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എഴുത്തുമാസിക

ചിന്തിക്കുന്ന പുരയങ്ങൾക്ക്



ദൂരെയിരുന്ന യുദ്ധം
കാണുന്ന നമ്മൾ
ബെന്യാമിൻ



നീതിയുടെ
സുര്യൻ
ബി.ആർ.പി



വികസനമെന്ന
അശ്ശിലം
ദയാബായി

മരണത്തിന്റെ വ്യാപാരികൾ

കെ.പി.ഫാബിയാൻ
സി.നാരായണൻ
അഗസ്റ്റിൻ പാംപ്ലാനി



കഥ വർഗീസ് അക്ഷമലി
കവിത ഒ.പി. സുരേഷ്
ഒളിനി ആൻഡ്രൂസ്

സിർവർലൈൻ
അഡ്വ. എ. ജയശങ്കർ

എം.തോമസ് മാത്യു
ബാലചന്ദ്രൻ വടക്കേടത്ത്
ജേക്കബ് തോമസ്
ഡോ.മേരി ജോർജ്ജ്

രാജ്യാന്തര ചലച്ചിത്രോത്സവം
സോഫ്റ്റ് ഹോർ



കൃഷിയോർമ്മ ▶
ഡോ. മിനി ആലീസ്

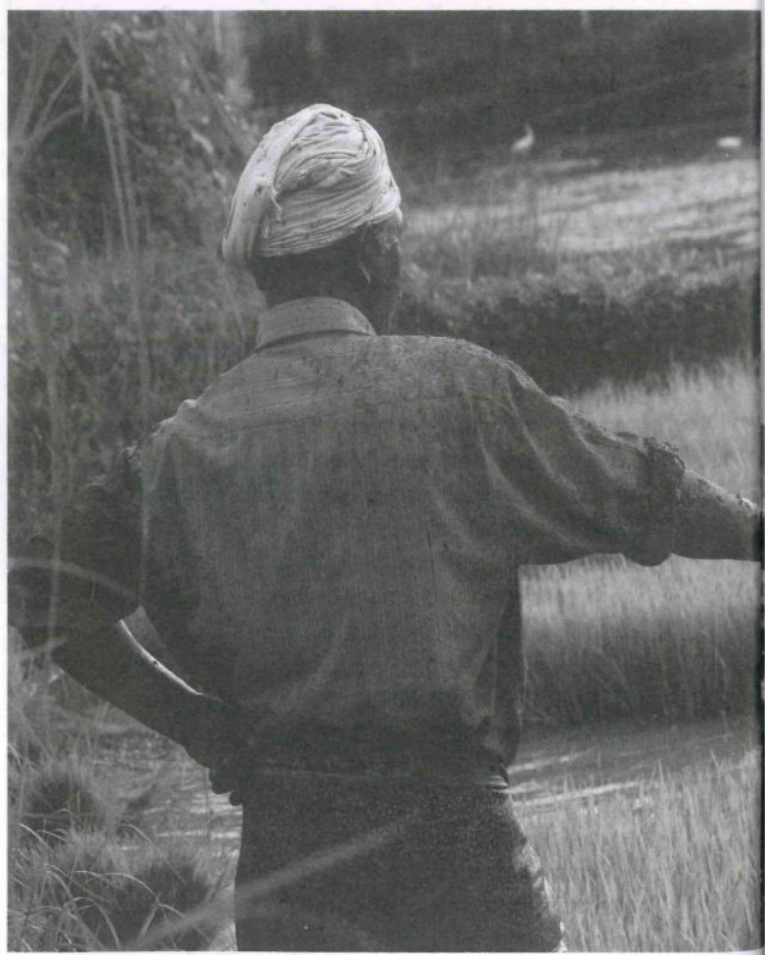
അധ്യാനത്തിന്റെ ഉഷ്

■ മധ്യതിരുവിതാംകൂറിലെ മധ്യവർഗ്ഗജീവിതവുമായി ബന്ധപ്പെട്ട കാർഷികവൃത്തിയുടെ ഒരേട്. കുറിയാക്കോസ് പാമ്പാടിയുടെയും കെ.ജെ.ഏലിയാമ്മയുടെയും ഓർമ്മകൾ

പച്ചയുടെ ധാരാളിത്തത്തിലും ഫലസമൃദ്ധിയുടെ നിറവിലും ഇരുണ്ട നിറമാർന്ന മണ്ണുമായി മല്ലടിച്ച മനുഷ്യന്റെയും കാലികളുടെയും അധ്യാനത്തിന്റെ ചുടും ചുരുമുണ്ടായിരുന്നു. നാൽക്കാലികളോടൊപ്പം ഇരുകാലികളും എല്ലാമുറിയെ പണിയെടുത്ത് നേടുന്ന അന്നത്തിന് ഭുതകാലം ഏറെ വിലകല്പിച്ചിരുന്നു.

മലമ്പ്രദേശങ്ങളിൽ നടുതലകൾ ധാരാളമായി കൃഷി ചെയ്യുകയും ഭക്ഷിക്കുകയും ചെയ്തിരുന്നുവെങ്കിലും അരിഭക്ഷണത്തോടുള്ള മമത മധ്യതിരുവിതാംകൂറിലും മാറ്റമില്ലാതെ നിലനിന്നിരുന്നു. പാടശേഖരങ്ങൾ കുറഞ്ഞ മലമ്പ്രദേശങ്ങളിലും തങ്ങൾ ആർജിച്ച് വികസിപ്പിച്ചെടുത്ത വിവിധങ്ങളായ കൃഷിയറിവുകളുടെ പിൻബലത്തിൽ കരണൽകൃഷി ഫലപ്രദമായി നിർവഹിച്ചിരുന്നു.

കാടുവെട്ടിത്തെളിച്ച് മലയോരങ്ങളിൽ നെൽകൃഷി ചെയ്യുന്നതിനായി നിലമൊരുക്കുന്നതിന് 'ഉഴവുവെട്ട്' എന്നായിരുന്നു പറഞ്ഞിരുന്നത്. പ്രാരംഭമായി കൃഷി ചെയ്യാനുദ്ദേശിക്കുന്ന പ്രദേശത്തെ കാടുതെളിച്ച് വെടിപ്പാക്കും. വേലി കെട്ടുവാൻ ആവശ്യമുള്ള മരക്കമ്പുകൾ ഒഴികെ ബാക്കിയുള്ളവ ഉണങ്ങിയശേഷം തീയിടും. അയൽവാസികളുമായി സഹകരിച്ച് എല്ലാവരും ഒരുദിവസം തന്നെ തീയിട്ടാണ് നിലമൊരുക്കുന്നത്. ആദിവസത്തിന് 'കടുന്നാൾ' എന്നാണ് പറയുന്നത്. വീടുകൾക്ക് അഗ്നിബാധയുണ്ടാകാതിരിക്കാനുള്ള മുൻകരുതലായി വെള്ളം ശേഖരിച്ച് കാവൽ നിൽക്കും. തീയിട്ട് നിലമൊരുക്കിയശേഷം പറമ്പിന്റെ നാലുവശവും വേലികെട്ടി തിരിക്കും. ഒരു പ്രാവശ്യം കൂടി പറമ്പ് അടിച്ചുചുട്ടിൽ നടത്തിയശേഷം മീനമാസം മുതൽ പണി ആരംഭിക്കും.





Abiotic Stress Management in Beach Trees Through Chlorophyll proportion Reshuffle: A Case Study from Peninsular India

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ABSTRACT

The present work is about beach tree species pigment content analysis and a method to explain how coastal trees manage abiotic stress through modification in chlorophyll and carotenoids. Pilot field visits were conducted for selecting the tree species for chlorophyll analysis, which gave a collection of 28 tree species from the four study sites (B1-B4). Eight tree species (P1-P8) were considered that are common in all the study sites and control from the natural stand (NS) was also considered. Total chlorophyll is higher than NS for samples from B3 for P1; B3 and B4 for P2, P4, P6; B2 for P3 and P7; B1, B3, and B4 for P5; B1, and B2 for P8. The study on Chlorophyll a/b ratio in P1 recorded a higher Chl a/b ratio than NS in specimens from B2, B3, and B4 for P1; B1, B3, and B4 for P2; B1 and B3 for P3; B4 for P4; B1 for P5; B1, B2 and B4 for P6; and B4 for P8. The highest Chl a/b was shown by P6 from B4 recorded as much as 7.29 and indicates high photon flux and nitrogen limitation.

KeyWords: Abiotic stress management, Beach trees, Chlorophyll content, Photon flux, Chlorophyll a/b ratio

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INTRODUCTION

The coastal belt of the terrestrial habitat is a dense grove of trees, which can be evaluated through biodiversity study in the area. Pressure on the coast has been increasing since the dawn of civilization [1]. Peninsular India in its southwest region, is dominated by coconut trees [2]. Living by the sea has to survive: salty winds, poor soil without mineral nutrition, rocky and sandy places, change in pH, temperatures, and many other environmental characteristics. Photo-inhibition of the photosynthetic pigment apparatus is affected by stress responses [3]. Photosynthesis maintains atmospheric oxygen levels and supplies all of the organic compounds and most of the energy necessary for life on earth [4]. Chlorophyll-a absorbs most energy from wavelengths of violet-blue and orange-red light whereas chlorophyll-b is more soluble in polar solvents. It is found that in shade-adapted chloroplasts there is a lower ratio of chlorophyll-a to chlorophyll-b [5]. Few studies have been conducted on coastal flora and studies on chlorophyll content of the coastal plants are limited. Therefore this study is focused on beach tree species pigment content analysis and methods to evolve to explain how coastal trees manage abiotic stress through modification in chlorophyll and carotenoids.

MATERIAL AND METHODS

Pilot field visits were conducted for selecting the tree species for chlorophyll analysis. Five plots of 100m² were taken and the list of trees in each plot was tabulated. This was repeated in all the four study sites (Table. 1). The binomial of trees were updated as regional and local flora [6], [7], [8]. Trees located in all four study sites were considered for pigment analysis.



Room temperature intrinsic ferromagnetism in pulsed laser ablated few layers of 2D-WS₂ on Si/SiO₂ substrates

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ABSTRACT

In this work we report the room temperature intrinsic ferromagnetism of pulsed laser deposited few layers of WS₂. The ablation was carried out by employing the fourth harmonics of Q-switched Nd-YAG laser (266 nm) at a temperature of 700 °C on Si/SiO₂ substrates. Few layers of WS₂ were confirmed by Raman and AFM measurements. The photoluminescence spectrum reveals the defect free nature of few layers of WS₂ and exhibits intense emission near the band gap. VSM measurements have explored the room temperature intrinsic ferromagnetism in a few layers of WS₂ thin films with a saturation magnetisation of 20.1 μemu. This is the first report of intrinsic ferromagnetism in PLD grown few layers of WS₂. The room temperature intrinsic ferromagnetic properties in a few layers of two dimensional WS₂ can be exploited to design atomically thin spintronic devices.

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1. Introduction

Inspired by the discovery of graphene two dimensional (2D) transition metal dichalcogenides (TMDCs) received much interest in the field of material science [1,2]. These low dimensional materials with unique optical and electronic properties will be dominant in the upcoming generation of optoelectronic devices [3]. They exhibit X-M-X layered structure with a metal atomic layer sandwiched between the chalcogen layers [4,5]. This layered structure allows them to make a cross over from indirect band gap to direct band gap when they are scaled down from bulk to mono/few layers [6–8]. In the group of TMDCs WS₂ is a prominent member and the least investigated one compared to others. It possesses the highest carrier mobility due to its smallest effective electronic mass, strong thermal stability, more resistance to oxidation and larger spin-orbit coupling etc [9,10]. Some of the major application of WS₂ includes sensors [11], transistors [12], photovoltaics, hydrogen storage etc [13,14].

The optical and electrical properties of 2D materials are most investigated based on these applications. The magnetic features

of these layered materials remain unexplored to a great extent. The magnetic studies reveal the ferromagnetic behaviour of mono/few layer TMDCs rather than the diamagnetic character of the bulk TMDCs [15]. Tuning the magnetic properties in 2D layered materials can open up new perspectives in the future of spintronic and quantum information devices [16,17]. A ferromagnetic semiconductor allows the controlled generation and detection of spin currents, which facilitate the fabrication of low dimensional spintronic devices. There was many attempts performed to induce long-range ferromagnetism in 2D materials. Introduction of defects into the lattice, transition metal doping, applying tensile strain, modification in the edge structure and saturation rate etc are some of the methods to realize the ferromagnetic behaviour in these materials [18]. Lie et al [19] proposed the magnetic properties of MoS₂ nanoribbons with armchair and zigzag edges using first-principle calculations. Zhang et al examined the ferromagnetism in WS₂ nanoribbons with zigzag edges using the first principle calculation [20]. Most of the reported works on magnetic studies are restricted to the theoretical aspects of WS₂. There are reports on experimental studies on the magnetic characteristics of WS₂. Ding et al [21] reported the enhanced ferromagnetism induced by defects in WS₂. In another report room temperature ferromagnetism exhibited by high quality vanadium doped WS₂ monolayers

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Effect of source-substrate distance on the transparent electrode properties of spray pyrolysed aluminium doped zinc oxide thin films

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ABSTRACT

The wide band gap zinc oxide is a potential metal oxide that has been widely used in optoelectronic applications. The zinc oxide thin films demonstrate excellent conductivity and transparency enabling them for transparent electrode applications. The aluminium doping is an efficient route in further improving the conductivity without compromising the transparency and scalable spray pyrolysis is an effective approach in realizing high quality thin films. Our current study focuses on the effects of distance between the substrate and spray nozzle on the structural, morphological, optical, and electrical properties of aluminium doped zinc oxide. Our results suggests that this spray parameter has appreciable impact on the thin film properties and can be optimized for tuning properties. We explain this in detail backed by the characterization of thin films by X-ray diffraction, Atomic Force Microscopy, UV-Vis-NIR spectroscopy, Photoluminescence and Hall effect measurements.

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1. Introduction

The intriguing coexistence of transparency and conductivity in metal oxide semiconductors have paved the way for a boost in the transparent electronics including technologies such as photovoltaics, LEDs, lasers, flat panel displays, transparent transistors and low emissivity windows [1]. From the study on CdO to investigations on ZnO, In₂O₃ and SnO₂ recognized the existence of such an exciting combination in various metal oxide thin films collectively referred to as transparent conducting oxides (TCOs) [2]. The most technologically important TCOs used to-date were developed by doping such as Sn doped In₂O₃ (ITO), Fluorine doped SnO₂ (FTO), Al doped ZnO (AZO) and Sb doped SnO₂ (ATO). Their conductivity and carrier concentration could go as high as $\sim 10^4$ S/cm and $\sim 10^{21}$ cm⁻³ along with extinction coefficients as low as ~ 0.0001 in the visible range [1]. While the extended scattering time can contribute to high transparency, the low effective mass and high carrier concentration enhance the electronic transport in the material. However, self-compensation effects and low solu-

bility of dopants could limit scattering time and carrier concentration. Besides, the vacant and widely-spread metal s-orbitals that constitute the conduction band minimum and low effective masses promise high electron mobilities in the range of 10–100 cm²V⁻¹s⁻¹ [3]. Recently, the strongly correlated systems like transition metal oxides (TMOs) demonstrate remarkable optical and electronic behaviors as a TCO from their large carrier effective mass resulting from the interactions of narrow partially occupied d bands [4]. The SrVO₃ or CaVO₃ showed carrier concentrations in the order of $\sim 10^{22}$ and alkaline-earth stannates like ASnO₃ (A = Ba, Sr, Ca) have displayed room-temperature mobilities up to 320 cm²V⁻¹s⁻¹ [5,6]. In TMOs, the transparency arises from the high effective mass of electrons which does not allow for oscillations with the electric field of incoming light, rather passing the photons through without any interruption. The electron-electron coulombic interactions are believed to be the reason for this increased electron effective mass. In addition, studies on SrVO₃ suggest a new theory based on the strong coupling of electrons moving in the ionic lattice (forming polarons) play a crucial role in this transparent behavior of thin transition metal oxide films that can also be extended to other metal oxides [4].

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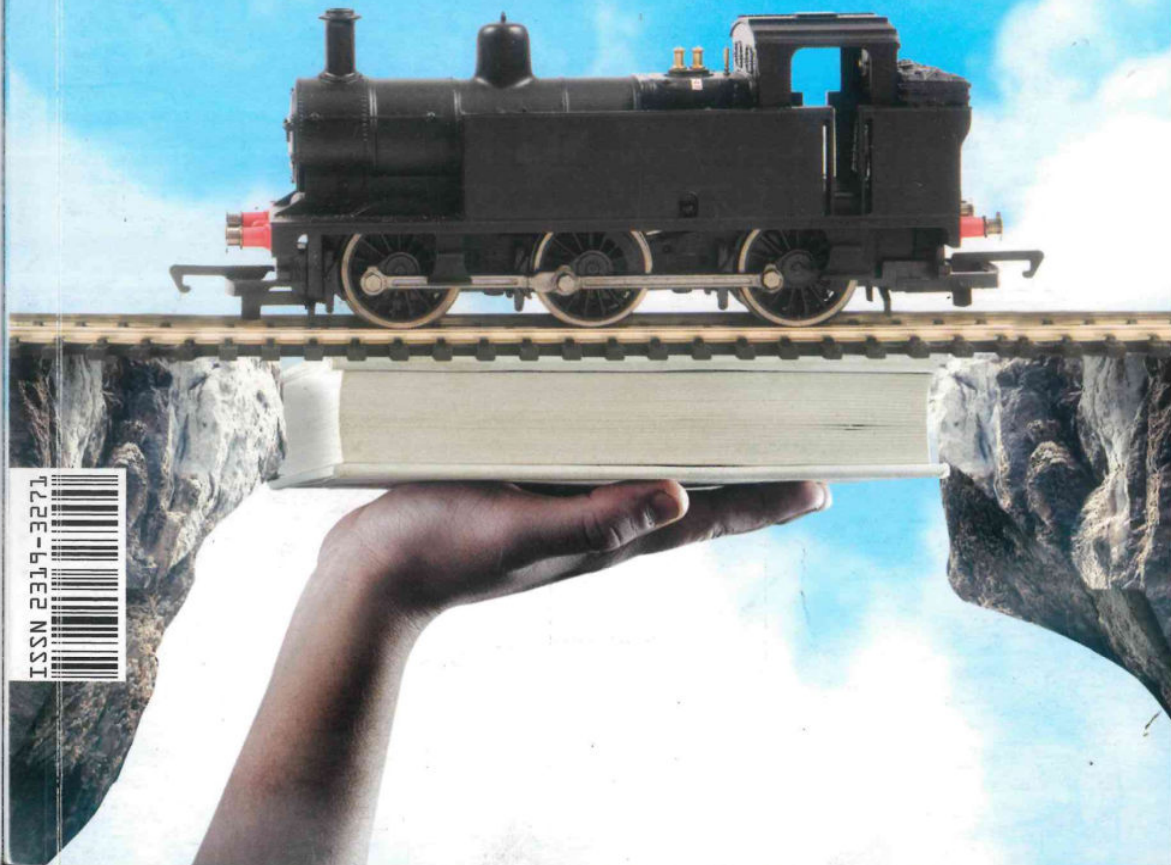
MALAYALAM LITERARY SURVEY

2022 January-March



Train of Thought

*Representation of
trains in Malayalam literature*



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Poesy: The crystals of brine

Dr Mini Alice

Translated by Nisha Narayanan

*M*use Mary is one of those poets who actively wrote after 2000, and her themes revolve around love, nature and spirituality. They hardly refer to 'contemporariness' and combine satiric, philosophical and lyrical elements amicably and diversely.

