMATICS

Family: FASCIOLARIIDAE Gray, 1853
Subfamily: FUSININAE Wrigley, 1927
Genus: *Granulifusus* Kuroda & Habe, 1952
Granulifusus poppei Delsaerd, 1995
(Figure 1A, C)

DIAGNOSIS

Colour whitish to light brown. Shell elongate and fusiform, thin, slightly transparent; post-nuclear whorls six. Body whorl rounded and elongate, sculptured with spiral cords that are slightly thickened at the point of crossing axial folds. 3–4 major light brown spiral cords interspersed with 3–4 minor threads; minor threads with whitish ground colour on the body whorls, getting coloured as the major cords on 6th and 7th post-nuclear whorls. Aperture oval, rather narrow, interior of aperture white and strongly liriate; columella with light brown spiral threads on the outside. Siphonal canal short and rather wide, ornamented with coloured spiral threads.

Operculum (Figure 1C) small, thick and ovate, about 6 mm in length. Amber coloured with an eccentric nucleus and ventral margins slightly ridged.

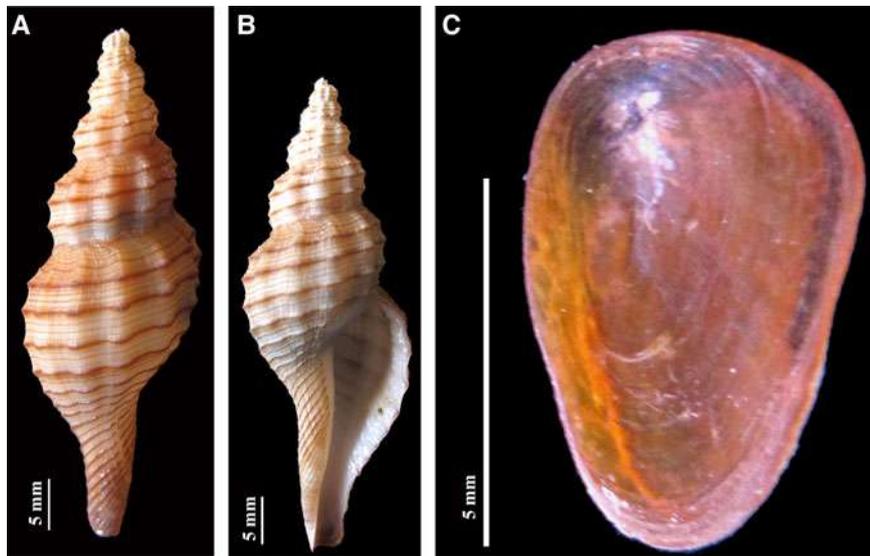


Fig. 1. *Granulifusus poppei*: (A) dorsal view; (B) ventral view; (C) operculum.

PHYLOGENY

Blast search showed that the obtained sequence has got 98% similarity with undescribed CO1 sequences of *Granulifusus* sp. available in GenBank (EU870579.1, EU870584.1 and EU870583.1), pointing to the possibility that these GenBank submissions may also represent *G. poppei*. The referred sequences in GenBank were submitted by Puillandre *et al.* (2009) from the egg capsules of *Granulifusus* sp. collected off the Philippines. However, collection of shells and availability of voucher specimens of *G. poppei* from the Philippines coast would alone help in establishing the argument. The phylogenetic position of our sequence was determined using maximum likelihood tree and found that our species is well clustered with other *Granulifusus* sp. with high bootstrap value (Figure 2). The taxonomy of our specimen was determined using conventional morphological analysis and therefore its barcode sequence has been submitted to GenBank under Accession Number KJ653226.

REMARKS

Delsaerdt (1995) first described the species *Granulifusus poppei* off Mogadishu, Somalia. The species was also recorded from Mozambique (Galli, 2014). The current record of *G. poppei* from the south-west coast of India shows the extended distribution of this species from the East African coast to the south-west coast of India in the western Indian Ocean. Sequence analysis of the mitochondrial CO1 gene confirmed clustering of our specimen with the genus *Granulifusus* and the sequence data generated by us will further help identification of *G. poppei* using DNA barcoding.

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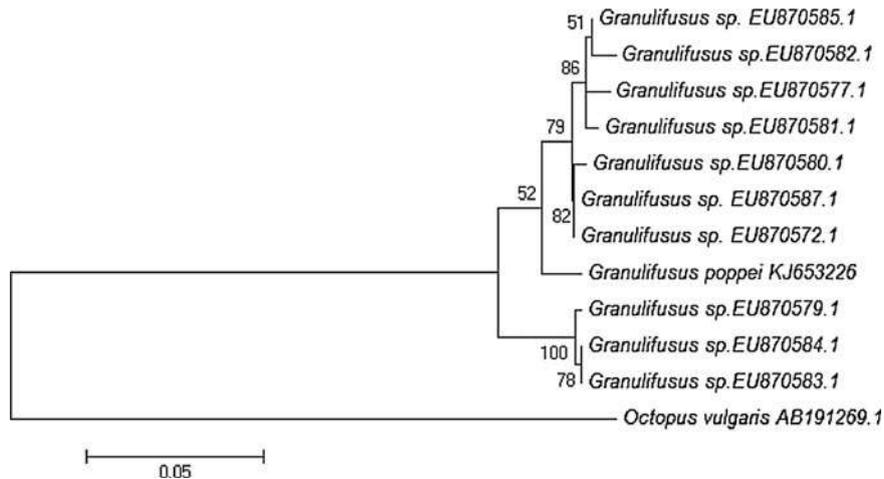


Fig. 2. Maximum likelihood tree of partially sequenced mt DNA CO1 gene of *Granulifusus poppei* (KJ653226) with other reference sequences of *Granulifusus* sp. in GenBank. The numbers on the tree branches indicate bootstrap values.

the Faculty Development Programme. Thanks are also due to Mr A. Delsaerd, Royal Belgian Society for Conchology, Belgium for confirming the identification of the species.