A movement from the simple to the complex is considered to be a speciality of the latest modern trends in poems. Her first collection *Isped Rani* (2008), has a handful of poems that convey the sweetness and bitterness of women's experiences and explore the unlimited expressions of women's seemingly limited world.

The poem 'Each Place Reminds Me of You'

എഡ്യേർഡ് ഒ.വിൽസൺ എന്ന ആധുനിക ഡാർവിൻ

1 മേയ് 2022

വില ₹ 25

വിജ്ഞാനകൈകൾ

കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട് പ്രസിദ്ധീകരണം

വിഭാഗീയതയുടെ
ഭാഷാബോധങ്ങൾ
മനുഷ്യരാശിയുടെ ഭാവി

റഷ്യ-യുക്രൈൻ
സംഘർഷങ്ങളുടെ
ചരിത്രബന്ധങ്ങൾ



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എൻ.വി.കൃഷ്ണവാരിയർ
സ്ഥാപക പത്രാധിപർ

വിജ്ഞാനകൈരളി

കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട് പ്രസിദ്ധീകരണം

മേയ് 2022 വാല്യം 54 ലക്കം 5 വില ₹ 25



റഷ്യ-യുക്രൈൻ സംഘർഷങ്ങളുടെ ചരിത്രബന്ധങ്ങൾ

പി.പി. അമൽ

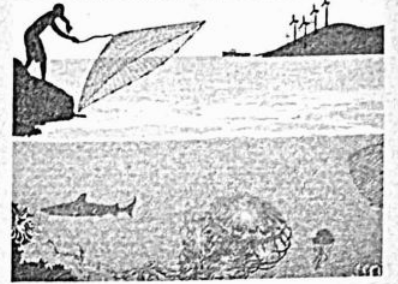
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ഒരു യുദ്ധവും പുരോഗമനപരമായ ഒരു മാറ്റവും സമൂഹത്തിൽ കൊണ്ടുവരുന്നില്ല എന്ന യാഥാർത്ഥ്യം ചർച്ച ചെയ്യേണ്ടതുണ്ട്.

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ഇന്ത്യൻ അർദ്ധവിജ്ഞാനീയവും ധൈഷണികാർത്ഥവിചാരമാതൃകയും ഭർതൃഹരിയുടെ ഭാഷാദർശനങ്ങളെ മുൻനിർത്തിയുള്ള വിശകലനം
ശരത് ചന്ദ്രൻ



സമുദ്ര സമ്പദ്‌വ്യവസ്ഥയിലെ സുസ്ഥിരതയും പ്രതിരോധവും സന്തോഷ് മാത്യു

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'കടലിനെ ആരു ഭരിക്കുന്നുവോ, അവർ ലോകത്തേയും ഭരിക്കും'
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അനുകൽപ്പനപ്രക്രിയയും ചലച്ചിത്രദാഷ്യവും

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സാഹിത്യവും ചലച്ചിത്രവും തികച്ചും വ്യത്യസ്തമായ ആവിഷ്കാരവഴികളുള്ള മാധ്യമങ്ങളാണ്. സിനിമയെക്കുറിച്ചുള്ള ശ്രദ്ധസങ്കല്പത്തിൽ ദൃശ്യവിചാരങ്ങൾക്കേ പ്രസക്തിയുള്ളൂ. എന്നാൽ സിനിമയുടെ ചരിത്രവും വർത്തമാനവുമെല്ലാം വെളിപ്പെടുത്തുന്നത് അത് ഇതരമാധ്യമങ്ങളുമായുള്ള കൊടുക്കൽവാങ്ങലുകളിലൂടെ വളർന്നുകൊണ്ടിരിക്കുന്നു എന്നതാണ്. പ്രത്യേകിച്ചും സാഹിത്യകൃതികളെ ആധാരമാക്കുന്ന ചലച്ചിത്രങ്ങൾ ദേശഭേദമെന്യേ കനപ്പെട്ടവയാണ്. സ്കോട്ട് മാർബിളിന്റെ നാടകത്തിന്റെ അനുകൽപ്പനമായിരുന്നു 'ദ ഗ്രേറ്റ് ട്രെയിൻ റോബറി'. പുഡോവ്കിന്റെ മദർ മാക്സിം ഗോർക്കിയുടെ 'അമ്മ' തന്നെ. ഷേക്സ്പിയർ കൃതികൾ അഭൂപാളിയിലാക്കാൻ ചലച്ചിത്രകാരന്മാർ മത്സരിച്ചിരുന്നു. സത്യജിത് റായിയുടെ 22 ചിത്ര

ങ്ങളും അനുകൽപ്പനങ്ങളാണ്. മലയാളത്തിൽ കവിതകൾക്കുപോലും ചലച്ചിത്രദാഷ്യമുണ്ടായി. എന്നാൽ മുൻകാലങ്ങളിൽനിന്നു വ്യത്യസ്തമായി എഴുത്തിന്റെ ലോകത്തുനിന്ന് ദൃശ്യങ്ങളുടെ ലോകത്തേക്ക് മാറ്റപ്പെടുന്ന പ്രക്രിയ ഇന്ന് താല്പര്യപൂർവ്വം ചർച്ച ചെയ്യാൻ ധാരാളം ഗവേഷകർ മുന്നോട്ടുവരുന്നുണ്ട്. അഡാപ്റ്റേഷൻ, അനുകൽപ്പനം, അനുരൂപണം, അനുവർത്തനം തുടങ്ങി വിവിധ നാമകരണങ്ങൾ ഈ പ്രക്രിയയ്ക്കുണ്ട്. ട്രാൻസ്ലേഷനും ട്രാൻസ്ക്രിയേഷനുമൊക്കെ ഇതിനോട് അനുബന്ധമായി രൂപപ്പെട്ടു വന്നിട്ടുള്ളതാണ്. എന്നാൽ ആധാരകൃതിയുമായി ഒത്തു നോക്കി സാമ്യവ്യത്യാസങ്ങൾ കണ്ടെത്തി മാത്രം അവസാനിപ്പിക്കേണ്ട ഒന്നല്ല അനുകൽപ്പനപാഠം. ചലച്ചിത്രദാഷ്യയിലേക്കുള്ള വിവർത്തനമായി പ്രസ്തുതപ്രക്രിയയെ പരി

Short Communication

Evaluation of ZnS:Mn Nanoparticles Capped with *Aloe vera* Gel Protein in Drug Delivery System

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Abstract

Objective: This study is aimed to find out the in vitro antimicrobial activity *Aloe vera* gel protein encapsulated Mn²⁺ doped ZnS nanoparticles (NPs) for drug delivery, biological, phytochemical and molecular properties of *Aloe vera* leaf gel extracts.

Methods: The protein is extracted from *Aloe* leaf gel by trichloroacetic acid-acetone method and tannins, saponins, flavonoids and carbohydrates were qualitatively analysed. ZnS:Mn nanostructured particles were prepared by chemical precipitation method. 25mL of each Zn(CH₃COO)₂, MnCl₂ and Na₂S solutions in water were used for preparation of Mn²⁺ doped ZnS NPs. Antibacterial assay of the ZnS:Mn nanostructured particles encapsulated with *Aloe vera* gel protein (ZnS:Mn/AV) was done by the well-diffusion method. And the genomic DNA of fresh and dried *Aloe vera* leaf gel was done by using cetyltrimethyl ammonium bromide method.

Results: Antibacterial activity of *Aloe vera* gel protein (ZnS:Mn/AV) is significantly above that of uncapped nanoparticle (NP) and gentamycin. The presence of tannins, saponins, flavonoids, carbohydrates was detected using standard protocols. Fresh young and dried leaf gel was used for DNA isolation and yielded good quality DNA.

Conclusion: During this study, protein extracted from *Aloe vera* (L) Burm. f (synonym *Aloe barbadensis* Miller) is employed as a capping agent to change the NPs widely exploited medicinal plants that have vast properties in the field of medicines. We report the antibacterial activity of ZnS:Mn NP encapsulated with *Aloe vera* gel protein synthesized by the chemical precipitation method, qualitative analysis of phytochemicals in *Aloe vera* gel extracts and isolation of genomic DNA from the *Aloe vera* plant. The ZnS:Mn capped with *Aloe vera* gel protein were also compared with the uncapped ZnS:Mn NP.

Keywords: capping, *Aloe vera*, nanoparticles, antibacterial activity



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എഴുത്തുമാസിക

ചിന്തിക്കുന്ന പുരയങ്ങൾക്ക്



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സോഫ്റ്റ് ഹോർ



കൃഷിയോർമ്മ ▶
ഡോ. മിനി ആലീസ്

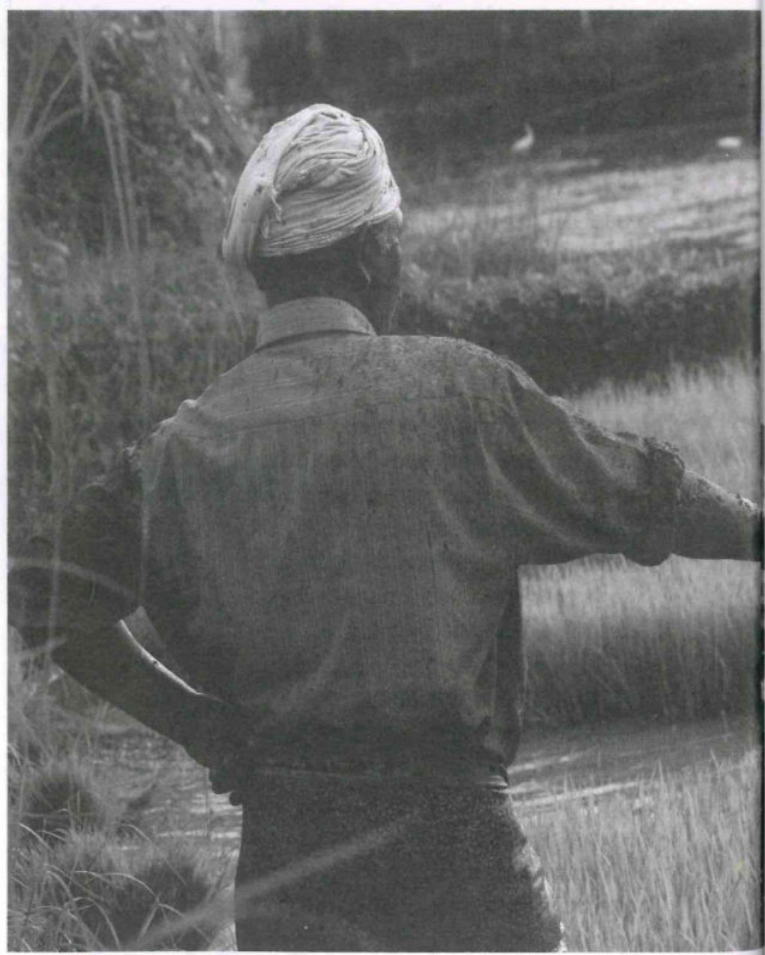
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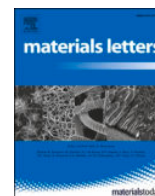
■ മധ്യതിരുവിതാംകൂറിലെ മധ്യവർഗ്ഗജീവിതവുമായി ബന്ധപ്പെട്ട കാർഷികവൃത്തിയുടെ ഒരേട്. കുറിയാക്കോസ് പാമ്പാടിയുടെയും കെ.ജെ.ഏലിയാമ്മയുടെയും ഓർമ്മകൾ

പച്ചയുടെ ധാരാളിത്തത്തിലും ഫലസമൃദ്ധിയുടെ നിറവിലും ഇരുണ്ട നിറമാർന്ന മണ്ണുമായി മല്ലടിച്ച മനുഷ്യന്റെയും കാലികളുടെയും അധ്യാനത്തിന്റെ ചുടും ചുരുമുണ്ടായിരുന്നു. നാൽക്കാലികളോടൊപ്പം ഇരുകാലികളും എല്ലാമുറിയെ പണിയെടുത്ത് നേടുന്ന അന്നത്തിന് ഭുതകാലം ഏറെ വിലകല്പിച്ചിരുന്നു.

മലമ്പ്രദേശങ്ങളിൽ നടുതലകൾ ധാരാളമായി കൃഷി ചെയ്യുകയും ഭക്ഷിക്കുകയും ചെയ്തിരുന്നുവെങ്കിലും അരിഭക്ഷണത്തോടുള്ള മമത മധ്യതിരുവിതാംകൂറിലും മാറ്റമില്ലാതെ നിലനിന്നിരുന്നു. പാടശേഖരങ്ങൾ കുറഞ്ഞ മലമ്പ്രദേശങ്ങളിലും തങ്ങൾ ആർജിച്ച് വികസിപ്പിച്ചെടുത്ത വിവിധങ്ങളായ കൃഷിയറിവുകളുടെ പിൻബലത്തിൽ കരണൽകൃഷി ഫലപ്രദമായി നിർവഹിച്ചിരുന്നു.

കാടുവെട്ടിത്തെളിച്ച് മലയോരങ്ങളിൽ നെൽകൃഷി ചെയ്യുന്നതിനായി നിലമൊരുക്കുന്നതിന് 'ഉഴവുവെട്ട്' എന്നായിരുന്നു പറഞ്ഞിരുന്നത്. പ്രാരംഭമായി കൃഷി ചെയ്യാനുദ്ദേശിക്കുന്ന പ്രദേശത്തെ കാടുതെളിച്ച് വെടിപ്പാക്കും. വേലി കെട്ടുവാൻ ആവശ്യമുള്ള മരക്കമ്പുകൾ ഒഴികെ ബാക്കിയുള്ളവ ഉണങ്ങിയശേഷം തീയിടും. അയൽവാസികളുമായി സഹകരിച്ച് എല്ലാവരും ഒരുദിവസം തന്നെ തീയിട്ടാണ് നിലമൊരുക്കുന്നത്. ആദിവസത്തിന് 'കടുന്നാൾ' എന്നാണ് പറയുന്നത്. വീടുകൾക്ക് അഗ്നിബാധയുണ്ടാകാതിരിക്കാനുള്ള മുൻകരുതലായി വെള്ളം ശേഖരിച്ച് കാവൽ നിൽക്കും. തീയിട്ട് നിലമൊരുക്കിയശേഷം പറമ്പിന്റെ നാലുവശവും വേലികെട്ടി തിരിക്കും. ഒരു പ്രാവശ്യം കൂടി പറമ്പ് അടിച്ചുചുട്ടിൽ നടത്തിയശേഷം മീനമാസം മുതൽ പണി ആരംഭിക്കും.





A comparison of in vitro cytotoxicity of undoped and doped surface modified CaS nanoparticles

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ABSTRACT

In the present study we compare the cytotoxicity of undoped and doped surface modified CaS nanoparticles synthesized by wet chemical co-precipitation technique using L929 human fibroblasts cell lines. The toxicity was determined by evaluating the cell viability and changes in cell morphology. In addition, the half-maximal inhibitory concentration (IC₅₀) values for all the samples were also compared. This analysis shows that undoped and terbium doped TEOA capped CaS nanoparticles are more biocompatible and will be better candidates for various applications in the biomedical field.

1. Introduction

Nanotechnology has revolutionized human life during the last few decades. The impact of nanotechnology is visible in electronics, medical science, genetic engineering, molecular biology, agriculture, food, and the textile industry. Nanoparticles have been widely employed in the medical field to diagnose and treat various diseases due to their small size and unique chemical and physical properties [1–3]. Several studies reveal that Calcium sulfide (CaS) nanoparticles are an important luminescent material that can be used for various biomedical applications, including cancer therapy [3–10]. The nanoparticles enter the body and contact with the cells and tissues when they are used for biomedical applications. Hence a detailed understanding of the toxicity of the nanoparticles in the human body is necessary for the safe use of nanoparticles.

The dose-dependent toxicity of the undoped and doped CaS nanoparticles has been reported earlier by us [11–15]. Here we present a comparative study of the in vitro cytotoxicity of undoped and doped CaS nanoparticles prepared by wet chemical synthesis. Two undoped samples, one capped with triethanolamine (TEOA) and the other capped with polyethylene glycol (PEG), were taken for our studies. Doped samples include europium doped and terbium doped CaS nanoparticles surface modified with TEOA. The cytotoxicity of the samples was assessed using MTT assay analysis on L929 human fibroblasts cells. In

addition, microscopic observation of the incubated cells was also done to check changes in the morphology of the cells.

The half-maximal inhibitory concentration (IC₅₀) values of the samples were also calculated. The evaluation of IC₅₀ in nanoparticles helps to detect the potential toxic effect related to their persistent accumulation in body parts. The half-maximal inhibitory concentration (IC₅₀) measures the dose of a drug that causes 50% inhibition in cells after a specified test duration. So IC₅₀ is used as a general indicator of the effectiveness of the substance used as a drug. In addition, IC₅₀ indicates the efficiency of the nanoparticles to achieve growth inhibition in cancerous cells in the field of cancer treatment using nanoparticles.

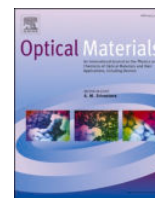
Comparison of the cytotoxicity of the samples was done using phase-contrast microscopy, percentage viability calculations, and IC₅₀ values.

2. Materials and methods

Both undoped and doped CaS nanoparticles were synthesized by the wet chemical co-precipitation method. The raw materials used were calcium chloride [CaCl₂·2H₂O, 97% Merck], sodium sulfide [Na₂S·xH₂O, Merck], europium acetate [Eu(OOCCH₃)₃, Alpha aesar 99.9%], terbium nitrate [Tb(NO₃)₃·5H₂O, 99.9% Sigma], TEOA, PEG, and 2-propanol. A detailed description of the synthesis procedure is reported in our earlier works [12–15]. Various samples were prepared employing this method, and the optimized samples were taken for

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Research Article

Effect of substrate temperature on the properties of spray deposited Ga₂O₃ thin films, for solar blind UV detector applications

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ABSTRACT

In this work, Ga₂O₃ thin films were deposited on glass substrates by chemical spray pyrolysis technique at three different substrate temperatures 350 °C, 400 °C, and 450 °C. The structural, optical, morphological and electrical characteristics of the deposited sample thin films were investigated. From the studies, it is understood that by tuning substrate temperature, we can extensively change the properties of the film. Optimum temperature for coating Ga₂O₃ thin films was understood and the work was extended to demonstrate a simple deep UV detector, working in photoconductive mode. The fabricated device exhibit medium response to UV light at 254 nm. The present work report the fabrication of solar blind UV detector based on Ga₂O₃ thin film, grown using low cost, easily scalable spray deposition technique.