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Effect of different media on the yield, production, biological efficiency and biochemical parameters of two *Volvariella* species

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ABSTRACT

Present study deals with the utilization of different agro waste substances like paddy straw and sugarcane bagasse singly and in combination for cultivation of two species of *Volvariella*. The combination of substrates (in equal proportion) was more productive and gave highest yield. Also, comparative analysis of biochemical parameters of *Volvariella* during the different stage of its development showed that the button stage has higher protein content than the open stage.

Keywords: *Volvariella*, paddy straw, sugarcane bagasse

The edible straw mushroom, *Volvariella volvaceae* (Bull. Ex Fr.) Sing., is a fungus of the tropics and subtropics and has been cultivated for many years in China (Benemerito, 1974) and in other Asian countries. Mushrooms are good source of protein, vitamins and minerals (Khan *et al.*, 1981). Mushrooms contain about 85-95% water, 3% protein, 4% carbohydrates, 0.1% fats, 1% minerals and vitamins (Tewari, 1986). Mushrooms contain appreciable amount of potassium, phosphorous, copper and iron (Anderson and Feller, 1942). Mushroom protein is intermediate between that of animals and vegetables. (Kurtzman, 1976). Mushroom also contain appreciable amount of niacin, pantothenic acid and biotin (Subramanian, 1986).

There are two species of *Volvariella* namely, *Volvariella volvaceae* and *V. diplasia* which are commercially grown in India (Sahoo, 1999). Different agro wastes can be used for cultivation of mushrooms (Tripathi *et al.*, 2011) such as straws of different crops, oil palm bunch, oil palm pericarp, young banana leaves, saw dust, cotton waste and water hyacinth,

and the production of mushrooms depend on the kind of substrate (Purkauashta *et. al.*, 1980). The present study is aimed to evaluate the utilization of two locally available agro wastes viz., paddy straw and sugarcane bagasse for yield and biochemical parameters of the fruit body.

MATERIALS AND METHODS

Tall variety of rice straw (*Oryza sativa* var. CR 30; *O. sativa* var. jajati, *O. sativa* var. pathara, etc.) was used. The rice straw bundle of about 2 feet length and 10 cm diameter was used for preparation of bed. The rice straw bundles were soaked in water for 15 to 16 hours and then removed from water and were kept in inclined position for 4 to 5 hours to remove excess water. The soaked straw bundles were placed length wise very close to one another on the bamboo bed platform. The 1st layer of straw bundles was constructed on the bamboo bed platform by placing 5 to 6 bundles very close to each other on East-West direction. The 2nd layer was placed on the 1st layer of the bundles. The bundles were kept on opposite

YIELD AND BIOCHEMICAL PARAMETERS OF *VOLVARIELLA VOLVACEA* AND *V. DIPLACEA*

direction of the 1st layer i.e. on North-South direction. The 2nd layer totally covered the 1st layer. Similarly, the 3rd layer was constructed over the 2nd layer in East-West direction i.e like 1st layer. The 4th or top most layer was placed over the 3rd layer in similar way to the 2nd layer. The first, second and third layer were 6 inches in thickness and were made of 5 to 6 bundles, but the fourth layer was 2 to 3 inches thick and made up of 2 to 3 bundles of the straw. After the rice straw bed had been prepared, it was sized by cutting the straw which were out of the bed. The bed was pressed gently to remove the air gaps among the layers in the bed to make appropriate compactness for the mycelial run as well as to check contamination. Therefore, the volume of the bed was length 25", Width 25" and height 20". The spawning in the bed were done in layer after layer up to 4th layer.

Besides the rice straw, sugarcane bagasse was also used for preparation of bed. The sugarcane bagasse was washed gently with clean tap water and then boiled for 30 minutes to soften it. The boiled sugarcane bagasse was made into bundles of 3 feet length and 10 to 15 cm diameter. The sugarcane bagasse beds were prepared like the rice straw bed. They were treated with sodium hydroxide (1%) and soaked in water for 15 days. During this period, a pinch of gypsum salt was added on 3rd day of soaking to neutralize the medium (Soto-velazco and Alvarez, 1998).

The experiments on *Vovariella* were conducted from April to September. About 10 to 15 kg of the rice straw/sugarcane bagasse were used for preparation of single bed. About 20 to 25 bundles are used for preparation of a single bed. The bed platforms were prepared inside "mushroom house" made up of bamboo for cultivation of mushroom. The bamboo sticks were made rectangular shaped tiers in the mushroom house. The 1st tier or platform of the bed was made 2feet above the ground to avoid

dirt, insects as well as contamination of soil microorganisms.

One bottle of spawn (about 350 g) was used for spawning one bed. The spawn bottles were broken or dug by glass rod and the spawn ball was kept in a container. Then they were made into small bits, of each contain 3 to 5 grains before spawning. The spawning was done along with gram powder. Two hundred and fifty gram of gram-powder was used for preparation of a single bed. The spawning was done on each layer of the bed. The 1st and 2nd layers were spawned with spawn bits about 2 to 3 inches apart from the edge and no spawning was done in the middle space. The gram - powder was used along the spawn grain during spawning. In the 3rd layer, spawning was done on entire surface without leaving any space and no spawning was done on top of the 4th layer. Quantitatively, the 1st and 2nd layer consumed 40% each of the total spawn where as the 3rd layer consumed 20% of the total spawn present in bottle.