1. Introduction

In recent years, Ga₂O₃, a wide band gap material, has been identified as a promising candidate for several applications including solar blind UV detectors [1,2], high power devices [3–5], memory devices [6,7] and high temperature gas sensors [8,9]. Compared to other wide band gap materials like SiC, GaAlN and diamond, Ga₂O₃ exhibit unique attributes such as ultra wide band gap (~4.9eV), excellent thermal and chemical stability and high dielectric constant values [10]. Some of the research works predict that Ga₂O₃ will be the future semiconductor, for high power electronic devices which are used in electric vehicles, current regulators, wind turbines etc. [2,3]. Being a wide band gap material, Ga₂O₃ is an ideal choice for fabricating solar blind UV detectors which produce signals only for wavelengths below 280 nm [1]. The alluring characteristics of Ga₂O₃, triggered the exponential growth of research papers related to this particular material in the last decade.

In general, Ga₂O₃ can occur in five different polymorph forms, namely α , β , ϵ , γ and δ [11]. Among them, the monoclinic phase β -Ga₂O₃ is especially interesting owing to its distinguished properties. The β -Ga₂O₃ has C2/m symmetry with lattice constants $a = 12.23$ Å, $b = 3.04$ Å, $c = 5.8$ Å and $\beta = 103.7^\circ$ [12]. So far, single crystals and thin films of gallium oxide were grown by several techniques including edge defined film-fed technique (EFG), pulsed laser deposition, atomic layer

deposition, sputtering and molecular beam epitaxy [5,6]. To achieve efficient devices, crystallinity, high degree of purity, uniformity of thin films are essential requirements. The oxygen vacancies and other defects incorporated during growth and deposition are pivotal, so that by carefully adjusting the deposition conditions and doping with suitable elements, we can modulate the various properties of the material [1].

Researchers have often adopted vacuum based techniques for device fabrications as the number of defects incorporated can be minimized. But for large scale production and commercial applications, it is often desirable to develop crystals and thin films by low cost, vacuum free techniques. Spray Pyrolysis is a simple, cost effective, solution based alternative method viable for large area industrial processes [13]. Even though there are many papers showing fabrication of Ga₂O₃ thin films using spray pyrolysis method [6,14,15], reports which extend up to device level implementation are limited. Thomas et al. has reported fabrication of thin film transistors based on Ga₂O₃ by spray pyrolysis technique [14]. To the best of our knowledge, there is only one paper which report UV detection property of β -Ga₂O₃ thin films, fabricated by spray pyrolysis method. In that paper, Ji et al. has reported feeble detection property, without giving the performance parameters and response time [1]. The main challenge in the fabrication of devices is that to obtain good quality uniform films with appreciable conductivity. Ga₂O₃ being a wide band gap material (4.5–5 eV), is basically an

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DRG-NET: A graph neural network for computer-aided grading of diabetic retinopathy

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Abstract

Diabetic retinopathy is emerging as a very serious vision disorder in the recent decades, due to escalation of diabetes world-over. This condition can be minimized to a great extent with timely prognosis. Computer-aided detection techniques are very useful for assisting ophthalmologists, for faster diagnosis and intervention. With the advent of digital fundus cameras and the digitization of retinal images, there is a huge availability of digital fundus images with expert-annotated labels. For addressing the challenge of digital image grading, an attempt was made to model the features in digital fundus images, utilizing the non-Euclidean geometry. Here, a Graph Neural Network with supervised learning is suitably adapted for diabetic retinopathy image grading. The images are represented as 3D graphs, to encapsulate discriminate information, as nodes in network. The features extracted from the diabetic retinopathy images, using Scale Invariant Feature Transform technique, is used for graph construction and training. The Diabetic Retinopathy Graph Neural Network namely, DRG-NET model is trained and validated on two publicly available datasets namely Aptos 2019 and Messidor. Ten different types of performance indicators, including accuracy and Cohen's kappa values, were estimated and used for the comparison of models. For the Aptos and Messidor dataset, the model achieved an accuracy of 0.9954/0.9984, F1-score of 0.9774/0.9968 and kappa score of 0.9930/0.9980, respectively. It is evident from the results that the proposed DRG-NET model shows state-of-the-art performance for retinal image grading.

Keywords Retinopathy · k -dimensional graph neural network · Non-Euclidean geometry · Feature descriptor

1 Introduction

The World Health Organization (WHO) estimates that around 300 million people will be affected by diabetes globally by 2025 [1]. Moreover, diabetic retinopathy (DR) is a progressive microvascular disease that requires early diagnosis and adequate treatment to prevent retinal damage. A retinal grading system based on the severity of the disease will be useful for adopting appropriate corrective measures. Retinal damages can be broadly classified into proliferative

DR (PDR) and non-proliferative DR (NPDR). The NPDR can be sub-grouped into 3 specific categories namely mild proliferative, moderate proliferative and severe proliferative conditions. The various grades of DR are denoted as numbers representing 0–4. The grade 0 images represent a healthy retina. The grade severity level 1 represents a mild non-proliferative stage showing symptoms of microaneurysms (MAs). The grade severity level 2 denotes moderate NPDR with an increase in MAs coupled with blood leakage into the retina causing haemorrhages (HMs). The yellow lesion such as exudates and cotton wool spots may also appear in grade 2. Grade 3 involves intra-retinal microvascular abnormality (IRMA) containing an enhanced number of DR lesions. Grade 3 represent a severe NPDR stage leading to blockage in a retinal blood vessel. Grade 4 represents proliferative diabetic retinopathy.

In the new era of computer-aided automated disease detection, several investigations have been made to address DR abnormalities, and a few of them are presented below. Somasundaram et al. [2] proposed a machine learning bagging

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Band gap engineering of TiO₂ by Mn doping and the effect of p-TNT: Mn/n-MnO₂ heterojunction on photocatalytic applications

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Abstract

The present study reports the achievement of improved photocatalytic performance of Titanium dioxide nanotubes (TNTs) by manganese doping and the subsequent formation of a p-TNT: Mn/n-MnO₂ heterojunction. The nanotubes and junctions are prepared by simple and cost-effective electrochemical anodization and doping techniques. The influence of doping and junction formation on the structural, optical, morphological and electrical properties of TNTs are analysed in detail. Energy dispersive x-ray mapping together with X-ray photoelectron spectroscopy is used to confirm the composition of the samples, while atomic force microscopy, field emission scanning electron microscopy and transmission electron microscopy are used for morphological assessment. The TNT/MnO₂ junction shows a photocatalytic degradation efficiency of ~98.6% with good cyclic stability for Rhodamine B dye. Manganese doping tailors the optical band gap of TNT from ~3.04 eV to ~2.73 eV enabling the absorption of visible photons for carrier production and induces p-type conductivity in the sample. While valence band photoemission spectra give insight into the Fermi level positions of doped and undoped samples and confirm the p type conductivity of the latter, the photoluminescence measurements give an idea regarding the defect states. The reduction in the band gap of TNT on Mn doping along with the formation of an n-MnO₂ layer with a band gap ~1.50 eV on its top play a crucial role in the improvement of the photocatalytic performance of the pn- heterojunction device.

Keywords TiO₂ · Heterojunction · Mn doping · Photocatalysis · Band gap tailoring

1 Introduction

The wide usage of dyes in many textile and cosmetic industries and their unethical discharge into water bodies have resulted in water pollution which has a serious impact on

the ecological balance [1–3]. The release of pharmaceuticals into aquatic environment is also a serious threat to the quality of water [4]. Researches are being conducted to arrive at economical and eco-friendly ways to remove unwanted organic and inorganic pollutants from water [5–7]. Investigations on photocatalysts that can degrade the contaminants in water to non-toxic products in the presence of sunlight stand out top on this list [8–11]. Scientists encounter several challenges, including the fact that often the fabrication processes are quite expensive, or it is challenging to remove the photocatalysts themselves from water to reuse them. Worse yet, the by-products that remain after degradation are toxic [12–16].

Semiconducting metal oxides like TiO₂ and ZnO, have caught considerable attention as effective photocatalysts due to their non-toxicity and good photochemical stability [17–21]. But the band gap of pure TiO₂ around 3.2 eV [22, 23] allows absorption only in the UV region and extension of the band gap to the visible range of the solar spectrum is one of the greatest challenges faced by researchers on TiO₂. Doping with

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Research Article

Green synthesis of ZnO nanoparticles with enhanced photocatalytic and antibacterial activity



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ABSTRACT

The study describes a concise and eco-friendly approach for synthesising nano ZnO (nZnO) particles using raw *Garcinia Cambogia* fruit pulp extract. The remarkable crystallinity, purity, and hexagonal wurtzite structure of nZnO are established by X-ray diffraction (XRD) analysis. The formation of almost spherical nZnO with an average diameter of 32.8 nm is revealed by Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). The Fourier Transform Infrared (FTIR) spectrum of nZnO outlines the synthesis mechanism. The recombinations of free excitons and oxygen vacancies are responsible for the peaks in the photoluminescence (PL) spectra. UV-Visible Diffuse reflectance spectroscopy (UV-Vis DRS) revealed that the optical bandgap of nZnO is 3.24 eV. nZnO exhibited excellent photocatalytic activity against the degradation of cationic and anionic dyes. The effects of process parameters on the extent of dye removal, such as photocatalyst quantity, solution pH, and time of irradiation, were investigated. The photocatalytic degradations of dyes were modelled by pseudo-first order kinetics, having a strong correlation coefficient ($R^2 > 0.95$). Statistical assessments of dye degradation using Analysis of Variance (ANOVA) and Least Significant Difference (LSD) were conducted. Antibacterial studies show that nZnO has a substantial bactericidal effect against pathogenic bacteria. Consequently, the green synthesised nZnO might be utilised to eliminate dyes and bacteria from industrial effluent water in an environmentally benign and cost-effective way.

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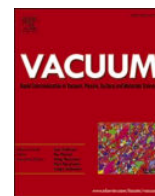
1. Introduction

Photocatalytic degradation of dyes or other organic contaminants has been a hotly debated topic since the final part of the twentieth century [1–5]. Synthetic dyes are now widely used in an array of items, including clothing, leather accessories, furniture, and plastics. However, approximately 12% of the dyes are wasted during the process of dyeing, and around 20% of this waste is released into the environment [6]. Dyes in wastewater inhibit processes including the normal physiological activity and photosynthesis in various aquatic plants and animals. Dyes also have a proclivity for forming chelates with metal ions, and these metal complexes are hazardous to aquatic organisms. Most of the organic dyes are toxic, carcinogenic, and have a direct impact on human and aquatic health [7].

Advanced oxidation processes (AOPs) are processes with fewer constraints and are now one of the most appropriate strategies for water treatment [8–12]. Among the several AOPs, a tertiary water treatment technique that has piqued the interest of researchers is photocatalysis using heterogeneous systems because of its capacity to break down target contaminants completely [13–15]. Photocatalysis employing semiconducting materials is regarded as a distinctly combative wastewater treatment methodology for the elimination of organic contaminants that are not removable by traditional approaches due to their good chemical stability and limited biodegradability. When the surface of a semiconductor (primarily oxides and sulphides) is illuminated with light of appropriate wavelength, electrons are elevated to the conduction band from the valence band. These excitons combine with oxygen or water, forming hydroxide radicals and superoxide anions, which have the ability to decompose a wide range of compounds, including commercial colours [16–18].

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Transparent heterojunctions of Cu-based delafossites n-CuInO₂/p-CuGaO₂ by reactive evaporation method for transparent electronic applications

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ABSTRACT

Fabrication of Transparent Conducting Cu-based p-n junction n-CuInO₂/p-CuGaO₂ by oxygen plasma assisted reactive evaporation method is reported herein for the first time. The p-n diode formed of p-CuGaO₂ of transmittance ~94% and conductivity $\sim 1.45 \times 10^{-3}$ S/cm and n-CuInO₂ of transmittance ~66% and conductivity $\sim 2.05 \times 10^{-3}$ S/cm manifests a rectification ratio ~164 at 4 V with turn on voltage ~3.61 V and an ideality factor ~4.1 and a transmittance ~76% at 618 nm wavelength. The optical bandgap of n-CuInO₂ is ~3.34 eV whereas that of p-CuGaO₂ is ~3.61 eV. The high rectification ratio along with good transmittance of the p-n junction gives it footing as a promising active device in transparent electronics.

1. Introduction

In recent years, the field of “Invisible electronics” [1] has a variety of applications in numerous technology related applications like functional smart windows, organic light emitting diodes, transparent flat panel displays etc. [2–4]. Recently, there is large interest in transparent conducting oxides (TCO's) -metal oxides which possess simultaneous behavior of good electrical conductivity and high optical transmittance in the visible spectrum [5–7]. Many researchers have reported the special structure of Cu-based and Ag-based delafossite TCOs suitable for optoelectronic applications in which the former possesses an “amphoteric behavior” in conductivity basically in CuInO₂ [8]. Hence, the fabrication of active devices based on both p-type and n-type delafossite TCOs is of great demand in this era of invisible electronics. The development of a p-type transparent conducting delafossite CuAlO₂ reported by Kawazoe et al. [9] invited the initial attention of researchers to the use of delafossites [10].

Both CuInO₂ and CuGaO₂ are potential candidates for the fabrication of transparent p-n junction diodes. Yanagi et al. reports the unique feature of capability of bipolarity in CuInO₂ [11]. There are reports on the manufacturing industry of transparent diodes using p-n heterojunctions based on delafossites and ZnO with configurations like CuAlO₂/ZnO [12], CuYO₂/ZnO [13] ZnO/CuGaO₂ [15] etc. Recent report by Mivolil et al. demonstrates the possibility of ZnO/CuGaO₂ heterojunction for space borne applications [15]. Since it has been reported

that the introduction of different compounds as layers of heterojunction results in a lattice mismatch which affects the device performance, many approaches are put forward to fabricate p-n homojunction diodes of various Cu-based n and p layers [16–18]. In 2001, Yanagi et al. fabricated p-n homojunction using CuInO₂:Ca as p-layer and CuInO₂:Sn as n-layer having forward to reverse current ratio ~10 with transmittance 60–80% [11]. As part of the research carried out in our lab to elucidate the role of Cu based delafossite in transparent electronics industry, Bindu et al. developed prototypes of thin film p-n homojunction diodes with configurations FTO/n-CuInO₂/p-Ca.CuInO₂/Ag and FTO/n-Sn.CuInO₂/p-Ca.CuInO₂/Ag, where the former showed better rectification and a junction with FTO/n-Sn.CuInO₂/p-Al.CuInO₂/Ag having rectification ratio of ~9.0 at 0.8 V and turn on voltage 0.62 V [8,18]. Also, Rahman et al. was successful in developing a thin film p-n homojunction diode with a very high rectification ratio ~612 with configuration n-CuInO₂/p-Ca.CuInO₂ on FTO by oxygen plasma assisted reactive evaporation method [16].

In this research work, we report the fabrication of transparent heterojunction diode with configuration FTO/n-CuInO₂/p-CuGaO₂/Ag by oxygen plasma assisted reactive evaporation method with rectification ratio ~164 at 4 V. Literature survey shows that development of diodes with the junction between CuInO₂ and CuGaO₂ is not reported till date, to the best of our knowledge. This study highlights the importance of CuGaO₂ as a promising p-type candidate for the fabrication of transparent thin film diodes in semiconductor industry.

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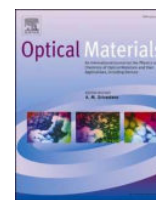
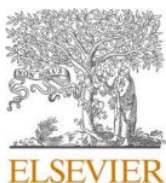
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Research Article

Influence of sodium doping on the material properties and photocatalytic activity of anatase titanium dioxide nanotubes prepared by anodization

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ABSTRACT

The properties of semiconducting materials can be altered to meet our needs by tuning their bandgap with suitable methods. Here bandgap tailoring of anatase TiO₂ nanotubes prepared by anodization technique is achieved by sodium doping at variant concentrations. The doped nanotubes with their reduced band gaps that match the visible range of solar spectrum exhibit greater photodegradation efficiency of methylene blue dye (97.3% in 180 min) than the undoped (56.8% in 180 min) with band gap in the UV region. Structural and morphological characterizations of the samples by X-ray diffraction, X-ray Photoelectron Spectroscopy, Raman Spectroscopy, Atomic Force Microscopy and Field Emission Scanning Electron Microscopy reveal that the doping-induced surface changes and increased Ti⁴⁺ to Ti³⁺ reduction play an active role in increasing the photocatalytic efficiency of the samples. Analysis of valence band photo emission spectra indicate shifting of fermi level away from conduction band edge with doping of Na¹⁺ at Ti⁴⁺ site producing defect induced super radical formation for photocatalysis.

1. Introduction

The development of modern industry has resulted in serious pollution of water bodies by organic compounds like dyes, pharmaceuticals and pesticides [1–3]. The toxicity and persistence of these compounds are matters of concern to the existence of aquatic as well as human life. The degradation of the organic pollutants has become a topic of interest among the researchers over the decades. The emergence of semiconductor photocatalytic technology has opened new windows in solving this environmental issue [4,5]. If the semiconductor materials can be engineered effectively to degrade the pollutants with the help of solar radiation, the threat caused by the organic pollutants can be reduced to a greater extent [3,6].

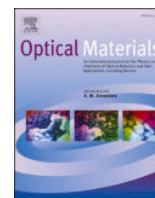
Titanium dioxide (TiO₂) is one of the widely investigated semiconductor material for its non-toxicity, low cost, optical, chemical and photocatalytic properties [3,6–12]. These materials find their applications in sensors, dye sensitized solar cells (DSSC), microelectronics,

catalysis and biomedical field [4,13–17]. Since photocatalytic reaction is a surface phenomenon, it is very sensitive to the surface structure. The reaction rate will be higher for catalysts with higher surface area [18]. When compared to nanoparticles and nanorods, nanotubes are having high surface to volume ratio. This facilitates higher interaction between the surfaces and the reactive species resulting in enhanced photocatalytic activity [19]. The TiO₂ nanotubes prepared by anodization have the advantage of providing higher surface area to enhance the efficiency of the device at low cost [19–21].

Typically, the band gap of anatase TiO₂ is 3.2eV which corresponds to the UV region [4,8,22]. This can lead to a decrease in dye degradation rate when employed for photocatalysis under sunlight. The spectral response of this wide band gap semiconductor can be improved through doping with suitable elements or by heterostructure formations [6,13, 23] [–] [25]. Bandgap tailoring of this semiconductor can enhance the optical absorption, reduce carrier recombination rate, improve carrier life time and charge transfer mechanism. Intense research is going on in

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Enhanced nonlinear absorptive behaviour of phenylcalix[4]resorcinarene-graphene oxide nanocomposite

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ABSTRACT

Calix[4]resorcinarenes is a macrocyclic molecule that serves as a host for various metal ions and neutral molecules. The anisotropic nature of this molecule makes it attractive as a nonlinear optical material. Herein, we report the remarkable developments in nonlinear absorption and competent optical limiting action of non-covalently functionalized phenylcalix[4]resorcinarene (PCR) graphene oxide (GO) compared to its constituent compounds. The Fourier transform infrared spectrum, Raman spectrum, photoluminescence spectrum, and UV-Visible absorption spectrum of the composite (PCR-GO NC) reveal the modified optical properties of PCR. The nonlinear optical studies were investigated by z scan technique using Q switched Nd: YAG laser operating at 532 nm with 7 ns pulse width. Reverse saturable absorption primarily contributes to the absorptive nonlinearity of PCR and PCR-GO NC in the nanosecond regime. Compared to the bare PCR sample, an elevated nonlinear optical (NLO) response is observed for the nanocomposite (PCR-GO NC), and the enhancement factor in the absorptive nonlinearity is found to be 3.4. Moreover, the optical limiting behaviour of PCR-GO nanocomposite (limiting threshold value - 0.91 J/cm²) is highly impressive compared to many of the benchmark results, making it suitable for making laser safety devices that can protect the human eye and devices from laser-induced damages. The phenomenally enhanced NLO behaviour of the nanocomposite could be derived from the combined effect of nonlinear absorption, photoinduced charge transfer between PCR and GO, and the intensified local field effect produced by GO.

1. Introduction

Materials with desirable nonlinear optical properties play a crucial role in optoelectronic and photonic applications such as memory devices, optical signal processing, optical limiting, and optical switching [1–3]. Third-order optical nonlinearity finds prime importance among the nonlinear processes because the refractive index variation induced by the intense light is fundamental to all-optical switching and computing. Organic materials and inorganic semiconductors are desirable materials for modifying light intensity and are thus explored in photonics [4]. Inorganic materials are better candidates to act as optical limiters from nanosecond to continuous-wave regimes [5–7]. However, poly conjugated organic materials have gained the attention of researchers because their structure-property relations permit reframing the design of molecules with a fast optical response, high nonlinearity,

and high damage threshold [8–10]. Fluorescent organic compounds are essential for developing low-cost optoelectronic devices [11]. Organic materials with outstanding nonlinear optical properties are designed by fine-tuning suitable donor and acceptor pairs through noncovalent interactions such as hydrogen bonding, π - π stacking, and charge-transfer interactions [12,13]. Thus, the quest for suitable organic chromophores for all-optical communication is always highly motivational.

The present study aims to identify the optical nonlinearity of phenylcalix[4]resorcinarene (PCR), a macrocycle synthesized from resorcinol and benzaldehyde in the presence of a p-toluene sulphonic acid-catalyzed reaction following green chemistry protocol. One of the methods for developing an optical system with desirable nonlinear properties is via material architecture, in which distinct materials are combined to form a composite material. Herein, we present the synthesis of a novel composite material, PCR-GO nanocomposite, and study its

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WISC-IV and Rey Auditory Verbal Learning Test Indicators of Specific Learning Disorder and Discrepant Academic Achievement

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Malini R¹ and Immanuel Thomas² 

Abstract

Though several studies have been undertaken to explore the correlates of academic achievement, there is a dearth of studies relating to the cognitive profiles of children who show marked discrepancies between their cognitive potential and actual academic achievement. The present study was undertaken in this context. The study was conducted on a sample of 308 students in the age range of 12–16 years, drawn from different schools in Kerala, India. The participants belonged to four groups, that is, Underachievers, Normal achievers, Overachievers, and those with Specific Learning Disorders (SLD). WISC-IV India and Rey Auditory Verbal Learning Test (RAVLT) were used for assessing cognitive functions. Results indicated that the SLD group could be discriminated from the other three groups in terms of Digit span, Letter-Number sequencing, Working Memory Index, and Processing Speed Index. Further, a retention score obtained from RAVLT could discriminate between the SLD and UA groups. Discriminant analysis of the variables resulted in the extraction of two significant functions composed of three variables of WISC and two variables of RAVLT. The results indicated that the different groups of scholastically backward children, though similar in their overall IQ, had distinct and characteristic cognitive profiles.

Keywords

cognitive indicators, academic achievement, underachievement, specific learning disorders, WISC-IV India, Rey auditory verbal learning test

Academic achievement, as an outcome variable, is known to be affected by a multitude of variables belonging to cognitive, affective, and social domains. The most important variable

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NAS-SGAN: A Semi-Supervised Generative Adversarial Network Model for Atypia Scoring of Breast Cancer Histopathological Images

Asha Das , Vinod Kumar Devarampati, and Madhu S. Nair , Senior Member, IEEE

I. INTRODUCTION

Abstract—Nuclear atypia scoring (NAS), forms a significant factor in determining individualized treatment plans and also for the prognosis of the disease. Automation of cancer grading using quantitative image-based analysis of histopathological images can circumvent the shortcomings of the prevailing manual grading and can assist the pathologists in cancer diagnosis. However, developing such a robust classifier model require sufficient amount of annotated data, while the labeled histopathological images are scarce and expensive to procure as annotation forms a time-consuming and laborious task. Hence, a semi-supervised learning framework combined with the deep neural network based generative adversarial training, that can improve the performance of the classification model with limited annotated data, is proposed in this paper. The proposed NAS-SGAN model consists of discriminator and generator models that are trained in an adversarial manner using both labeled and unlabeled samples. The discriminator model is designed as an unsupervised model stacked over the supervised model sharing the model parameters and learns the data distribution by extracting the discriminative features. The generator model is trained over a stable feature matching objective function following a composite GAN architecture, and its for the first time the semi-supervised GAN model is explored for the grading of breast cancer. Experimental analysis shows that the proposed model could better discriminate different cancer grades thereby improving the robustness and accuracy of the system, even with limited amount of labeled samples.

Index Terms—Breast cancer, generative adversarial network, histopathology, nuclear atypia scoring, semi-supervised learning.

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HISTOLOGICAL grading or nuclear pleomorphism scoring, often termed as nuclear atypia scoring (NAS) of cancer describes a tumor based on how far the structure of tumor cells differ from normal tissue. From the last few decades, the physical microscopic investigation and analysis of histopathological slides stained with haematoxylin-eosin (H&E) is considered to be the established procedure for breast cancer detection and grading. Breast consists of well differentiated cells, having specific structure and shape depending upon their functionality within the organ. However, in the malignant cancerous cells this differentiation is often reduced or lost when compared with the normal cellular tissue. The Nottingham grading system (NGS) adopted by the World Health Organization (WHO) is the most widely accepted standard for breast cancer grading. NGS, the modified Scarf-Bloom-Richardson grading system [1], forms a qualitative evaluation technique in which the grading score is calculated based on three morphological features: degree of tubule formation, nuclear pleomorphism or nuclear atypia and mitotic count [2]. Sample breast cancer histopathological images with the three grading scores are shown in Fig. 1 [3].

Automation of cancer grading often requires developing accurate and robust classifier models, which needs to be trained with a large amount of annotated data. The advancements in the field of digital pathology have been accelerated by the advent of whole slide imaging (WSI) techniques [4] that can produce high resolution digital slides within a fraction of minutes at reasonable cost. This has led to a drastic increase in the availability of histopathological digital images. Often these images are unlabeled and needs annotation to be carefully done manually by experienced and proficient pathologists, to be used for training a robust classifier model. This manual examination and annotation of a large number of high resolution digital slides form a tedious, expensive and a time-consuming task. The resemblance between the tissue structure for different cancer grades and the complex structure of the cancerous tissue pattern makes annotation process a laborious work for the pathologists. Furthermore, it requires several such experts to annotate the same image to assure the fidelity of diagnosis which makes annotation much expensive, especially for procuring a decent amount of labeled images.

The need for annotated data can be considerably reduced if the information from the unlabeled samples could be made use



RDD-Net: retinal disease diagnosis network: a computer-aided diagnosis technique using graph learning and feature descriptors

Amritha Abdul Salam¹ · Manjunatha Mahadevappa¹ · Asha Das² · Madhu S. Nair³

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Abstract

Ocular diseases are a prevalent disease among the aging population across the world. The retinal damage and vision loss can be substantially decreased through early-stage diagnosis with computer-aided ocular disease diagnosis. With the use of color fundus photography for obtaining digital retinal fundus images, there is a growth in the online accessibility of digital fundus images. For diagnosing ocular diseases, an attempt was made to model graphs from images for feature learning. Three feature detection algorithms, namely scale-invariant feature transform, binary robust invariant scalable keypoints and oriented fast and rotated BRIEF (ORB) techniques are computed individually. As graphs are represented in the non-Euclidean domain, the graph neural network is used to learn the node embedding to model the network for ocular disease diagnosis. Three distance measures: the Euclidean, Manhattan and Chebyshev distances, are computed for analyzing the discriminative power of the model. The proposed RDD-Net model is trained and evaluated on the ODIR-2019 dataset with eleven different performance indicators. The results show that mapping images to non-Euclidean geometric space have obtained a successful diagnosis of ocular diseases from digital fundus images. The ORB descriptor outperforms the other two feature descriptors as well as the existing algorithms for ocular disease diagnosis. Results of the Chebyshev distance measure show superior performance when compared to the other two distance measures based on computation time and performance evaluation metrics. The proposed RDD-Net achieves an F1-score of 0.9970 and a sensitivity of 0.9969 with the ORB descriptor and shows state-of-the-art performance.

Keywords SIFT · BRISK · ORB · Graph neural network · Non-Euclidean geometric space

1 Introduction

Ophthalmologists encounter serious challenges in diagnosing ocular diseases that cause damage to the retina. Early diagnosis and intervention prevent severe retinal damages that lead to vision loss [1]. The hyperglycemic and elderly population are at risk of developing eye diseases and require periodic monitoring. It is estimated that approximately, 196

million people will suffer from age-related macular degeneration [2], 13.5 million will go blind due to cataract [3], 76 million will suffer from glaucoma by 2020 [4]. Globally diabetic retinopathy [5] is expected to rise from 126.6 million in 2010 to 191.0 million by 2030 [6]. Myopia is a common disease that affects 1.45 billion people with the highest incidence rate in Asia [7]. Estimates from 2010, suggest 1.39 billion people suffer from hypertension worldwide [8]. This leads to eye-sight disorders such as hypertensive retinopathy and other retinal diseases. It's important to address these retinal diseases that affect a large section of the population around the world. Examples of retinal diseases are shown in Fig. 1 from the ODIR-2019 database.

Earlier attempts on algorithms for diabetic retinopathy detection were based on classical approaches from image processing such as threshold setting [9]. Feature learning and subsequent classification of diabetic retinopathy using Support Vector Machine (SVM) was carried out by several researchers [10–12]. Sheet et al. [13] implemented a

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ഉള്ളടക്കം

മലയാളഭാഷയിലെ സംസ്കൃതരൂപങ്ങളും പ്രയോഗസാധുതയും അലക്സ് എൽ.	11
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പ്രൊഫസർ, മലയാള വിഭാഗം, യു.സി. കോളേജ്, ആലുവ

“എഴുതുക തോന്നുന്നപോലെ നീയിച്ഛിച്ച
വരികൾ നിൻരീതിയിൽത്തന്നെ
ഒരുവഴി മാത്രമേ ശരിയെന്ന പാലത്തി-
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ഒഴുകിക്കടന്നുപോയ്, ഓർക്കുക കവിതയിൽ
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ഒരു മുൻവ്യവസ്ഥയുണ്ടതിശയിച്ചീടണം
കടലാസിലുള്ള ശൂന്യത്തെ”

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കയ്യെഴുത്തിൽനിന്ന് അച്ചടിയിലേയ്ക്കുള്ള മാറ്റം സാഹിത്യത്തിലുണ്ടാക്കിയ വിസ്ഫോടനാത്മകമായ പരിണാമത്തിന്റെ തുടർച്ച തന്നെയാണ് തിരമൊഴിയായി മാറിയപ്പോഴും സംഭവിച്ചത്. സർഗ്ഗാത്മകതയെയും സാഹിത്യീയതയെയും ജീവിതാവബോധത്തെയുമൊക്കെ മാറ്റിമറിക്കുന്ന സങ്കല്പനങ്ങൾ കവിതയെഴുത്തിന്റെ രീതിക്കൊപ്പം മാറിവന്നു. ഓലയെഴുത്തും പേപ്പറെഴുത്തും കടന്നു വോളെഴുത്തിലേയ്ക്ക് കടക്കുമ്പോൾ അക്ഷരങ്ങളുടെ മുർത്ത അമൂർത്ത സങ്കല്പനങ്ങൾ വരെ തകിടം മറിയുന്നുണ്ട്. വെബ് ലോഗിന്റെ ചുരുക്കെഴുത്തായ ബ്ലോഗ് എന്ന ഇടം സമകാലിക എഴുത്തിന്റെ ഇടമായി മാറുന്നു. സാമൂഹിക മാധ്യമങ്ങളെല്ലാം കവിത ആവിഷ്കരിക്കുവാനുള്ള പുതുസ്ഥലങ്ങളായി മാറുന്നിടത്താണ് കവിതയുടെ എഴുത്തും വായനയും പുതിയ പ്രതലങ്ങൾ തേടുന്നത്. മലയാളകവിതയുടെ പുതുവർത്തമാനത്തിൽ സാങ്കേതികവിദ്യയ്ക്കുള്ള പങ്ക് ഏറെ പ്രധാനമാണ്.

നവമാധ്യമങ്ങളിലൂടെ കടന്നുവരുന്ന കവിത എന്നതിനുമപ്പുറം സൈബർ കവിത, വാക്കും ശബ്ദവും ദൃശ്യവും ചിത്രവും സൈബർപ്രതലത്തിന്റെ ചലനാത്മക സാധ്യതകളിലൂടെ ആവിഷ്കരിക്കുന്നു. വാക്കുകളെ സാങ്കേതികപരമായ വിവിധ സാധ്യതകളിലൂടെ അവതരിപ്പിക്കുന്ന നവമാധ്യമ കവിതകൾ ബഹുവിധ ഭാഷണത്തിന്റെ അടരുകളെ സന്നിവേശിപ്പിക്കുന്നു. ഏകകർത്താവെന്ന സങ്കല്പത്തിലുള്ള ഊന്നലുകളെയെല്ലാം അപ്രസക്തമാക്കിക്കൊണ്ടുള്ള പാഠരൂപീകരണം ഇവ സാധ്യമാക്കുന്നു. നിശ്ചിതവും മാറ്റമില്ലാത്തതുമായ പാഠമെന്ന സങ്കല്പനത്തിന്റെ സ്ഥാനത്ത്



Amphiphilic block copolymers: From synthesis including living polymerization methods to applications in drug delivery

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ABSTRACT

Controlled radical polymerization (CRP) is a useful tool for the synthesis of new polymeric materials with varying compositions, functionalities, and topologies capable of self-assembly into well-defined supramolecular structures. Controlled supramolecular assemblies of block copolymers (BCs) could lead to bioactive and biodegradable materials with extraordinary properties that could be used as targeted drug delivery scaffolds for biomedical applications. Loading and delivery of drugs to explicit areas of the human body using materials-based systems have been moving towards the forefront of biomedical research for the past few decades. The idea has arisen from our progressing knowledge of materials – for example, biocompatible nanomaterials that encapsulate drugs and respond to environmental stimuli, and biodegradable hydrogels with tunable drug release profiles. Physical aggregates of amphiphilic molecules, such as polymeric micelles have been considered as powerful nanocarriers in the dawning era of polymer therapeutics. Polymeric nanoparticles-based therapeutics due to their flexibility in structure and unique chemical properties have made a significant clinical impact and has resulted in the development of polymer-drug conjugates that could enable the delivery of therapeutic agents to their intended site of action in a spatiotemporal manner, which can further improve efficacy and reduce toxicity. An ideal drug delivery system must respond to physiological changes in such cases synthetic polymers which show environmentally responsive behavior is the need of the hour. Advances in the fields of CRP have led to the development of multifunctional polymeric nanoparticles with precise control over the individual polymer segments. This review focuses on some of the most important CRP techniques and some recent developments in the field of stimuli-responsive BC systems. We hope that this review will not just give enlightening knowledge to analysts in this field but also offer new insights and applications for the advancement of CRP.

1. Introduction

Amphiphiles (from the Greek, amphis: both and, philia: love, friendship) are molecules that have an affinity for two distinct kinds of environments. This dual character is incorporated into the molecule by covalently linking parts having diverse properties. Given the chance, the two unique components try to reduce their contact, thereby driving the amphiphilic molecules to acquire a preferential orientation. Accordingly, amphiphilic molecules self-assemble at interfaces and in solutions resulting in considerable changes in interfacial properties and significant improvements in compatibility and partitioning.[1] Surfactants and (polar) lipids are expert examples of low molecular weight amphiphiles with different hydrophilic (water-loving) and hydrophobic (water-hating) parts.[2,3]

The amphiphilic nature of a surfactant or lipid results in different interactions of both the part of the same molecule either with a solvent (polar or non-polar) and/or the surface. There are two distinct approaches to deliver good intermolecular contacts conceivable in surfactants while taking out ominous ones: self-assembly in solution and adsorption at a surface or an interface. The self-assemblies can be a mixed aggregate formed together with a macromolecule and/or a low molecular weight cosolute or it involves only amphiphilic molecules.[4]

Self-assembly involves the formation of realms of hydrophobic clusters (in contact with a nonpolar solvent) and domains of hydrophilic groups (in contact with a polar solvent) leading to complex phase behavior.[5,6] A general observation is that the phase behavior becomes more extravagant as the size of the surfactant molecule increases.[7]

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Enhanced photocatalytic activity of nZnO/n⁺Al:ZnO homojunction with an overlayer of Al₂O₃ nanoballs

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Abstract

This paper reports improvement in the degradation efficiency of ZnO for the organic dye methylene blue by constructing a homojunction of nZnO and n⁺Al doped ZnO with an overlayer of alumina nanoballs. The thin film junction is fabricated by the simple, cost-effective two stage electrochemical method of anodization followed by electrochemical doping at room temperature. Structural, optical, morphological and electrical analyses are done to elucidate the corresponding properties of each layer as well as of the junction. The compositional depth profile is obtained by the Rutherford backscattering technique. Valence band x-ray photoelectron spectroscopy in conjunction with optical data is used for designing the schematic of the junction formation. The rectification ratio of the thin film junction is determined to be $\sim 10^2$ from voltage–current data.

Keywords: ZnO, homojunction, Burstein Moss effect, alumina, photocatalysis

(Some figures may appear in colour only in the online journal)

1. Introduction

With the rapid increase in industrialization and the injudicious and unethical methods of disposal of industrial effluents to surroundings, our environment including air, water and soil faces a severe risk of alarmingly high rate of contamination. The disposal of pollutants like organic dyes, plastic materials, chemical pesticides etc without proper treatment to rivers is becoming a major threat to our waterbodies [1, 2]. Since the performance of conventional water treatments do not yield expected results [3], advanced oxidation process (AOP) [4, 5]

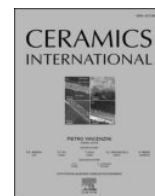
replaces the conventional technologies. Water treatment using photocatalytic activity of semiconductors based on AOP is an emerging method [6]. In this technique, the organic pollutants that come in contact with the surface of semiconductors are readily converted to benign end products. The essential features recommended for an ideal photocatalyst are (a) high specific surface area (b) suitable band gap for the optical absorption of sunlight in a wide range (c) long lifetime of photogenerated charge carriers (d) high stability and reusability [7]. Extensive research on the applicability of semiconductor metal oxides like CeO₂, TiO₂, ZnO, WO₃, SiC, CuO, CdS, PbS, SnO₂ for photocatalysis are in progress [8, 9]. ZnO nanostructures [10–12] have promising features such as high photochemical reactivity, chemical stability, biocompatibility,

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Photoluminescence studies of non-toxic monoclinic yttrium oxide quantum dots synthesized at low temperature for live cell imaging applications

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ABSTRACT

Synthesis of monoclinic Y_2O_3 remains a challenging task due to complex formation conditions such as high pressure or high temperature environments. Monoclinic yttria exhibits better photoluminescence characteristics compared to the cubic phase and hence can be a better host for nanophosphors. Reports are available predicting the stability of monoclinic phase at low temperature in extremely fine particles. But experimental preparation of this phase at low temperature is not yet reported. Here we report the first-time preparation of monoclinic Y_2O_3 at 90 °C using simple laboratory hot air oven. The synthesized nanoparticles exhibit intense PL emission in the blue region and hence can find applications in display industry. The band structure calculations were carried out using density functional theory and the excitonic Bohr radius was estimated using the electron as well as hole effective masses determined from band structure. The cytotoxicity studies reveal non-toxic nature the particles. The fluorescence imaging experiments show that the material is capable of emitting blue fluorescence in L6 skeletal cell lines and it ensures the applicability of this material in the biomedical field.