The room was maintained at 30° to 35° during fructification. The entire bed was covered by polythene to maintain appropriate humid condition. Watering was done at regular interval of two days using a water sprayer. Watering were continued till the last crop has been harvested.

The fresh weight of the mushroom was measured by Digital balance (Dhona 48), then they were placed immediately in an oven at 80°C for 48 h, and after dry recorded the dry weight. Measurements of protein, carbohydrate and nucleic acid contents in mushrooms were made according to the methods of Lowaryet. al., 1951, Morris, 1948 and Mallik and Singh, 1980.

The following parameters were computed basing on following formula: -

Biological efficiency (BE) = (Fresh weight of mushroom / Air dry weight of substrate) x 100

Production rate (PR) = Biological Efficiency (%) / time (days)

Compost net loss = Compost dry weight. - (Compost dry weight after cultivation + mushroom dry weight)

Dry material loss rate = (Net weight loss of dry material / total dry weight of original substrate) x 100

Bioconversion rate = (Dry weight of the fruiting body / Dry material net loss) x 100

Moisture content = (Fresh weight of fruiting body - Dry weight of fruiting body / fresh weight of fruiting body) x 100

RESULTS AND DISCUSSION

The Table 1 shows the yield of *Volvariella* mushroom on different combinations of rice straw and sugarcane bagasse. The pinhead emerged in different beds such as paddy straw bed on 10 days after inoculation, paddy straw

and sugarcane bagasse (3:1) bed on 11th day, paddy straw and sugarcane bagasse (1:1) bed on 9th day, paddy straw and sugarcane bagasse (1:3) on 12th day and only sugar cane bagasse on 10th day after inoculation in *V. volvaceae*. Similarly the number of fruit bodies per bed were more in paddy straw and sugarcane bagasse of equal proportion as compared to other treatments in the experiment. This higher value is also reflected in fresh weight and dry weight. Similar trend was observed in *V. diplasia*. Sugarcane bagasse is available locally in plenty and is used as fuel after drying. Soto-Velazco and Alvarez, 1995 observed that sugarcane bagasse after pretreatment with sodium hydroxide (0.5 or 1%) and fermented for 19 days at 80% moisture resulted 1.5 fold more mushroom yield than that on wheat straw. The mixture of rice straw and sugarcane bagasse (1:1) give early pinhead emergence than pure rice straw or pure sugarcane bagasse, and also the mixture of these two substrates gave better yield of mushroom. Our finding are also in agreement with earlier reports of Padhy, 2001; and Tripathy 2001.

Table 1. Production of *Volvariella* on compost of rice straw, sugarcane bagasse and with three different combinations. Each value is mean of 10 replicates. \pm SEM

Substrate	<i>Volvariella volvaceae</i>				<i>Volvariella diplasia</i>			
	Days for pin head emergence	No. of mushrooms per bed	Fresh wt. (g)	Dry wt. (g)	Days after pin head emergence	No. of mushrooms per bed for spawning	Fresh wt. (g)	Dry wt. (g)
Rice Straw	10	75 \pm 6	1518.24 \pm 10.25	203.91 \pm 20.21	8	106 \pm 6	2145.44 \pm 30.23	253.21 \pm 14.28
75% rice straw +25% sugarcane bagasse	11	72 \pm 2	1470.32 \pm 16.90	97.32 \pm 10.36	9	101 \pm 8	2062.67 \pm 25.31	247.28 \pm 20.22
50% rice straw + 50% sugarcane bagasse	9	78 \pm 2	1690.43 \pm 18.25	83.67 \pm 12.25	10	108 \pm 5	2214.52 \pm 22.80	283.72 \pm 12.66
25% rice straw + 75% sugarcane bagasse	12	64 \pm 4	1201.65 \pm 10.16	78.29 \pm 15.40	9	92 \pm 2	1862.08 \pm 21.33	214.52 \pm 11.21
Sugarcane bagasse	10	70 \pm 6	1427.23 \pm 19.82	94.55 \pm 16.23	8	99 \pm 8	2003.76 \pm 23.83	225.27 \pm 10.84

YIELD AND BIOCHEMICAL PARAMETERS OF *VOLVARIELLA VOLVACEA* AND *V. DIPLASIA*

Bioefficiency of *V. volvaceae* and *V. diplasia* are presented in Table 2. The Bioefficiency of *V. volvaceae* was 56.73% and *V. diplasia* was 55.83%. The dry weight of the compost was 980.45 and 985.34 g, mushroom fruit body fresh wt. was 556.23 g and 550.15 g mushroom. The production rate was 4.72 in *V. volvaceae* and 4.65 in *V. diplasia*.