1. Introduction

Phosphors are physical systems which exhibit photoluminescence. The predominant materials for phosphor applications include oxides, sulphides, selenides, nitrides etc. Among these, oxides show more stability. Yttria or yttrium oxide is one of the most explored phosphor host materials which has unique physical, chemical and optical properties. It finds applications in display [1] as well as biomedical industries [2,3].

Y_2O_3 mainly exist in three phases namely cubic, monoclinic and hexagonal. The most reported phase of yttrium oxide is its cubic phase as it shows greater thermal stability compared to the other phases. Almost all application-level research focuses on this particular phase [4,5]. Y_2O_3 favours cubic phase at ambient pressure but it switches to monoclinic and hexagonal phase with the increase in pressure [6]. Certain reports claim that monoclinic yttria shows better photoluminescence characteristics than cubic yttria [7]. However, there are only less studies on this phase since complex procedures are required for the formation of stable monoclinic yttrium oxide. High temperature as well as high pressure techniques are employed for the preparation of monoclinic yttrium oxide according to reports [7–9]. There are reports which claim the stability of monoclinic yttria in fine particles [10,11]. However, no

attempts are made on the low temperature synthesis of this phase. According to literature, stable monoclinic yttrium oxide can form at low temperature when the particles size is extremely small [8]. The experimental confirmation for the same is not yet reported.

Our research becomes important as we tried to synthesize monoclinic yttrium oxide at low temperature (90 °C) using a simple laboratory hot air oven and the attempt was fruitful. The work includes the preparation of monoclinic Y_2O_3 at low temperature using laboratory hot air oven. Here, urea is employed as the fuel and post annealing techniques were not performed for the development of monoclinic phase. The prepared samples were characterized using x-ray diffraction (XRD), Raman Analysis and high-resolution transmission electron microscopy (HRTEM) for structural analysis. Energy Dispersive X-Ray Analysis (EDX) spectrum was taken for elemental confirmation and the material was optically characterized using UV–Vis–NIR absorption spectroscopy and photoluminescence (PL) measurements. The work also focuses on the antibacterial studies and cytotoxicity of the sample. We also tried to explore the antioxidant behaviour of the sample and imaging possibility.

The electronic band structure for the bulk material was also studied using periodic density functional theory (PDFT). The confinement effects were thus studied by estimating the Bohr-exciton radius using the

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Room temperature intrinsic ferromagnetism in pulsed laser ablated few layers of 2D-WS₂ on Si/SiO₂ substrates

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ABSTRACT

In this work we report the room temperature intrinsic ferromagnetism of pulsed laser deposited few layers of WS₂. The ablation was carried out by employing the fourth harmonics of Q-switched Nd-YAG laser (266 nm) at a temperature of 700 °C on Si/SiO₂ substrates. Few layers of WS₂ were confirmed by Raman and AFM measurements. The photoluminescence spectrum reveals the defect free nature of few layers of WS₂ and exhibits intense emission near the band gap. VSM measurements have explored the room temperature intrinsic ferromagnetism in a few layers of WS₂ thin films with a saturation magnetisation of 20.1 μemu. This is the first report of intrinsic ferromagnetism in PLD grown few layers of WS₂. The room temperature intrinsic ferromagnetic properties in a few layers of two dimensional WS₂ can be exploited to design atomically thin spintronic devices.

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1. Introduction

Inspired by the discovery of graphene two dimensional (2D) transition metal dichalcogenides (TMDCs) received much interest in the field of material science [1,2]. These low dimensional materials with unique optical and electronic properties will be dominant in the upcoming generation of optoelectronic devices [3]. They exhibit X-M-X layered structure with a metal atomic layer sandwiched between the chalcogen layers [4,5]. This layered structure allows them to make a cross over from indirect band gap to direct band gap when they are scaled down from bulk to mono/few layers [6–8]. In the group of TMDCs WS₂ is a prominent member and the least investigated one compared to others. It possesses the highest carrier mobility due to its smallest effective electronic mass, strong thermal stability, more resistance to oxidation and larger spin-orbit coupling etc [9,10]. Some of the major application of WS₂ includes sensors [11], transistors [12], photovoltaics, hydrogen storage etc [13,14].

The optical and electrical properties of 2D materials are most investigated based on these applications. The magnetic features

of these layered materials remain unexplored to a great extent. The magnetic studies reveal the ferromagnetic behaviour of mono/few layer TMDCs rather than the diamagnetic character of the bulk TMDCs [15]. Tuning the magnetic properties in 2D layered materials can open up new perspectives in the future of spintronic and quantum information devices [16,17]. A ferromagnetic semiconductor allows the controlled generation and detection of spin currents, which facilitate the fabrication of low dimensional spintronic devices. There was many attempts performed to induce long-range ferromagnetism in 2D materials. Introduction of defects into the lattice, transition metal doping, applying tensile strain, modification in the edge structure and saturation rate etc are some of the methods to realize the ferromagnetic behaviour in these materials [18]. Lie et al [19] proposed the magnetic properties of MoS₂ nanoribbons with armchair and zigzag edges using first-principle calculations. Zhang et al examined the ferromagnetism in WS₂ nanoribbons with zigzag edges using the first principle calculation [20]. Most of the reported works on magnetic studies are restricted to the theoretical aspects of WS₂. There are reports on experimental studies on the magnetic characteristics of WS₂. Ding et al [21] reported the enhanced ferromagnetism induced by defects in WS₂. In another report room temperature ferromagnetism exhibited by high quality vanadium doped WS₂ monolayers

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Improving the Moisture-Induced Part Qualities by Optimization of Plasticization and Processing Parameters of Injection Molding



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Abstract

Silver streak marks, air bubble defects, etc. are some of the undesirable features that are regarded as visual surface defects on injected thermoplastic parts and these defects are typically brought on by moisture, trapped air, etc. Moreover, hygroscopic materials have the natural propensity to absorb moisture from the environment during production, thereafter, the finished product can suffer from a number of quality problems, leading to produce more plastic waste. Therefore, to improve the quality of the final product part, this research study aims to examine the impact of injection speed, mold temperature (MT), and plasticization parameter levels on a moisture-induced optical product part. Consequently, it was found that the product samples (C2: 50mm/sec - injection speed, 95 °C MT and C5: 50mm/sec - injection speed, 115 °C MT) produced by the optimization of the plasticization process are perfect resemble to the product part produced by using the dried raw material. Moreover, the measured transmittance value of those samples (C2: 90.59 %, C5: 91.36 %) was close to the transmittance value of the product part produced using the dried raw material (D1: 91.29%). This endorses the research finding that by using the method of optimization of the plasticization and processing parameters of injection molding the product part quality can be improved and the moisture effect defects can be suppressed.

Keywords: Silver Streak Marks; Air Bubble; Atmospheric Moisture Absorption; Hygroscopic Materials; Plasticization Parameter Optimization; Processing Parameters; Injection Molding; Polycarbonate

Introduction

Silver streak marks, air bubble defects, etc. are some of the undesirable features that are regarded as visual surface defects on injected thermoplastic parts. If they do, it may be quite hard to solve this technological issue, especially if the reason for their occurrence isn't genuinely understood. Surface defects appear in a variety of forms on injected thermoplastic parts; The defects may be brought on by poor mould design (flashing, burning markings, visible weld lines), improper production circumstances, or improper preparation of the polymer granulate, depending on the factors that led to their formation of flow marks, gate design, and others. According to D.V. Rosato and Marlene G. Rosato [1] surface defects like splay marks, air bubbles and silver streaks are typically brought on by moisture, trapped air, etc. Likewise, hygroscopic materials like polyurethane, acrylonitrile butadiene styrene, polycarbonate, and others have found extensive use in engineering, biomedical, and automotive industries. However, because of these materials' natural propensity to absorb moisture

[2] from the environment during production, the finished product can suffer from a number of quality problems, and leading to the produce more plastic waste.

Research studies were conducted to understand the impact of moisture and to improve the product part quality. Thereby, Martin Kusy and Miroslav Kosik [3] in their study, examined the surface defect brought on by moisture and the appearance of silver streaks on the surface of an injection-molded component. Similarly, U. Schulz and S. Jakobs [4] studied how polycarbonate optical lenses are affected by moisture absorption. Moreover, F. Xie and V. Kurusingal [5] in their paper discussed the effect of moisture absorption, surface defects, degradation and stabilization of polyurethane elastomers. Furthermore, H Park and B Kim [6] used the screw quenching experiment in the plasticization process to investigate the formation of entrapped air bubbles in the screw channel. Thereby, Han Su [7] study on the enhancement of moisture-induced plastics injection molding process by

RELATIONSHIP BETWEEN SPIRITUAL INTELLIGENCE AND JOB PERFORMANCE AMONG MANAGERIAL LEVEL BANK EMPLOYEES IN COCHIN REGION

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ABSTRACT

Banks offer good social status, comparatively better salary and nice office to work. But, work pressure is huge on banking professionals as business volume increases and also with the increase in cadre. A model developed by Campbell (1990), provides a comprehensive overview of the theoretical lineage to predict important employee outcomes, including turnover and citizenship behaviours, job performance, absenteeism, and tardiness (Meyer *et al.*, 2002). This study explores the “Relationship between Spiritual Intelligence and Job Performance among managerial level employees in Bank sector in Cochin region”.

Spiritual intelligence is the mind’s capacity to handle substantial and spiritual aspects of life. It calls for multiple ways of knowing and for the integration of the inner life of mind and spirit with the outer life of work in the world. According to previous studies, spiritual intelligence can be effective in the promotion of different variables. One such variable is job performance. Job performance of employees may have potentially serious effects on an organization’s function and can be a major influence on its effectiveness. This study explores the relationship between spiritual intelligence and job performance among managerial level employees in banking sector in Cochin region. A sample size of 300 was collected using simple Random Sampling for this study. Data collection was performed by using the self-report measure for the Spiritual Intelligence Self-Report Inventory (SISRI-24) with psychometric and statistical support developed by David King and Teresa L. De Chico and the Job Performance Questionnaire by Campbell (1990). According to my analysis the results showed that a definite correlation existed between spiritual intelligence and Job Performance among employees. Higher spiritual intelligence corresponded to higher Job Performance, which was proven high for women employees in banking sector.

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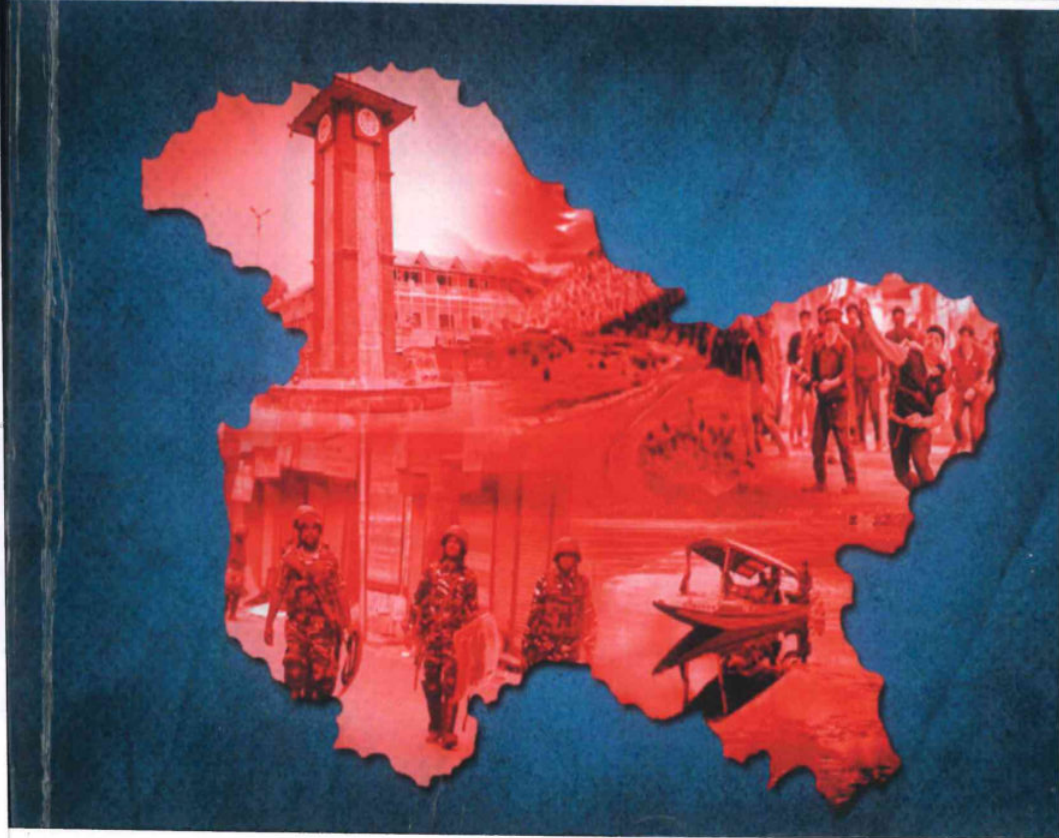
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डॉ. शगुफ़्ता नियाज़

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देश-विभाजन, भारत की स्वतंत्रता और राष्ट्रीय उपलब्धि का ग्रहण था जिसकी काली छाया में मानवता क्षत-विक्षत और आहत हुई थी। जिस भारत की कल्पना स्वाधीनता आंदोलन के शहीदों और क्रांतिकारियों ने की थी वह धूमिल और प्रायः नष्ट-भ्रष्ट हुई। स्वाधीनता मिलने के साथ ही दुख-तकलीफों, यातनाओं और संघर्षों का एक नया सिलसिला शुरू हुआ जिसका आज भी कोई अंत नज़र नहीं आ रहा। इस एक झटके ने सभ्यता और संस्कृति, राष्ट्र और कौम संबंधी अवधारणाओं में ऐसी तब्दीली ला दी कि लोग हतप्रभ से देखते रह गये। भारत की वर्तमान सामाजिक, सांस्कृतिक और राजनीतिक हालत के कारणों की खोज में जुटते हैं तो पाया जाता है कि उनकी जड़ें विभाजन की त्रासदी से होती हुई इतिहास में दूर तक फैली हुई है। इसका उत्तम दृष्टांत है कश्मीर समस्या जो भारत के आगे आज भी सबसे ज्वलंत एवं तनाव का मुद्दा बना हुआ है। धर्मांधता, धार्मिक कट्टरता और आतंकवाद साथ में मिलने से कश्मीर की धार्मिक स्थिति में बदलाव प्रकट होने का नतीजा था कश्मीरी पंडितों का विस्थापन।

हिन्दू रहित स्वतंत्र कश्मीर राष्ट्र का नारा बुलंद करने वाले यह भूल जाते हैं कि राष्ट्र एक राजनीतिक इकाई नहीं बल्कि सांस्कृतिक अवधारणा है। कश्मीर की धरती में अत्याचार-आक्रमण के कारण निष्कासन का दौर होता रहा जो आज अपना विकराल रूप धारण करके खड़ा है। कश्मीर विस्थापन, वास्तव में धार्मिक कट्टरता एवं आतंकवाद से उपजी हिंसात्मक हरकतों का नतीजा है। 1990 में आतंकवाद द्वारा सृजित राजनीतिक उथल-पुथल की वजह से लगभग साढ़े तीन लाख कश्मीरी पंडित, विस्थापन के भीषण दौर से गुजर गये। चारों तरफ अराजकता और उलझन थी, जीवन की सारी प्रतीक्षा निराशा एवं बेबसी में तब्दील हो गई। सारे चल एवं अचल संपत्ति, सालों के कठिन प्रयत्न से इकट्ठे किये कीमती सामान और जायदाद सब सड़ने के लिए छोड़कर पंडित अपनी सुंदर घाटी से खाली हाथ भाग गये। लगातार हो रहे आक्रमक तेवर और आक्रमण से मजबूर अपनी जान एवं सम्मान को बचाने की कोशिश में आँधी में छितरे हुए पत्तों की तरह कश्मीरी पंडित सब कहीं बिखर गये। सबके जीवन में वतन महत्वपूर्ण एवं एक जरूरत है, इसके बिना हम सबकुछ खो जाते हैं। लेकिन कश्मीरी पंडित को जिंदा बचने के लिए रात के अँधेरे में वही वतन छोड़ने के सिवाय कोई विकल्प नहीं बचा



Endophytic Fungal Diversity in *Eclipta prostrata* (L.) L through Illumina MISEQ Platform

Sreelakshmi Rajesh, M Anilkumar*

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ABSTRACT

*Plant-microbe interaction is a common and inevitable phenomenon that has been studied in detail by many researchers. Some of these relationships are beneficial while others are harmful. Among the beneficial interactions, endophytic association of a bacteria or fungi with plants are of great interest. These beneficial plant-microbe interactions are said to affect plant health, resistance and stress tolerance level in a positive way. Some of them have influenced in their metabolic pathways too. The present study is an attempt to understand the endophytic fungal diversity in the leaves, stem and roots of *Eclipta prostrata* (L.) L through metagenomic approach using illumina MiSeq platform. Metagenomic diversity analysis were based on the sequencing of ITS region of endophytic fungi. OTU analysis at different taxonomic level clearly catalogues two phyla viz. Ascomycota and Basidiomycota in all the three samples. OTU heatmap analysis elucidated the most prevalent species in the sample viz. *Vishniacozyma*, *Wallemia*, *Cladosporium*, *Verticillium*, *Pichia* and *Acremonium* with a prevalence of 1.0 at a minimum threshold of 0.010%. Comparative analysis revealed 164 fungal endophytes that were common to both leaf, stem and root while 174 genera were exclusive to leaf and stem and 80 were unique to the root sample. This diversity analysis has helped in identifying the endophytic fungi in *E. prostrata* and would form a base for further investigation on their role in metabolic pathways or in contributing to ethnomedicinal properties.*

Keywords: *Metagenome, Illumina Miseq, OTU, diversity analysis, relative abundance*

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INTRODUCTION

Plants can harbour microbiota both in its rhizosphere and the phyllosphere ecosystems [1]. They can be archaea, fungi, bacteria, viruses or oomycetes [2, 3] and the interactions can be either pathogenic or beneficial [4]. Mutualism, symbiosis, commensalism or neutralism are some of the beneficial interactions. Out of these, endophytes are an important group of microorganisms that execute a mutualistic beneficial interaction in plants which can include both fungi and bacteria. They enter the plant through rhizospheric soil and colonise its internal tissues [5] without showing any harmful effects on plant health [6,7]. Studies demonstrated that these endophytes developed certain strategies that influence the production of metabolites in plants [8]. The recent research conducted in endophyte biology exposed that almost all plants are symbiotic with mycorrhizal fungi and/or fungal endophytes [9]. These associations could be traced back to the time of plant origin and can be regarded as a key to bring plant evolution on land. Endophytes reside within the plant tissue and can grow and then sporulate within them without producing any harm to the host [10,11,12]. Based on evolutionary relations, taxonomy, plant hosts, and ecological purposes there are two types of fungal endophytes viz.; the clavicipitaceous endophytes (C-endophytes) and the nonclavicipitaceous endophytes (NC-endophytes). The former commonly infects grasses and the latter are found from tissues of ferns, conifers, non-vascular plants and angiosperms [13]. Metagenomics is a culture independent way of understanding microbial populations which opened a new dimension of ecosystem analysis. It encompasses sampling genome sequences of a group of microorganisms occupying a common environment [14]. Over the past decade next generation sequencing (NGS) is extensively used in metagenomics because of its high speed, low cost and technical advancements [15] that increased the number of metagenomic projects dramatically [16]. The first metagenomic study using NGS technique was based on pyrosequencing to explore the microbial sample in Soudan Mine, USA, that used a systemic approach by integrating biology, chemistry, bioinformatics

which lead to a milestone in advancing modern microbial ecology. Earlier, molecular taxonomy of fungal classification was much more difficult [17,18,19,20] because of the presence of intermediate forms, the instability of morphological characters and the phenotypic overlay among various taxa [21]. *Eclipta prostrata* (L.) L, commonly called as *Bhringaraj* in India, is a plant of great ethnomedical significance. This plant belongs to Asteraceae family can be seen commonly in tropical and subtropical regions [22]. A number of compounds like Wedelolactone, Ecliptalbine, Demethylwedelolactone, Eclalbatin, Dasyscyphin C and Ecliptine are reported from *E. prostrata* [23] that contributed hepatoprotective, hair growth promoting, antidiabetic, analgesic, anti-inflammatory, neurological, antimicrobial, antioxidant, antimalarial, cardiovascular, anticancer, antiulcer, immunomodulatory and antiepileptic effects [24]. The endophytic microflora and its metadiversity remain an underexplored area in *E. prostrata*. The present work is an attempt to analyse the diversity of endophytic fungi in the leaves, stem and roots of *Eclipta prostrata* (L.) L using metagenomic approach through illumina Miseq platform.