The bioconversion of dry compost into fruit body in *Volvariella* grown on rice straw are presented in Table 3. The dry wt. of the compost after cultivation of *V. volvaceae* and *V. diplasia* were 551.24 g and 535.16 g respectively. The fruit body conversion rate (%) were 8.09 in *V. volvaceae* and 7.20 in *V. diplasia*. The biochemical contents such as carbohydrate, protein and nucleic acid were 32.26, 43.28 and 3.0 % of dry weight respectively in *V. volvaceae* and these were 33.21, 42.83 and 2.9 % of dry weight respectively in *V. diplasia*. "Biomass conversion efficiency" is dependent on the occurrence of the contaminants and growth competitors in the growth substrate (Rajarithnam *et. al.*, 1987 and Grandy, 1985). The biomass includes the mycelium generated

in the growth substrate, developed fruiting bodies, and also mycelium grown in liquid culture. Rajarithnam, 1981 has identified several enzymes responsible for degradation of growth substrate the mushroom mycelium. The bioefficiency of *Volvariella volvaceae* and *Volvariella diplasia* were 56.73% and 55.83 % respectively. These figures are quite in agreement with the earlier reports of Zadrail, 1978 and Mehera, 2001. Patro and Pani, 1995 observed that certain changes in substrate combination and climatic conditions lead to higher bioconversion rate.

The mycelial growth of *Volvariella* on rice straw, sugarcane bagasse and rice straw and sugarcane bagasse (1:1) are given in Table 4. The data were analyzed statistically by using Duncan's multiplicative model, linear model and exponential model. The table reveals that the rice straw and sugarcane bagasse (1:1) gives better mycelial diameter in comparison to either rice straw or sugarcane bagasse. The better mycelial growth is reflected in better yield of the mushroom. The results of the experiment support earlier works of Kaur and Lakhanpal, 1995 and Sahoo, 1999.

Table 2. Bioefficiency of *Volvariella* grown on rice straw as substrate.

Species	Days after harvested	Compost dry wt. (g)	Mushroom fruit body fresh wt. (g)	Mushroom fruit body dry wt. (g)	Bio efficiency (%)	Dry mushroom yield rate (%)	Production rate
<i>V. volvaceae</i>	12	980.45±10.15	556.23±19.34	32.16±3.52	56.73	3.68	4.72
<i>V. diplasia</i>	12	985.34±15.12	550.15±10.12	30.24±4.48	55.83	3.31	4.65

Each value is mean of 10 replicates ± SEM

Table 3. Bioconversion of dry compost into fruit body, substrate carbohydrates, protein and nucleic acid content of *Volvariella* spp. grown on rice straw

Species	Compost dry wt.(g) after cultivation	Compost net loss (g)	Fruit body conversion rate (%)	Compost loss rate (%)	Carbohydrates content (% dry wt.)	Protein content (% dry wt)	Nucleic acid content (% dry wt.)
<i>V. volvaceae</i>	551.24±11.32	397.05±9.56	8.09	40.49	32.26	43.28	3.0
<i>V. diplasia</i>	535.16±10.25	419.94±9.28	7.20	42.61	33.21	42.83	2.9

Each value is mean of 10 replicates ± SEM

Table 4. Mycelial growth (mm) of *Volvariella* spp. on different agricultural substrates

Substrate used	Mycelial diameter (mm)	
	<i>V. rotstracae</i>	<i>V. diplasia</i>
Rice straw	0.76a	0.73a
Sugarcane bagasse	0.72a	0.70b
Rice Straw+ Sugarcane bagasse (1:1)	0.81a	0.79

Cultures are 14 days after inoculation

a = Duncan's multiplicative model ($y = ax^b$); b = linear model ($y = a + bx$); c = exponential model. ($y = \exp(a + bx)$)

The correlation coefficient of the biochemical content with different stage of development of *Volvariella* species indicate that protein, DNA, RNA and total nucleic acid content are higher at button stage as compared to primordial and open stage (Table 5). These biochemicals differ significantly at 0.05 in *V. rotstracae* and *V. diplasia* level (Table 5). The protein content of *Volvariella* is higher than many vegetables and nucleic acid content is much lower (< 3%) than algal class of single cell protein (>10%). The data supported the earlier reports of FAO and WHO, 1970; Khanna and

Garcha, 1986; Rajarathanam *et al.*, 1987 and Bihary 2003. In the button stage these chemical are significantly high at 0.05 level than primordial or open stage which is in agreement with earlier reports of Rajarathnam and Zakia Bano, 1991; Rolzet. *al.*, 1988; and Mohanty, 1999.

The correlation coefficient between yield and loss in bed weight of *Volvariella* mushrooms are presented in Table 6. The correlation coefficient between yield and loss in bed weight were significantly high at 0.05 level.

Table 5. Correlation coefficient of the biochemical contents of *Volvariella* spp. at different stage of development

Biochemical parameters	<i>Volvariella rotstracae</i>			<i>Volvariella diplasia</i>		
	Primordial stage	Button stage	Open stage	Primordial stage	Button stage	Open stage
Protein	31.32	32.34*	28.31	29.30	31.32*	27.55
DNA	0.71	0.72	0.68	0.70	0.71*	0.67
RNA	2.01	2.06*	2.0	1.99	2.0*	1.98
Total nucleic acid	2.72	2.78*	2.68	2.69	2.71*	2.65

Table 6. Correlation coefficient between yield and loss in bed weight of *Volvariella* mushroom

Mushrooms	Temperature (°C)	Relative humidity (%)	Spawn run period (in day)	Yield in fresh wt./ bed (g)	Loss in bed (% dry wt.)	Correlation coefficient between yield and loss in bed wt. (g)
<i>V. rotstracae</i>	30 - 35	85 - 90	12 - 16	467.31	42.3	0.98*
<i>V. Diplasia</i>	28 - 35	85 - 90	10 - 15	465.51	38.1	0.96*

* Significant at 0.05 Level

YIELD AND BIOCHEMICAL PARAMETERS OF *VOLVARIELLA VOLVACEA* AND *V. DIPLACEA*

Based on the investigation it can be concluded that the straw along with sugarcane bagasse in equal proportion gives better yield in *Volvariella* as compared to rice straw and sugarcane bagasse alone and also other combinations of substrate.

The bioefficiency and bioconversion rate of *Volvariella volvaceae* and *V. diplasia* are 55 to 57 % and 7 to 9 % respectively, which is approximately five times that of cereals like rice per unit land. Their protein conversion efficiency is approximately twenty times that of meat generating animals. Comparative analysis of biochemical content in mushroom during different stage of its development revealed that the button stage of *Volvariella* has significantly higher protein content. So button stage may be adopted during the harvesting of the mushrooms. It can be concluded that combination of rice straw at sugarcane bagasse (1:1) is better substrate and harvest of closed (button stage) fruit bodies is better from nutritional point of view as well.

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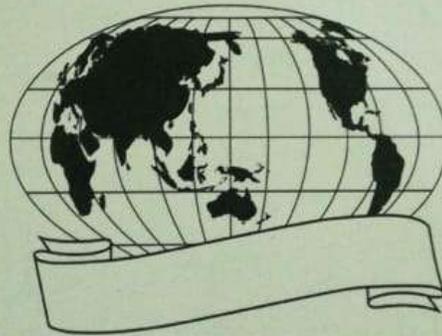
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Disability Management: Need to Empower the Women Carers

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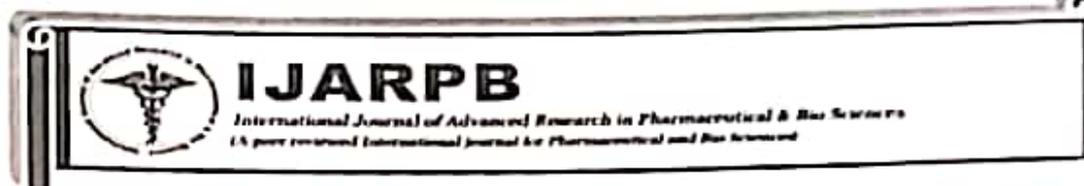
ABSTRACT

People with disabilities constitute 2.21 per cent of India's population. Social inclusion of these people is therefore of primary importance. This paper analyses the need for early intervention in disability management. The need to empower the women who are the primary carers of the disabled is also studied. The study concludes that early intervention and empowerment of women leads to social inclusion of the disabled at the earliest.

INTRODUCTION

According to World Health Organisation, Disability is an umbrella term covering impairment, activity limitation and participation restrictions. The Social Model of Disability (Mike Oliver, 1990) differentiates between impairment and disability. Impairment is a collection of physical, intellectual and mental functional limitations while Disability refers to disadvantages induced by lack of appropriate accommodation by the society or community. This model focuses on the struggle for equality and the need to establish the dignity and rights of disabled people. Disability is a developmental issue, because of its bi-directional link to 'poverty.' Disability may increase the risk of poverty and poverty may increase the risk of disability. The onset of disability may lead to the worsening of social and economic well being and poverty through its adverse impact on education, unemployment, earnings and increased expenditure related to disability. Poverty of people with disabilities leads to social exclusion and disempowerment.

Amartya Sen's Capabilities Approach (Development as freedom, Sen, 1999) offers a theoretical base to understanding the need for equal opportunities to the disabled. Individuals differ greatly in their abilities to convert the same resources into valuable functioning ('beings' and 'doings'). For example, those with physical disabilities may need specific goods to achieve mobility and pregnant women have specific nutritional requirements to achieve good health. There is an evaluation that focuses only on means, without considering what particular people can do with them, is insufficient.

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A Comparative Phytochemical Analysis And Screening of Antimicrobial Activities of Three Different Extracts of Leaves of *Uvaria Narum* (Dunal) Wall, And Their Hptlc Analysis.

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ABSTRACT

The study was conducted to understand the phytochemical nature and antimicrobial potential of petroleum ether, methanol and water extract of leaves of *Uvaria narum*. The leaves of *Uvaria narum* (Dunal) Wall were extracted in three different mediums and the extracts were subjected to antimicrobial investigation against six human pathogenic bacteria by Disk Diffusion Method and phytochemical investigations were conducted to analyse chiefly the presence of secondary metabolites followed by HPTLC screening. The petroleum ether extracts showed maximum zone of inhibition against the harmful human pathogens while aqueous extracts showed no activity against the bacteria. The preliminary phytochemical analysis showed the presence of steroids and Triterpenoids in the highly active petroleum ether extracts while methanol extracts showed the presence of alkaloids, tannins, cardiac glycosides, flavonoids, steroids as its secondary metabolites. The aqueous extracts also showed the presence of alkaloids, tannins, cardiac glycosides, and saponins but it failed to show any bioactivity against the pathogenic bacteria. The HPTLC chromatography was done on all the three extracts to obtain its chromatographic fingerprints. The Petroleum ether extract showed 11 peaks, while aqueous extracts and methanol extracts showed 14 peaks each at 580 nm after the plate was derivatised with anisaldehyde sulphuric acid spray reagent. The results satisfactorily proved that *Uvaria narum* was an underexploited plant with immense antimicrobial and hence pharmaceutical effect and further experiments should be done on it to evaluate and discover the lead compounds that actually gave it its antimicrobial properties.

KEY WORDS: Disk Diffusion Method; HPTLC chromatograph; zone of inhibition; secondary metabolites

INTRODUCTION

Plants have been an inseparable entity of human existence and since time immemorial human being has made use of plants in different ways and also used plants as a source of medicine.