MATERIAL AND METHODS

Plant Sample Collection and Sterilization

Healthy and flowering plant samples of *E. prostrata* were collected from three sites (Ernakulam 10°0'12.1" N 76°17'30.8"E) with same soil conditions, pooled and used for DNA extraction after surface sterilization. The collected plants were washed in soap solution followed by running tap water for 30 min. Plants were then immersed in 0.1 % mercuric chloride for 5 minutes followed by a quick dip in 70% ethanol. It was followed by immersion in distilled water thrice, 5 min for each wash. The final wash with distilled water was poured into a sterile nutrient agar plate that served as a control to ensure that the sample is devoid of any external contaminants.

DNA Isolation

DNA isolation was carried out using Himedia Higenome Kit Method.

Experimental Process And Sequencing

DNA samples were quantified using a Qubit 4.0 Fluorometer (Invitrogen, Carlsbad, CA, USA). 50-100ng DNA was used to generate amplicons using a panel of primers designed.

Amplicon Generation

Oligonucleotide primers were designed to anneal to relatively conserved sequences spanning fungal ITS regions. ITS2 region was amplified using forward primer containing sequence "GTGAATCATCGARTC" and reverse primer containing sequence "TCCTCCGCTTATTGAT". Besides the ITS target-specific sequences, the primers also contain adaptor sequences allowing uniform amplification of the library with high complexity ready for downstream NGS sequencing on Illumina Miseq platform. All PCR reactions were carried out in 50µL reactions with 25µL of Phusion® High-Fidelity PCR Master Mix (New England Biolabs), 0.4µM of forward and reverse primers, and about 20 ng template DNA. PCR amplification was initiated by denaturation at 98°C for 1 min, followed by 30 cycles of denaturation at 98°C for 10 s, annealing at 60°C for 30 s, and elongation at 72°C for 60 s followed by finally extension at 72°C for 5 min.

PCR Product quantification

The PCR products were electrophoresed on 2% agarose gel for detection. Samples with one bright main band between 400-450bp were chosen for further experiments.

PCR Product Purification

PCR products were purified by bead based purification method [25].

Library preparation and sequencing

Sequencing libraries were generated using NEB Next® Ultra™ DNA Library Prep Kit for Illumina (NEB, USA) following manufacturer's recommendations and index codes were added. The library quality was assessed on the Qubit® 4.0 Fluorometer (Thermo Scientific) and Agilent Bioanalyzer 2100 system. DNA libraries were multiplexed and loaded on an Illumina MiSeq instrument according to manufacturer's instructions (Illumina, San Diego, CA, USA). Sequencing was performed using a 2x300/250 paired-end (PE) configuration; image analysis and base calling were conducted by the MiSeq Control Software (MCS) embedded in the MiSeq instrument.

Analysis Workflow

At first, adapters and low quality data were filtered out from the original data. Then the chimera sequences were removed to obtain the effective sequences for cluster analysis. Each cluster was called an OTU (Operational Taxonomic Unit). The taxonomy analysis of the representative sequence of each OTU was then performed to obtain species distribution information. UPGMA clustering tree can be constructed based on Unifrac distance to illustrate the differences in community structure between different samples or groups.

Sequencing data quality optimization

Sequencing errors such as point mutations might occur in high-throughput sequencing, and it's common that bases toward the end of the sequence reads have lower than average quality. In order to obtain higher quality and more accurate bioinformatics analysis results, it is necessary to optimize the raw data of the sequencing to obtain higher quality and more accurate bioinformatics analysis results.

Analysis software: Trimmomatic (0.39), vsearch (v2.14.1)

Data Analysis

The QIIME [26] data analysis package was used for ITS rRNA data analysis. The forward and reverse reads were joined and assigned to samples based on barcode and truncated by cutting off the barcode and primer sequence. Quality filtering on joined sequences was performed and sequence which did not fulfill the following criteria were discarded: sequence length = 20. Then the sequences were compared with the reference database (RDP Gold database) using UCHIME algorithm to detect chimeric sequence, and then the chimeric sequences were removed. The effective sequences were used in the final analysis. Sequences were grouped into operational taxonomic units (OTUs) using the clustering program VSEARCH (1.9.6) against the UNITE ITS database (<https://unite.ut.ee/>) pre-clustered at 97% sequence identity. The Ribosomal Database Program (RDP) classifier was used to assign taxonomic category to all OTUs at confidence threshold of 0.8. The RDP classifier uses the UNITE ITS database which has taxonomic categories predicted to the species level. Unweighted Pair Group Method with Arithmetic mean (UPGMA) tree from beta diversity distance matrix was builded.

RESULT

Sequencing Data Quality Optimization

The data obtained after high- throughput sequencing was further analyzed using Trimmomatic (0.39), vsearch (v2.14.1) softwares to obtain higher quality and more accurate bioinformatics analysis results. The sequence data has been deposited at NCBI under Sequence Read Archive database (accession numbers PRJNA773862, PRJNA774103).

Table 1. Preliminary Data Analysis- Raw Data Statistics

Sample	Raw reads	Raw bases	Raw data (w)	Q20 (%)	Q30 (%)	GC (%)
1LSITS_1	100179	30153879	64.5	95.4	87.9	49
1LSITS_2	115235	34685735	64.5	87.8	75.2	50
2RITS_1	139714	42053914	89.9	92.5	84.6	48
2RITS_2	139714	42053914	89.9	85.2	73.1	48

Data Analysis

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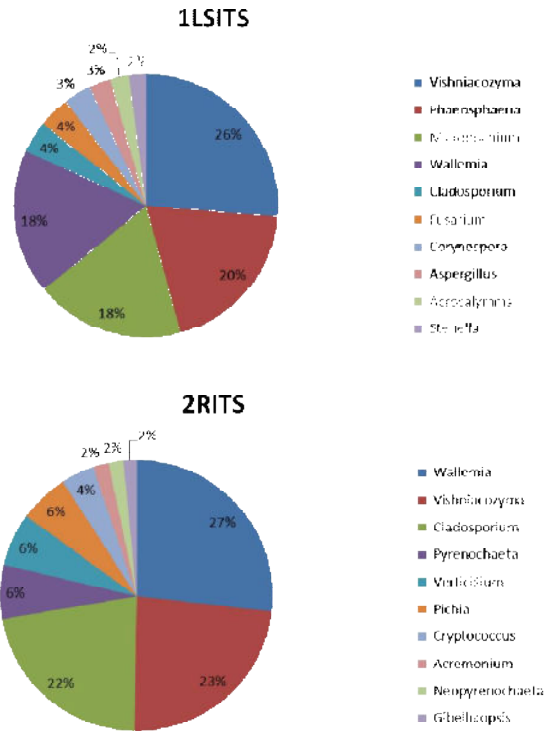


Fig 1. Pie chart showing relative abundance of genus in 1LSITS and 2RITS

Genus abundance Heat- map

The abundance distribution of most dominant genera among all samples were analysed using Plot by R software and is displayed in the genus abundance heatmap.

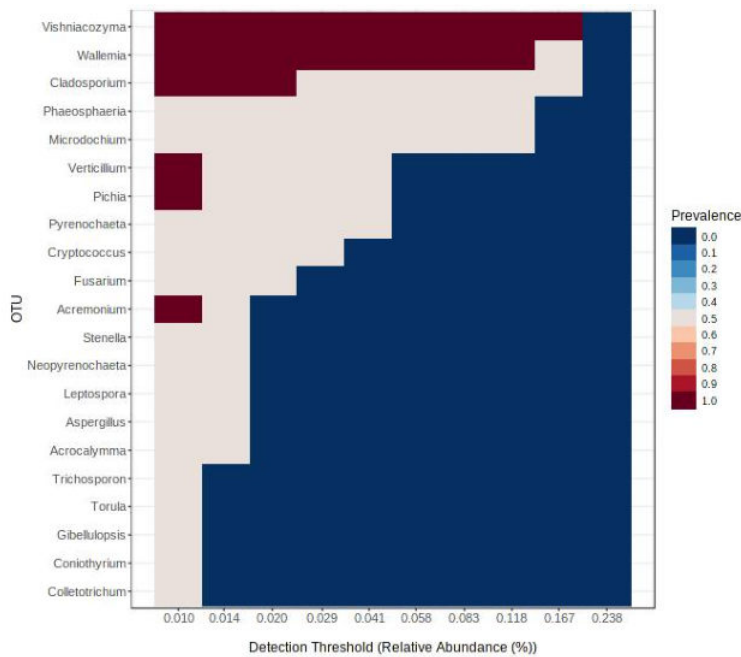


Fig 2. OTU Heatmap

Venn diagram

A Venn diagram (aka Euler diagram) is a method of visualizing the amount of overlap between two (or three) lists of data, using circles to signify the size of each circle and positioning the circles such that the area of overlap represents the amount of list overlap.

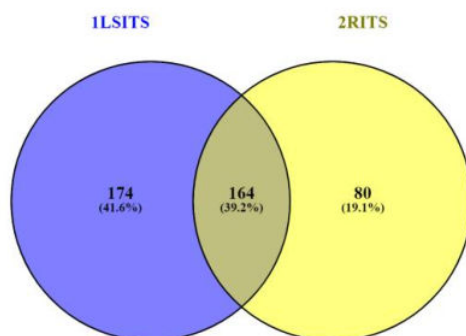


Fig 3 . Venn Diagram of samples; 1LSITS and 2RITS

DISCUSSION

OTU and Taxonomic Composition Analysis

The distribution of top most abundant classifications of endophytic fungus in the sample at different taxonomic levels were analyzed using Qiime software. OTU analysis at different taxonomic level clearly catalogues two phyla viz. *Ascomycota* and *Basidiomycota* in the leaf stem sample. *Basidiobolomycetes*, *Dothideomycetes*, *Eurotiomycetes*, *Mortierellomycetes*, *Tremellomycetes* and *Wallemiomycetes* were the recognized classes. Out of these classes, 7 orders such as *Capnodiales*, *Eurotiales*, *Pleosporales*, *Pleosporales*, *Tremellales*, *Wallemiales* and *Xylariales* were distinguished. Most abundant families were viz. *Bulleribasidiaceae*, *Mycosphaerellaceae*, *Phaeosphaeriaceae*, *Trichocomaceae* and *Wallemiaceae*. *Vishniacozyma*, *phaeosphaeria*, *Microdochium*, *Wallemia*, *Cladosporium*, *Fusarium*, *Corynespora*, *Aspergillus*, *Acrocalymma*, *Stenella* shows the direction of Genus in its decreasing relative abundance from leaf stem sample.

Ascomycota and *Basidiomycota* are the most important phyla obtained from root sample. The most abundant classes were viz. *Basidiobolomycetes*, *Dothideomycetes*, *Mortierellomycetes*, *Tremellomycetes* and *Wallemiomycetes*. OTU analysis at different taxonomic level clearly catalogues two phyla viz. *Ascomycota* and *Basidiomycota*. In these classes, three orders such as *Tremellales*, *Cystofilobasidiales* and *Wallemiales* were identified. Among these, three families viz. *Tremellaceae*, *Wallemiaceae* and *Trichosporonaceae* were represented predominantly whereas *Rhynchogastremataceae*, *Sirobasidiaceae*, *Carcinomycetaceae*, *Cystofiobasidiaceae* were less represented. *Wallemia* was the most abundantly seen endophytic genus while *Vishniacozyma*, *Cladosporium*, *Pyrenochaeta*, *Verticillium*, *Pichia*, *Cryptococcus*, *Acremonium*, *Neopyrenochaeta* and *Gibellulopsis* showed decreasing relative abundance in the root sample.

Only a few studies have been conducted in plants for investigating the biodiversity of fungal endophytes using illumina Miseq platform. A total of 249 fungal endophytes were isolated from *Eclipta prostrata* in our study. Both these samples represented two phyla viz. *Ascomycota* and *Basidiomycota* as the predominant one which was in agreement with a previous study of metagenomic fungal diversity analysis in strawberry plants [27]. Screening of endophytic fungal associates from *Eclipta prostrata* was done by and they reported the presence of *Aspergillus niger*, *Cladosporium oxysporum*, *Fusarium moniliformae* and *Phoma sp.* as the culturable fungal endophytes [28]. This study coincides very much with our results were we found *Acremonium*, *Acrocalymma*, *Aspergillus*, *Cladosporium*, *Corynespora*, *Cryptococcus*, *Fusarium*, *Gibellulopsis*, *Microdochium*, *Neopyrenochaeta*, *Phaeosphaeria*, *Pichia*, *Pyrenochaeta*, *Stenella*, *Verticillium*, *Vishniacozyma*, *Wallemia* as the most abundant ones.

According to some studies, the abundance of endophytes were found more in the roots than the stems and leaves [29]. However, in this study leaf-stem as well as the root sample showed almost a wide range of endophytic composition with the leaf stem sample contributing much more unique orders and families to the group. Relative abundance (Fig 1) shows that *Vishniacozyma*, *Wallemia* and *Cladosporium* are three genera that are commonly found in greater richness in both the samples. The relative abundance of *Vishniacozyma*, *Wallemia* and *Cladosporium* in the leaf stem sample is 26%, 18%, 4% and the belowground root sample is 23%, 27% and 22% respectively. All most all the isolated fungal genera were found to have bioactive properties. *Cladosporium* is described to have antioxidant, antimicrobial [30] and phyto beneficial properties [31], *Phaeosphaeria* is a GA producing fungus [32], *Microdochium* is reported to have bioactive isocoumarins [33], *Wallemia* is a halotolerant fungus [34], *Fusarium* and *Aspergillus* is reported to have antioxidant characters [35,36] and *Acremonium* is the one with antibiotic property [37].

Core microbiome analysis based on relative abundance (Fig 2) showed sample prevalence of 21 fungal genera at minimum detection threshold of 0.010% and a maximum of 0.238%. Plotting detection

threshold against OTU gives the most prevalent species in the sample which are *Vishniacozyma*, *Wallemia*, *Cladosporium*, *Verticillium*, *Pichia* and *Acremonium* with a prevalence of 1.0 at minimum threshold of 0.010%. *Phaeosphaeria*, *Microdochium*, *Pyrenochaeta*, *Cryptococcus*, *Fusarium*, *Stenella*, *Neopyrenochaeta*, *Leptospora*, *Aspergillus*, *Acrocalymma*, *Trichosporon*, *Torula*, *Gibellulopsis*, *Coniothyrium* and *Colleotrichum* are the least prevalent species with a prevalence of 0.0 at minimum threshold 0.010%. similar results were observed were Core microbiome investigation exhibited that 17 genera showed a minimum detection threshold of 0.001% . Here, the core microbiome characteristic were presented by *Clostridium*, *Desulfomicrobium*, *Advenella*, *Tindallia*, *Parabacteroides*, *Sedimentibacter*, *Desulfuromonas*, *Pseudomonas*, *Eubacterium*, *Tissierella*, *Trichococcus*, *Azospira*, *Thauera*, *Erysipelothrix*, *Alkaliphilus*, *Delftia*, and *Azoarcus* at a minimum detection threshold of 0.001% (38).

In comparative analysis (Fig 3), Out of the total endophytes sequenced, 164 elements were common to both 1LSITS and 2RITS (39.2%) whereas 174 elements (41.6%) were unique to 1LSITS and 80 elements (19.1%) to 2RITS sample. A core microbiome of 164 fungal genera is common to leaf, stem and root habitat. There ar 174 unique fungal genera present in leaf and stem and 80 unique fungal genera in root. In another study of endophytic fungal diversity analysis, root and the leaf sample shared about 0.9% of the total endophytic the fungal genera in the plant. 6.8% unique fungal elements were present in the leaf whereas root constituted about 0.5% unique elements of the total endophytic fungi. The unique and shared mycobiome may have vital roles. This mycobiome could have been also present in rhizosphere soil if facultative endophytes are taken into account [39].

In the present study, endophytic fungal biodiversity analysis through illumina Miseq platform has helped in proper identification of a large number of fungal members to generic level. Many such biodiversity studies using NGS techniques have been done in bacterial endophytes related to medicinal plants [40] but not much with fungal endophytes. Culture dependent method of isolation is more common however, is delicate as it is greatly influenced by surface sterilisation techniques, incubation settings, isolation protocol etc [41] and only <1% of the total endophytes can be isolated through this technique [42] as some endophytes grow slowly and may be outcompeted by other fast expressing members on artificial nutrient media. To ignore all these potential constraints, molecular analysis techniques can be employed to trace out all the endophytic members and to further elucidate some specific candidates that would have significant role properties of the plant *Eclipta prostrata*.