India has a valuable heritage of herbal remedies for various ailments. In India vast populations of rural people still depend to a greater extent on the indigenous systems of medicines (Singh V., 2001). Increasing prevalence of multidrug resistance of many microbes has revealed

exploration of alternative antimicrobial agents. Medicinal plants have become the focus of intense study in terms of validation of their traditional uses through determination of their actual pharmacological effects. Synthetic drugs are not only expensive but have more side effects (Kachwala et al, 2012). Plants have a limitless ability to synthesize aromatic substances mainly secondary metabolites (Malikarjuna et al 2007). Though a vast amount of resources have been utilized, millions of them remain to be brought to the mainstream of pharmaceutical research. One such underexplored and under exploited plant is *Urena narum* (Dural) Wal. that is mostly confined to the lower altitude areas of Western Ghats, Pargies that includes Kerala and lower foothills of Western ghats in Karnataka. A host of ethnomedicinal uses have been reported for the plant. Roots & leaves have been reported to be used in treatment fever, biliousness, jaundice, bowel diseases and eczema (Khan C.P, 2010).

Urena narum has been kept in the family *Asteraceae*. It has been reported to be containing saponins (Hishama et al 1991) that are a characteristic feature of family *Asteraceae* and it also includes the sterols: Glycerol, Glycerol, Taraxerol, Beta sitosterol, beta/ campesterol and palmitoleone. Winder R. et al. (1995). Uramonin-A, I and II are the novel saponins being isolated from the bark of *Urena*. (Hishama et al. 1991). The Antibacterial and antioxidant activity of the root bark of *U* has been reported in earlier journals. Subramanya et al. (2011) and antimicrobial activity of the leaf extract has also been established (Rao, 2012). Since ethnomedicinally this plant has been used for the treatment of bowel diseases, jaundice and in eczema, it may imply about its suggested

antimicrobial effect against some isolated human pathogens. This study aimed at understanding the phytochemical properties of this plant and evaluating the antimicrobial properties of its aqueous, methanolic and petroleum ether extracts. An HPTLC of the three extracts were also conducted to obtain the number of compounds in each of them.

Materials and methods:

The plant was collected from Ulloor, Amalapuram of Thrissur district in Kerala and was authenticated by Expert Botanist Dr V T Antony of S.B.College Changanacherry. A voucher specimen of the plant has been deposited in the herbarium of department of P.G.studies in S.B.College, Changanacherry. The leaves of the plants were washed thoroughly in cold normal water and dried in shade at 25-30°C. The dried leaves were then taken and powdered carefully in a dry grinder to make sure that it did not get overheated.

Preparation of sample extract

20mg of the powdered material was taken and extracted at room temperature (25-30°C) on the rotary shaker for around 48 hrs in three different mediums of petroleum ether, methanol and distilled water. The resulting mixture was then filtered and the filtrate further subjected to centrifugation. The obtained filtrate was the required plant extract. The methanol and petroleum ether extracts were evaporated to dryness and the aqueous extract was kept on water bath at around 50°C and evaporated to dryness. The evaporated weight of the extract was noted. The extracts were stored in dry glass containers for further evaluation.

Antibacterial Screening:

Test organism:

The antimicrobial activity was individually tested against *Gram-negative* (Bacterium - *Escherichia coli*, *Shigella flexneri* and other negative bacteria *Escherichia coli*, *Shigella flexneri*, *Enterobacter aerogenes*, *Normal* *Enterobacter aerogenes*, *Normal* *Enterobacter aerogenes* and *Proteus* *Proteus*). All the test strains were obtained from the IGC and Research Department of Botany and Microbiology, S.S College, Changanacherry, and maintained on Mueller Hinton Agar (Merck), and was subcultured every two weeks.

Culture medium and inoculum:

The stock cultures of microorganisms used in this study were maintained on Nutrient Agar slants at 4°C. Inoculum was prepared by suspending a loopful of bacterial cultures into 10ml of nutrient broth and was incubated at 37°C for 24 hrs. 10⁸cfu/ml bacterial cells with O.D.1 were taken to study antibacterial activity.

Antibacterial activity assay:

The disc diffusion method was adopted to test the antibacterial activity. The disc diffusion method was used to determine the growth inhibition of bacteria by the plant extract according to Kirby Baur's method of checking sensitivity (Baur's method, 1965). Paper discs containing different concentration of dissolved plant extracts were used to check the antibacterial activity. The discs were prepared by punching the Whatmann's No.1 filter paper (5mm in diameter), sterilized in glass bottles and autoclaving at 121°C for 15 min. 100mg. of the dried extract was dissolved in 1ml. of the respective solvents (i.e. Petroleum ether, and Methanol) to make the concentration 10µg/µl of the respective pure solvent and drawing out the

required amount in µl. The discs were coated with three concentrations of the extract i.e. 10 (10µg), 100 (100µg) and 1000 (1000µg) from the above prepared stock of the extract and evaporated to dryness. The pure solvent of Petroleum ether and Methanol were taken as the negative control. The antibiotic disc of the standard drug (Chloramphenicol (30µg) and Amikacin (30 µg) were used as the positive control to compare the results of experimental data.

Culture medium:

The Mueller-Hinton Nutrient agar medium (Merck) was sterilized in a flask and poured to 50-55°C and poured into autoclaved and sterilized petriplates, where 30ml. was poured into each petriplate, which was then swirled first in clockwise and then in anticlockwise direction to distribute the medium homogeneously. The medium was then allowed to solidify in the room temperature. The prepared bacterial inoculums were inoculated on the solidified nutrient agar plates by using autoclaved sterile cotton swabs that had been dipped in the diluted suspension of the organism, as stated above. The discs were then aseptically placed evenly on the surface of the inoculation and gently pressed down with the forceps to ensure complete contact with the inoculated solid agar medium. Plates were also set for the positive control (antibiotic discs) as well as for the negative control (Pure solvents). The plates were finally incubated at 37° for 18-24 hrs. The plates were examined after 24hrs for a clear zone of inhibition. All experiments were done in triplicates and all measurements were taken in mm. Standard deviation was calculated for every measurement and recorded to understand the variation in the individual results.

Preliminary Phytochemical analysis:

The three sample extracts were analyzed for the presence of various phytoconstituents as flavonoids, alkaloids, glycosides, steroids, saponins, and tannins according to the standard methods used by Chandrabhan Seniya et al (Chandrabhan, 2011). The result of the screening has been shown in Table 2.

Phytochemical screening using HPTLC method of screening:

Phytochemical screening using HPTLC was done at Tropical garden research institute, Palode Thiruvananthapuram, Kerala. An HPTLC system (CAMAG, Switzerland) made of a Linomat V sample applicator, a CAMAG twin trough plate development Chamber, CAMAG TLC Scanner 3 and WinCATS Software 4.03 was used for the analysis of these extracts. The aim of the HPTLC analysis was to obtain a fingerprint of the

aqueous, methanol and Petroleum ether extracts of leaf of *Uvaria narum*.

Results :

Antimicrobial analysis: The bioactivity of the extracts were determined by observing and measuring the clear zone of inhibition that appeared around each disc loaded with the extract. The results have been shown in Table 1.1 along with those extracts and concentration that showed maximum diameter of the clear zone of inhibition. The components derived in Petroleum Ether extracts showed the maximum activity while Methanolic extract showed intermediate activity while distilled water extract showed absolutely no bioactivity. The sensitivity of the antibiotic discs as positive control and the pure solvents at 200µl as negative controls have been shown in Table 1.2

Mean of the Inhibition Zone as shown by the Crude extracts of *U.Narum* Leaf in Pet ether, Methanol and aqueous extracts at three different concentrations.

Test Organism	Zone of inhibition (mm)								
	Pet EE			ME			AqE		
	50µg	100µg	200µg	50µg	100µg	200µg	50µg	100µg	200µg
<i>Staphylococcus</i>	18±0.1	20±0.57	22±0.4	16±0.4	16±0.1	27±0.50	-	-	-
<i>Escherichia</i>	21.5±0.4	34±0.10	36±0.4	16±0.4	19±0.1	20±0.50	-	-	-
<i>Klebsiella</i>	20±0.1	20±0.4	24±0.4	-	-	16±0.10	-	-	-
<i>Enterobacter</i>	20±0.5	20±0.8	30±0.4	-	-	-	-	-	-
<i>Serratia</i>	-	-	-	-	-	15±0.10	-	-	-
<i>Proteus</i>	14±0.6	25±0.8	30±0.8	16±0.4	17±0.4	16±0.45	-	-	-

- The results are the mean values of triplicate tests measured in two directions after 18-24 hrs at 37°C.
- AE= Aqueous extract ; ME= Methanol Extracts; Pet EE= Petroleum ether Extracts.
- SD of the results have also been calculated.

Table 1.2

Mean of the Inhibition Zone as shown by different antibiotics * (Positive control) and different solvents** (Negative Control)					
Test Organism	Zone of inhibition				
	Amikacin	Chloramphenicol	PE	MET	DW
<i>Staphylococcus aureus</i>	17±0.48	26±0.05	-	-	-
<i>Escherichia coli</i>	17.5±0.75	15±0.48	-	-	-
<i>Klebsiella pneumonia</i>	22.05±0.07	22.5±0.78	-	-	-
<i>Enterobacter aerogenes</i>	27.5±0.68	29±0.48	-	-	-
<i>Serratia marcescens</i>	20.5±0.78	32±0.01	-	-	-
<i>Proteus vulgaris</i>	30±0.01	25±0.1	-	-	-

- Antibiotics discs taken at a concentration of 30 µg /m
- PE= Petroleum ether; ME= Methanol ; DW=Distilled water . Amount used=200µl

Phytochemical analysis of Bioactive compounds in three solvent extracts of *Uvaria narum*:

Phytochemical studies revealed the presence of various secondary metabolites and were almost in accordance with the earlier studies on the same plant. (Joji Reddy et al, 2012), and the results have been documented in Table 2. One striking point was that even though the aqueous extract showed the presence of saponins, tannins, terpenoids and steroids it showed

absolutely no antimicrobial activity in this study. The methanolic extract that showed an Intermediate Bioactivity against bacterial pathogens, indicated the presence of alkaloids, cardiac glycosides, condensed tannins, triterpenoids and steroids. The most bioactive extract among the three extracts, the Petroleum ether extract contained triterpenoids and steroids among its important constituents that perhaps gave it its immense antimicrobial activity against harmful human pathogens.(Trease,2011).

Qualitative estimation of secondary metabolites from the plant parts used:

Table 2. Phytochemical analysis of three extracts of *Uvaria narum*

	Saponins	Steroids	Flavonoids	Tannins	Cardiac glycosides	Alkaloids	Phenols	Triterpenoids
PE	-	+	-	-	-	-	-	+
ME	-	+	+	+	+	+	-	+
AE	+	+	-	+	-	-	-	+

The HPTLC analysis at 584 nm gave the fingerprint of petroleum ether extract, in methanol and the water extract that can be further used to identify the original material. The Petroleum ether extract showed 11 compounds at 580nm,

methanolic fraction showed 14 compounds and aqueous extract showed 14 compounds at 580 nm, after the plates were derivatised with anisaldehyde and sprayed with concentrated sulphuric acid.