CONCLUSION

Our results shows that *Eclipta prostrata* harbours a large number of endophytic fungi in the leaf, stem and roots which would help in the further characterisation of prominent fungal species and to trace the role of endophytes in plant growth promotion, stress tolerance and involvement in metabolic pathways. OTU analysis at taxonomic level clearly catalogues two different phyla viz. Ascomycota and Basidiomycota as the prominent ones. Subsequent findings point 17 generas viz. *Acremonium*, *Acrocalymma*, , *Aspergillus*, , *Cladosporium*, *Corynespora*, , *Cryptococcus*, , *Fusarium*, *Gibellulopsis*, *Microdochium*, *Neopyrenochaeta* , *Phaeosphaeria*, *Pichia*, *Pyrenochaeta*, *Stenella* , *Verticillium*, *Vishniacozyma* and *Wallemia* as the most prominent ones. Knowledge in both the culture dependent and independent endophytic species can open new vistas to unveil the mystery behind the plants ethnomedicinal properties.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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Quality assessment of planting stock using chlorophyll content analysis

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Abstract

The present work envisages chlorophyll pigment analysis to assess the quality of planting material for the agroforestry programs using tree species. Data on Chlorophyll-a, chlorophyll-b, total chlorophyll, and chlorophyll a/b ratio was obtained from the samples namely TRMC, TRMV, TRMP, TRMG, and a control TM of *Terminalia bellerica* (Gaertn) Roxb. The seedling chlorophyll content to assess the impact of rooting media and the management practices on the increase in chlorophyll content was a focal area in the investigation series. Fresh seeds of *Terminalia bellerica* gathered from the tropical natural stands of southwest peninsular India were used for raising the seedlings. The seeds were sown after processing in the experimental field. The fresh leaves of seedlings were used for the analysis. The result showed that the mean values of chl a ranges from 0.1167 ± 0.000577^c (TRMC) - 0.05800 ± 0.001000^a (TM), chl b in the range of 0.02433 ± 0.000577^c (TRMG) - 0.04200 ± 0.001000^a (TRMP), Total chl in the range of 0.03267 ± 0.000577^c (TRMC) - 0.09000 ± 0.001000^a (TM) and chl a/b ratio in the range of 0.55700 ± 0.051449^d (TRMC) - 1.81333 ± 0.075976^a (TM). The values of these parameters significantly differed between seedlings of different mediums. Data and the findings of the present study show that there is a positive influence for rooting media together with management practices in the production of chlorophyll in *Terminalia bellerica* seedlings. Since chlorophyll content is a measure of photosynthesis capability, it can be further predicted that a higher amount of chlorophyll from the least unit area of leaves is an indication of plants with higher vigor.

Keywords: chlorophyll a/b ratio, rooting media, terminalia, root-trainers, abiotic stress in seedlings

Introduction

The characteristic green color of the green plants is imparted by their chlorophyll content. The quantity of chlorophyll in a plant is the indicator of its capacity to carry out the process of photosynthesis [1]. Thus leaf chlorophyll content act as an indicator of the photosynthetic mechanism of the plants. The amount of chlorophyll in a plant-primarily depends upon the amount of sunlight it receives, however the soil quality and nutrient uptake also play an important role in providing the molecule synthesis of chlorophyll pigment [2]. The essential components of plant photosystems are chlorophyll-a and chlorophyll-b, in which chlorophyll-a act as an important factor of the energy production in plants [3]. The concept of photosynthetic capacity and its role in plant growth is not verified in forest tree plantation programs. The variation and role of chlorophyll pigments and their role in seedling growth remain unclear [4]. The total amount of leaf chlorophyll and chlorophyll ratio (Chl a/b) directly impacts the photosynthetic capacity of plants.

The chlorophyll content is reported to have medicinal properties such as blood sugar control, detoxification, digestive metabolism, and allergy control [2, 5]. The variation in the chlorophyll content will give evidence regarding the physiological fitness of the plant/leaf [6]. Thus it is important to study the influence of different rooting mediums in determining the quality and quantity of chlorophyll content in the leaf/plant, and will help to find or improve the efficiency of rooting media, to enable maximum production of chlorophyll, which will be helpful in plantation programs.

Terminalia bellerica is a medicinally as well as economically valuable forest tree species that are under high threat of overexploitation. Proper plantation programs have to be developed for the successful regeneration of this plant before it goes to be extinct. The quality and vigor of the plant seedlings will depend upon their health status and physiological metabolism such as photosynthesis. Thus in this study, the effect of different rooting media in maintaining the healthy condition of the seedlings of *Terminalia* sp. for the production of quality seedlings has been identified by the spectrophotometry method.

Materials and Methods

All the leaf samples for the study were collected from the raised seedlings of *Terminalia bellerica* in the nursery of Prof. T. C. Joseph memorial Garden, Department of Botany, Union Christian College, Aluva, (+10°7'30'65''



***Lasiodiplodia theobromae* infection on *Myristica malabarica* seeds: Threat in artificial regeneration**

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Abstract

Lasiodiplodia theobromae (Pat.) Griffon and Maubl. was found associated with seeds of several tropical tree species, which eventually proved decline in regeneration potential in many forest tree species. Germination studies on seeds of *Myristica malabarica* for artificial regeneration recorded incidence of the ascomycetic fungal pathogen in stored *Myristica* seeds. Seeds were collected from the natural stands during the months of February - March for four consecutive years of study 2018 to 2021, from Mullaringad forest range in South India with coordinates of 10°1'4" N and 76°47'10" E. Seeds stored in containers detected fungal infection after one month of storage. Mean incidence percentage of 28.75% was recorded in stored seeds collected during 2018. Infection appeared as fluffy, cottony, grayish white patches. Germination characteristics of fresh and stored seeds were evaluated by ANOVA. Fresh seeds recorded a mean germination percentage of 31% and that of infected seed lot was 4.5%. Seed borne fungi *Lasiodiplodia theobromae* is a threat in plantation practices of *Myristica malabarica*. The disease incidence is random in seed lots but has a significant impact in reducing germination. Since *M. malabarica* is listed as vulnerable in IUCN, its propagation requires high consideration.

Keywords: fungal incidence, germination percentage, germination value, peak value, seed dimensions

Introduction

There is a growing need for forest nurturing due to dramatic increase in loss of forest cover. Plantation of native species in reforestation programs has been of great interest in present days^[1]. In past decades emerging infective diseases in forest is mainly due to introduction of invasive pathogens to new geographical areas, hybridization of fungal pathogens or hyper virulent strain of an existing pathogen^[2]. Pathogenic fungi such as *Puccinia psidii*, *Cryphonectria cubensis*, *Phaeophleospora destructans* and more than thirty species of *Mycosphaerella* are a major threat to the *Eucalyptus* plantation in Indonesia^[3]. Economic loss to forest owners in Europe were caused by a fungal pathogen *Heterobasidium annosum sensu lato (s.l.)* in 1995 was about € 600 million annually due to wood decay and tree mortality^[4]. In northern Europe the frequency of root rot has been increased by 23% in plantation forest^[5] *Teratosphaeria zuluensis* causing stem canker in *Eucalyptus* were observed within the collected seeds and seed capsule^[6]. White pines in Northern USA and Eastern Canada which is a crucial forest component are infected with 22 species of fungi including *Lecanosticta acicola*, *Septorioides sp.*, *Lophophacidium dooksii*, *Bifusella linearis* affecting pine needles and fruiting bodies^[7].

From 100 selected tree species of four forests of Western Ghats, twenty eight *Pestalotiopsis* spp. isolated as foliar endophyte^[8]. Seeds collected from forest trees like Teak, Subabul, Gulmohar, Mangium, Ratangunj and Garmalo are frequently infected with *Alternaria*, *Aspergillus sp.*, *Fusarium sp.* and *Trichoderma sp.*^[9]. Rubber tree plantation is affected by *Rigidoporus microporus* throughout the tropics which is a serious disease causing reduced yield^[10]. In tropical forest trees seed storage is a major problem as it is sensitive to desiccation and most of them are recalcitrant^[11]. (Vázquez-Yanes and Orozco-Segovia, 1990). *Fusarium sp.* and *Cercospora sp.* are seed-borne fungi in *Tectona grandis* can cause wrinkling and decay of seeds within stony endocarp^{[12][13]}.

Lasiodiplodia theobromae, a pathogenic fungi reported to infect host plants like mango, avocado, papaya, cocoa and jatropha^[14, 15, 16, 17]. Dieback symptoms of *Mangifera indica* are frequently caused by *Lasiodiplodia theobromae* along with four other species of *Lasiodiplodia*^[16]. Among five species of *Lasiodiplodia* identified, *L. theobromae* is the most prominent fungi causing stem-end rot in *Carica papaya*^[18]. Root rot and collar rot disease reported in *Jatropha curcas* due to *L. theobromae* showed symptoms like yellowing and shedding of leaves, root rotting and blackening and decaying of stem collar^[19].

Myristica malabarica Lam. included among top traded twenty medicinal plants of India^[20]. Fruit rind is traditionally used to treat gastric disorders, leucorrhea, fever and piles^[21]. Methanol extract of plant cures stomach ulcer^[22]. It is also a component of antitumour drug 'muthu-marunthu'^[23].

Seed propagation plays an important role in natural regeneration of forest. Infection and degeneration of fruits and seeds affect restoration of forest cover. Studies based on fungal infection in tropical plants with respect to seeds were scanty. Present study deals with fungal infection in seeds of tropical tree species *Myristica*

International Service-Learning: Proposal for a Multi-Dimensional Model for Student Selection

Akhila Narayanan, Justin R. Nayagam, and Malini R.

In an age where students display competency in diverse fields of activities, selecting qualified candidates from an assorted group for a service-learning exchange program demands a multidimensional approach. The framework for student selection for International Service-Learning (ISL) at Union Christian College (UCC) has been designed bearing this in mind. Its value increases when there is a proportionally higher number of applicants for a limited number of slots. Practiced for the last three years (2018-2021), the model has been designed using seven-fold criteria. The compositely designed rubric examines Q&A responses, perspectives on SL, and problem-solving skills at various stages in the assessment. Each assessment level is graded from A to D, with highest A and least D. The evaluation is conducted to assess student social commitment, community engagement, leadership qualities and personal initiatives. The process of enriching writing skills and designing SL activities for diverse communities during the SL committee selection process prepares students to meet challenges in the field. Students prepared under such a method are selected for ISL.

Keywords: *international service-learning, multi-dimensional model, rubric, institutional, student selection*

Aprendizaje-Servicio Internacional: Propuesta de un Modelo Multidimensional para la Selección de Estudiantes

Akhila Narayanan, Justin R. Nayagam, y Malini R.

En una época en la que los estudiantes muestran competencia en diversos campos de actividades, identificar a los candidatos más cualificados de un grupo variado para realizar un programa de intercambio de aprendizaje-servicio exige un enfoque multidimensional. El marco para la selección de estudiantes al programa de Aprendizaje-Servicio Internacional (ASL) en la universidad Union Christian College (UCC) ha sido diseñado teniendo esto en consideración, lo cual es de gran relevancia debido a que el número de solicitantes es bastante mayor que el número limitado de plazas. Este modelo, que se ha seguido durante los últimos tres años (2018-2021), ha sido diseñado tomando en cuenta siete criterios. La rúbrica incluye preguntas y respuestas, diversas perspectivas sobre aprendizaje a través del servicio a la comunidad y resolución de problemas en varias etapas de la evaluación. Cada nivel de evaluación se califica en un rango que va de la A a la D, siendo A la máxima nota y D la mínima. La evaluación se lleva a cabo para hacer examinar de un modo efectivo el compromiso social del estudiante, los compromisos adoptados con la comunidad, la calidad del liderazgo, así como iniciativas personales. A los estudiantes se les prepara para enfrentar los desafíos de este campo durante el proceso de selección. Para ello, el comité prepara actividades con las que los estudiantes desarrollan sus habilidades de escritura y aprenden a diseñar actividades de aprendizaje-servicio. Los estudiantes preparados bajo dicho método son finalmente seleccionados para el programa de ASL.

Palabras clave: *aprendizaje-servicio internacional, modelo multidimensional, rúbrica, institucional, selección de estudiantes*

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HPTLC finger print profiling and evaluation of anti-inflammatory and antioxidant properties of fractions of leaf extract of *Litsea quinqueflora* (Dennst.) Suresh

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ABSTRACT

Folklore medicines are well-known among local people and have been used for curing different ailments. Plant-derived drugs are a potent source of many therapeutically active compounds. The isolation, purification and characterization of such compounds using chromatography and advanced spectrophotometric methods followed by their bioactivity studies has opened a new era in the field of herbal medicine. *Litsea quinqueflora* has been used by traditional healers of Kerala as an anti-inflammatory agent. The different fractions of methanol extract of leaves were used for the present study. HPTLC fingerprint profiling followed by derivatization with aluminium chloride revealed the presence of flavonoids. Anti-inflammatory properties of hexane, chloroform, ethyl acetate and methanol fractions were assessed through inhibition of protein denaturation assay. Ethyl acetate and methanol fractions showed IC₅₀ values of 113.29 µg/ml and 66 µg/ml respectively. Antioxidant studies using methanol fraction clearly indicated its free radical scavenging activity with IC₅₀ values 69.25 µg/ml (DPPH) and 56.37 µg/ml (ABTS) and total antioxidant capacity of 0.139±0.47 GAE/g. These results scientifically support the traditional use of *L. quinqueflora* as a natural anti-inflammatory and antioxidant agent.

Keywords: *Litsea quinqueflora*, HPTLC, flavonoids, protein denaturation, DPPH, ABTS.

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INTRODUCTION

Phytochemical constituents of herbal plants are the key factors behind their medicinal attributes. Medicinal plants and their wide applications were prevalent in traditional systems of medicine even during the prehistoric period. But their phytochemical compositions remained hidden for many years and became popular with the advent of science and technology. The study of the chemistry of medicinal plants has gained attention as there is an urge to synthesize natural as well as synthetic drugs with fewer side effects and affordable prices. Isolation of the active principle present in plants will help in the production of pure and active natural components [1]. These chemical constituents are not meant for their immediate survival and are produced by secondary metabolism. Secondary metabolites are byproducts of primary metabolism [2], produced incidentally and considered as the immune system of plants.

Herbal formulations have been used as preventive medicines and are capable of fighting against many diseases [3]. In this context, the selection and identification of a well-known traditional medicinal plant and extraction of its phytochemical constituents are crucial. Phytochemical components are non-nutritive chemical compounds synthesized by plants and have been used as an effective anti-inflammatory, antioxidant, antimicrobial, anti-diabetic, anticancer, anti-aging, and antidepressant agents [4].

In the present study *Litsea quinqueflora* (Dennst.) Suresh of the family Lauraceae has been selected to scientifically validate its traditional use as an anti-inflammatory agent. The genus *Litsea* is a group of plants with effective medicinal properties and renowned drugs has been used by the local people to cure many inflammatory disorders and lack scientific evidence [5]. They possess different bioactive compounds such as alkaloids, flavonoids, sesquiterpenes, monoterpenes, diterpenes, amides, steroids, lignans and fatty acids with different biological activities [6]. There exist many lacunae in the proper assessment through bioassay-guided phytochemical analysis and purification of bioactive components. *L. quinqueflora* was reported to contain many pharmacologically effective compounds viz. decanal, β-elemene, β-caryophyllene and α-caryophyllene and *L. deccanensis* harbours germacrene-3,9,11-triene, β-caryophyllene, caryophyllene epoxide, bicyclogermacrene, limonene and α-humulene. Among them, β-caryophyllene is biologically more active with anti-inflammatory, antibiotic, antioxidant, anticarcinogenic and anaesthetic properties [7]. The

Research Article



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Keywords

Domestic violence, patriarchal society, female subjugation, financial empowerment, gender sensitization

People's Perception of Domestic Violence: An Inquiry in Kerala

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Domestic violence (DV) is everyday terrorism within the home context across cultures. The universal portrayals of female victims and male perpetrators are still prevalent. With the emergence of a pandemic-specific lifestyle, DV surged at an alarming rate worldwide. Although the conformist patriarchal notions in our society persistently try to normalize DV, people are getting aware of this social evil with governmental and non-governmental initiatives. In this context, this qualitative study was framed to explore the DV perceptions and experiences of people in Kerala. Ten couples (N=20) were interviewed in-depth to elicit data. A thematic analysis of data revealed the meaning that participants attached to DV, its causes, effects, and their experiences of DV. In addition, this study garnered participants' opinions on preventive measures for DV. The codes, subthemes, and themes answered the research questions. The result revealed that men are less likely to experience DV; therefore, women empowerment, gender sensitization, and attainment of gender equality can abolish DV.

INTRODUCTION

Despite the horror and severity of domestic violence (DV), the simplistic stories attached to it often keep this complex social issue out of mainstream discourse (Barocas *et al.*, 2016). The normalization of this everyday terrorism (Pain, 2014) contributes to a cycle of violence. Therefore, a rationalized narrative for DV is needed to ensure the protection of victims and the punishment of perpetrators. Moving away from the traditional partner violence framework, DV requires a broader approach to scientific research, criminal justice, and policymaking. Moreover, society must change culturally entrenched patriarchal perceptions of DV.

DV occurs in the context of the family or home and affects both victims and witnesses. It includes physical violence, intimidation, and controlling behaviours (Barocas *et al.*, 2016). Apart from intimate partner violence (IPV) (Miller and McCaw, 2019), Parent-child abuse, adolescent-to-parent abuse (APA) (Holt, 2016), gender-based violence, including same-sex violence (Stiles-Shields and Carroll, 2015) within the family come under the domain of DV. DV occurs in different forms, whether physical, emotional, economic, or sexual. Physical forms of DV may range

from grabbing and slapping to even withholding physical needs such as food or sleep or withholding help when a victim is sick or injured. Emotional abuse involves using words or actions that embarrass or depress another person's self-esteem, ultimately affecting their sense of well-being. An example of financial abuse is when an abuser exercises control over another person's assets or limits prospects using power and control (Postmus *et al.*, 2020). Sexual assault is an underreported aspect of DV but is nonetheless prevalent. Abuse can be sexual as any sexual act, attempt to obtain a sexual act, unwanted sexual comments or advances, or acts to traffic, or otherwise directed, against a person's sexuality using coercion. It also includes obligatory inspections for virginity and female genital mutilation. Incest, or sexual contact between a related adult and a child, is one form of familial sexual violence.

The finding, based on several studies from several countries around the world, shows that DV incidents increased in response to Covid-19 stay-at-home/lockdown orders (Kourti *et al.*, 2021; Piquero *et al.*, 2021; Usta *et al.*, 2021). India's DV cases also soured at an alarming rate during the pandemic (Maji *et al.*, 2021). When alcohol and unemployment motivated the perpetrator, women's lower



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ഉള്ളടക്കം

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സിബു മോടയിൽ

അധ്യാപകൻ, മലയാളവിഭാഗം, ആലുവ യു.സി.കോളജ്

ചലിക്കുന്ന ചിത്രമാണ് ചലച്ചിത്രമെന്ന ലളിതമായ സമവാക്യം വിസ്മരിക്കുന്ന ചലച്ചിത്രകാരന്മാർ ഏറെയുണ്ട്. അവരാണ് സിനിമയെ നാടകത്തിൽ നിന്നു വ്യത്യസ്തമായ ഒന്നായി കാണാൻ കഴിയാത്തവർ. അരങ്ങിന്റെ സ്വഭാവമുള്ള ചിത്രങ്ങൾ പെരുകുന്നതിനും അതാണ് കാരണം. മലയാള മുൾപ്പട ലോകത്തിലെ ഏതു സിനിമയുടെ ചരിത്രമെടുത്തു നോക്കിയാലും ഈ പ്രവണത കാണാവുന്നതാണ്. എന്നാൽ റോഡ് മുവികൾ ചലച്ചിത്രം എന്ന മാധ്യമത്തിന്റെ തനതുസാധ്യതകൾ പരമാവധി വിനിയോഗിക്കുന്ന സവിശേഷശാഖയാണ്. വാൾട്ടർ സാലസിന്റെ *സെൻട്രൽ സ്റ്റേഷൻ* എന്ന സിനിമയെ മുൻനിർത്തിയാണ് റോഡ് മുവികളെക്കുറിച്ചുള്ള പഠനം ഇവിടെ നിർവ്വഹിച്ചിരിക്കുന്നത്.