Discussion: The plants are having special ability to synthesize aromatic substances mainly secondary metabolites which are cleverly used by plants as defensive molecules against predation by microorganisms, insects and herbivores. Some of these defensive molecules give plants their medicinal values which are appreciated by human beings. Traditional medicine, like orthodox medicine has its own methods and techniques of application which however aims at healing diseases. (Wurochekke et al, 2008). Early publications have pointed out that relatively little of the world's plant biodiversity has been extensively screened for bioactivity and that very little of the estimated microbial biodiversity has been available for screening. (Dougheri et al, 2007). With the growing realization that the chemical diversity of the natural products is a better match to that of the synthetic drugs and also with the emergence of multi drug resistant pathogen, (Feher and Schmidt,2003) , the interest in drug discovery from natural chemical compounds seem to be increasing again (Galm and Shen,2007)

In this study, both the methanol and the petroleum ether extracts of *Uvaria narum* showed considerable antimicrobial activity against the harmful human pathogens, and on an average Petroleum ether extract was found to be the most active among the three extracts in its activity against the bacteria. The HPTLC screening too showed the presence of around 11 compounds in PE extracts. In fact the activities at times were found to be higher than the standard antibiotics as Chloramphenicol and Amikacin (30µg each) screened under similar conditions. As per the standard table of sensitivity test (Sharma Kanika,2011), a zone with a diameter above 10mm is considered as Intermediately sensitive while one above 15mm is said to be sensitive

and the zone below 10 is to be marked as resistant.

This study showed that the Petroleum ether extracts exhibited a very good inhibitory activity against five out of six bacteria that were taken (22mm-38mm inhibition zone at 200 µg) and its activity against *Escherichia coli* that causes important gastrointestinal disorders has been really effective and was much higher than the antibiotics Chloramphenicol and Amikacin. While *Klebsiella pneumonia* and *Proteus vulgans* were competent enough with the antibiotics, *Serratia* showed absolutely no sensitivity to Petroleum ether extracts in any of its triplicates.

The effect of the Methanolic extract was the most profound in *Staphylococcus aureus*, (which is an important agent of Skin Infection) with the extracts showing the maximum activity at 200 µg with an inhibition zone of 27mm. This could be a possible reason to explain its popular use in traditional medicines against skin ailments. *Serratia* showed sensitivity to the methanolic extract alone (15mm inhibition zone at 200 µg). The methanolic extract showed inhibition to all other bacteria but in a lesser amount than the Petroleum ether extract.

Taking the result from the phytochemical analysis, it can be ascertained that the hydrophobic compounds of steroidal nature present in the Petroleum ether extract must have conferred the antimicrobial property to the extract. (Joj Reddy et al, 2012).

Conclusion: Vast literature of this plant is not available which means this plant has not been brought as yet to the mainstream of research. From the above experiments it can be seen that the methanolic and Petroleum ether extract of *Uvaria narum* showed extensive antimicrobial

activity against considerable bacteria specially against *E. coli* and methanolic extract against *Staphylococcus aureus*. The preliminary phytochemical screening of the plant revealed the presence of several phytochemical compounds it is Carbohydrates, Tannins, Flavonoids and Steroids in its methanolic extract and Flavonoid and Steroid is sufficient amount in its Petroleum ether extract that may have exhibited its antimicrobial property. It is been a highly encouraging study as the positive results have shown that *Urena lobata* should be included in the plant to cure the bad microbes that have actually exhibited its antimicrobial property on *Urena lobata*. (Teresa 2011)

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**EFFECT OF THIODAN ON
ANTIOXIDANT ENZYMES AND LIPID PEROXIDATION IN THE
GILL OF *OREOCHROMIS MOSSAMBICUS***

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Abstract: This study aims to investigate the effects of the insecticide Théoden, a commercial grade endosulfan on antioxidant enzyme activities and lipid peroxidation in the gill of *Oreochromis mossambicus*. The fish were exposed to various sub lethal concentrations of Théoden (1/20th, 1/15th and 1/10th of LC₅₀ value) and sampling was carried out on the 10th, 20th and 30th day. Despite the initial increase in activity at the lowest and intermediate sub lethal concentrations, gill tissue showed decreased superoxide dismutase (SOD) activity on the 30th day. Catalase (CAT) activity in gill of the exposed fish showed inhibition at the highest sub lethal concentration on all exposure periods. Inhibition of glutathione peroxidase (GPx) activity was recorded in fish exposed to the highest sub lethal concentration towards the end of the exposure period. In other sub lethal concentrations up and down fluctuation in activity was noticed. The fish subjected to different sub lethal concentrations of Théoden exhibited elevation in malondialdehyde (MDA) level which was both time and dose dependent. The results indicate that *O. mossambicus* resisted oxidative stress by antioxidant mechanisms and prevented increases in lipid peroxidation during the initial phase of exposure at low and intermediate concentrations of Théoden. But inhibition of enzyme activity was noted at the highest sub lethal concentration at all exposure periods. As a consequence, increased lipid peroxidation would have taken place in gill which was evidenced by the escalation in MDA level.

Key words: Théoden, *Oreochromis mossambicus*, Superoxide dismutase, Catalase, Glutathione peroxidase, Malondialdehyde