മലയാളത്തിൽ അടുരിന്റെ *സ്വയംവര*ത്തിന് ലഭിച്ച ശ്രദ്ധയുടെ ഒരു കാരണം അതിന്റെ ചലനസ്വഭാവമാണ്. തുടക്കത്തിലെ ബസ് യാത്രതന്നെ അതിന്റെ അടയാളമാണ്. ഇറ്റാലിയൻ നിയോറിയലിസത്തിന്റെ സ്വാധീനഫലമായി മലയാളമുൾപ്പട ലോകസിനിമയിൽ പുറംവാതിൽ ചിത്രീകരണത്തോടുള്ള ആഭിമുഖ്യം വർദ്ധിക്കുകയുണ്ടായി. പുറംവാതിൽചിത്രീകരണത്തിൽ ഏറെ ശ്രദ്ധേയമാകുന്നത് യാത്രകളുടെ ആവിഷ്കാരങ്ങളാണ്. മലയാളസിനിമകളിൽ യാത്രാ വിഷ്കാരങ്ങൾ ധാരാളമുണ്ടെങ്കിലും 'റോഡ് മുവി'കൾ എന്നു വിശേഷിപ്പിക്കാവുന്ന സിനിമകൾ വിരളമാണ്. ജോൺ ഏബ്രഹാമിന്റെ *അമ്മ അറിയാൻ* എന്ന ചിത്രം റോഡ് മുവികളുടെ ചില ആശയധാരകൾ പങ്കുവെക്കുന്നുണ്ട്. പാതകൾ കാൽപ്പനികവൽക്കരിക്കപ്പെടുന്നതുപോലെ ആ സിനിമയിൽ രാഷ്ട്രീയവും കാല്പനികഭാവുകതയും ആവശ്യപ്പെടുന്നുണ്ട്. *വീട്ടിലേക്കുള്ള വഴി*, *ശാഫിക്*, *നീലാകാശം പച്ചക്കടൽ ചുവന്ന ഭൂമി* തുടങ്ങി ചില ചിത്രങ്ങൾ പരാമർശം അർഹിക്കുന്നുണ്ടെങ്കിലും ഹോളിവുഡിനേപ്പോലെ റോഡ് മുവി എന്ന സവിശേഷശാഖ മലയാളത്തിൽ സജീവമല്ല. അലച്ചിലിന്റെയും കുടിയേറ്റത്തിന്റെയും അനുഭവങ്ങൾ മറ്റിടങ്ങളേപ്പോലെ കേരളത്തിൽ അത്ര തീവ്രമല്ല എന്നത് ഇതിനൊരു കാരണമാകാം. അമേരിക്കയിൽ ഉണ്ടായ പാതാസംസ്കാരം ഹോളിവുഡിൽ റോഡ് മുവികളുടെ വർദ്ധനവിന് കാരണമായതായി നിരീക്ഷണമുണ്ട്. (*Romancing the Road: Road Movies and Images of Mobility*, Ron Eyerma and Orvar Lofgren, 1995) പാതാസംസ്കാരത്തിനു പാകപ്പെട്ട ഗതാഗതസംവിധാനത്തിന്റെ അഭാവം കേരളത്തിലുണ്ടെന്ന് ശ്രദ്ധിക്കേണ്ട

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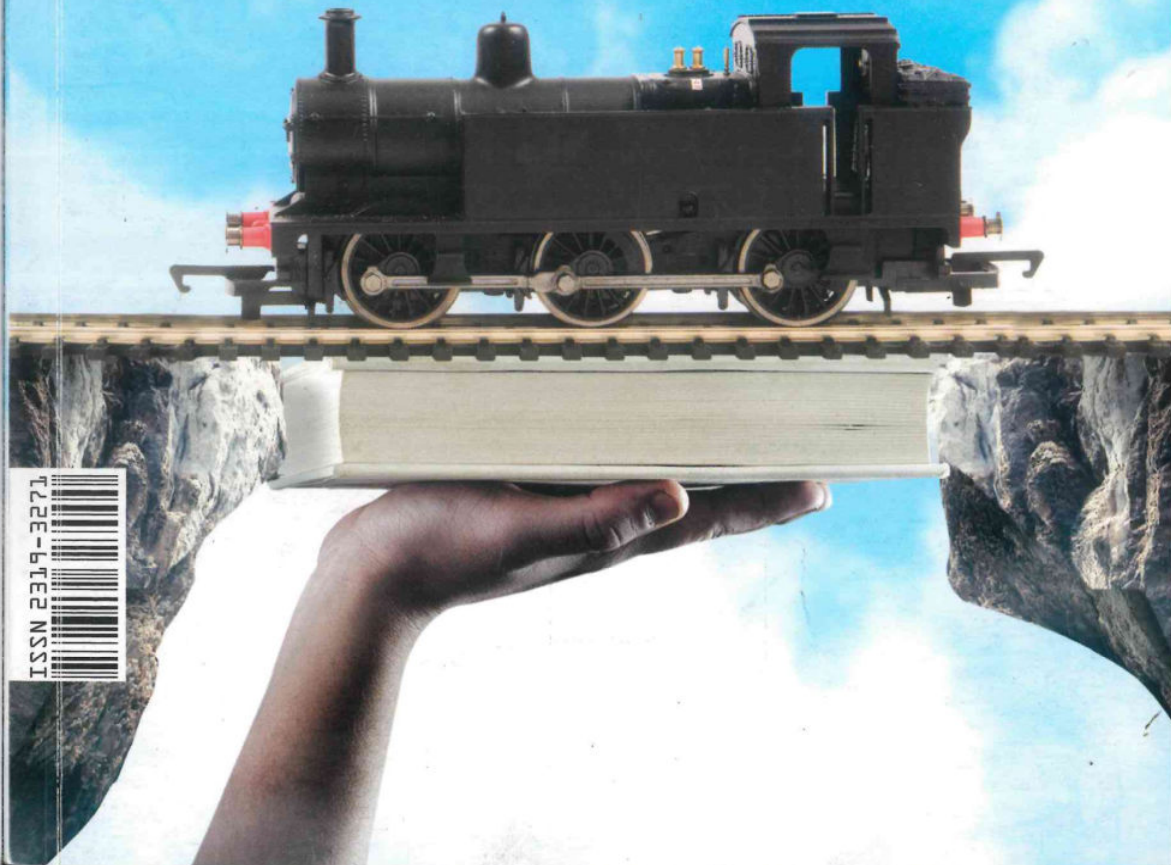
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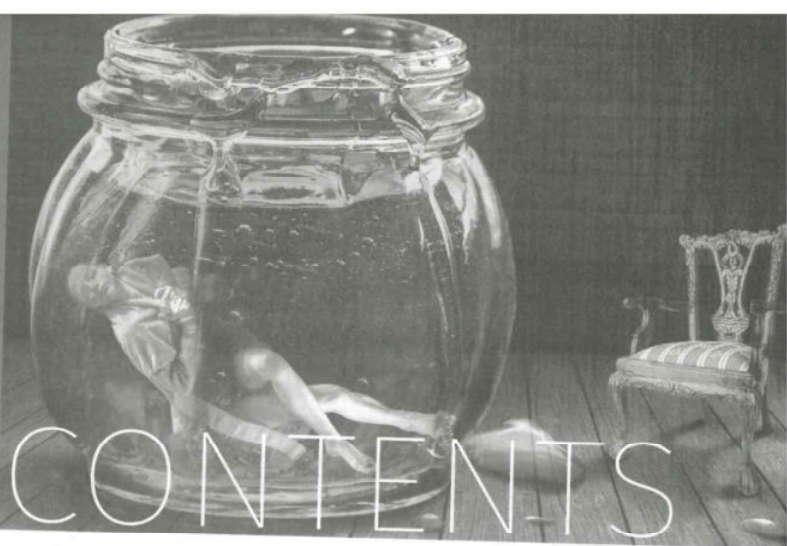
Train of Thought

*Representation of
trains in Malayalam literature*



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Beyond meaning: Train metaphors in ONV poems

Dr Siby Modayil Eapen,
Alwin Alexander

Train metaphors have always been accorded special significance in world literature. Along with representing the social and psychological spheres of human life, they have the potential to concretise the space-time conundrum too. The singularity of the train, distinguishing it from other vehicles, is the presence of many compartments. But an object or phenomenon does not become a metaphor merely because of certain unique affinities or similarities. The train becomes an apt metaphor to epitomise life in its diverse colours and forms, cultures and expressions due to the convergence of various factors. Conspicuously, the sea was the most common metaphor used by Indians before the invention of trains. The metaphorical use of *samsara saagara* (sea of life) was common in the Epics, Puranas, Vedas and Upanishads. It was Ezhuthachan who most prominently pre-

എം. ഗംഗാധരൻ മാപ്പിളപറമ്പ് പരിപ്രേഷ്യം

1 മാർച്ച് 2022

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വിജ്ഞാനകൈരളി

കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട് പ്രസിദ്ധീകരണം



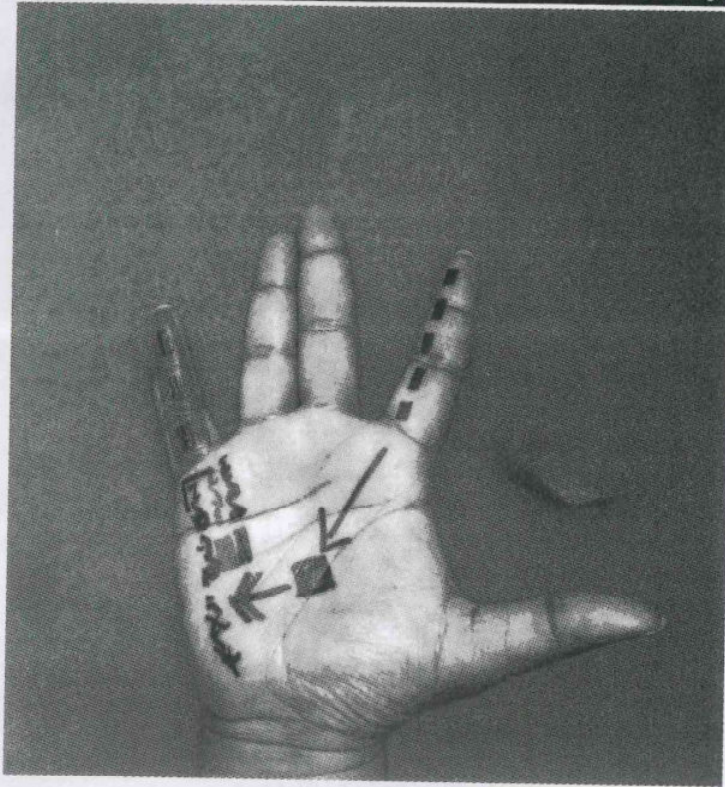
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കോളന മഹാമാരിയും

ചരിത്രം
തിരുത്തിയ
വിധിയും
വിചാരണയും

സാങ്കേതിക വിജ്ഞാന
വിവരവിനിമയം
ഇന്ത്യൻ
കാർഷികമേഖലയിൽ

ഇന്ത്യയിൽ ഗാന്ധിയുടെ
ആദ്യ ജയിൽവാസത്തിന്റെ
ന്താനംവർഷം





പെൺതിരമൊഴിയാഴങ്ങൾ

ഡോ. മിനി ആലീസ്

ഓൺലൈൻ സാധ്യതകളെ ഉപയോഗിച്ചുള്ള സ്ത്രീകളുടെ കവിതാപരിശ്രമങ്ങളിൽ അതിജീവനത്തിന്റെ മുഖമുദ്രകൾ കടന്നുവരുന്നുണ്ട്.

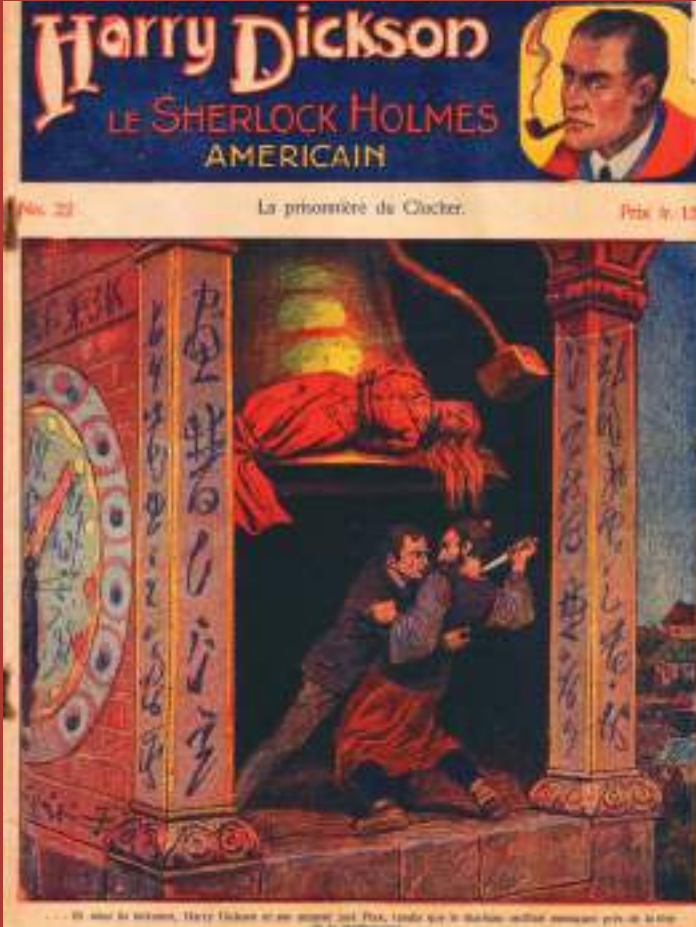
മുഖ്യധാരാകവിയുടെ ഓരങ്ങളിൽ സ്ഥാനമുറപ്പിച്ചുകൊണ്ട് പതിഞ്ഞ ശബ്ദത്തിൽ പാടിത്തുടങ്ങിയ പെൺകവിയുടെ ശബ്ദം ഇരുപതാം നൂറ്റാണ്ടിന്റെ അന്ത്യത്തിൽ ഉച്ചസ്ഥായിയിലാവുന്നുണ്ട്. ഇരുപത്തൊന്നാം നൂറ്റാണ്ടിന്റെ പ്രാരംഭത്തോടെ സൈബറൈറ്റിന്റെ സാധ്യതകൾ മലയാളകവിയയിൽ പ്രബലമാകുന്നു. മലയാളസ്ത്രീകവിയുടെ മുന്നോട്ടുള്ള പ്രയാണത്തിന് ഇരട്ടിവേഗം നൽകാൻ നവമാധ്യമങ്ങൾക്ക് സാധിച്ചു. ഇരുപത്തൊന്നാം നൂറ്റാണ്ടിന്റെ പ്രാരംഭത്തിൽ തന്നെ ബ്ലോഗുകവിതകളിലൂടെ സ്ത്രീകൾ സൈബറിടത്തിന്റെ സാധ്യതകളെ സ്വീകരിച്ചുതുടങ്ങി. ബ്ലോഗുകളും ഓൺലൈൻ കവിതാമാസികകളും മാത്രമല്ല ഓർക്കുട്ടും ഫേസ്ബുക്കും വാട്സ്ആപ്പും ഇൻസ്റ്റഗ്രാമും ഉൾപ്പെടെയുള്ള നവകാല മാധ്യമങ്ങളിലൂടെയുള്ള കവിതാപ്രസിദ്ധീകരണം പുതുകാലപെൺകവിതകളുടെ ഇടംനേടലിൽ സുപ്രധാന സ്ഥാനം വഹിച്ചു. കവിതകൾ പ്രസിദ്ധീകരിക്കുന്നതിന് എഴുത്തുകാരികൾ നേരിട്ടിരുന്ന പ്രതിബന്ധങ്ങൾക്ക് സൈബറിടത്തിന്റെ അനന്തമായ സാധ്യത ഒരു പരിധിവരെ പരിഹാരമായിരുന്നു. പ്രസിദ്ധീകരണരംഗവുമായി ബന്ധ

പ്പെട്ട അധികാരത്തിന്റെ ബലതന്ത്രങ്ങളെ മറികടക്കുന്നതിന് സ്ത്രീകൾക്ക് ഓൺലൈൻ സാധ്യതകൾ സഹായകമായിരുന്നു. നവസാങ്കേതികവിദ്യ ഉപയോഗിക്കുന്നതിലുള്ള പരിചയക്കുറവ് പല എഴുത്തുകാരികൾക്കും കവിയുടെ ഓൺലൈൻ പ്രസിദ്ധീകരണത്തിനും പുതുപരീക്ഷണങ്ങൾക്കും തടസ്സമായെങ്കിലും അടുത്ത തലമുറ അത് അനായാസമായി സ്വായത്തമാക്കുന്നതായി കാണാം. "അതായത് മൾട്ടി മീഡിയ, ബ്ലോഗിങ്, വ്ലോഗിങ്, സോഷ്യൽ മീഡിയ, പ്രോഗ്രാമിങ്, ഇന്ററാക്റ്റിവിറ്റി, ലൂപ്പിങ്, നെറ്റ്വർക്കിങ്, മറ്റു നിരവധി നടപടിക്രമങ്ങൾ എന്നിവയിലൂടെ കവിയുടെ ആവിഷ്കാരശക്തിയെ സമൂലമായി പുനർനിർമ്മിക്കുന്നതിലൂടെ അവരുടെ വ്യക്തിപരമായ കാഴ്ചപ്പാട് സംയോജിപ്പിക്കാനുള്ള ഇടവും കൂടിയായത്" (ഡോണ മയൂര, പോയടിയ) കവിയുടെ നൂതനവഴികൾ (ഭാഗം-19) എന്ന ലേഖനപരമ്പരയിലാണ് ഡോണ മയൂര സൈബറിടത്തിന്റെ സാധ്യതകളെ വ്യക്തമാക്കുന്നത്. സൈബറിടം തുറന്നെഴുത്തിന് നൽകുന്ന സ്വാതന്ത്ര്യം സ്ത്രീകളുടെ എഴുത്തിന് രാസത്വരകമായിട്ടുണ്ടെന്ന് നിസ്സംശയം പറയാം.

മലയാളപ്പച്ച

ഭാഷ, സാഹിത്യം, സംസ്കാരം

14-ാം ലക്കം



അപസർപ്പക സാഹിത്യം
കല, സമൂഹം, രാഷ്ട്രീയം

പ്രസാധനം

മലയാളവിഭാഗം

കെ.കെ.ടി.എം. ഗവണ്മെന്റ് കോളേജ്

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കുറ്റാന്വേഷണ സാഹിത്യലോകത്തിന്റെ ചരിത്രവഴികൾ	11

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*മലയാളപ്പച്ചയിൽ പ്രസിദ്ധീകരിക്കുന്ന പ്രബന്ധങ്ങളുടെ
പുർണ്ണ ഉത്തരവാദിത്തം അതതു ലേഖകരിൽമാത്രം നിക്ഷിപ്തമാണ്*

അന്വേഷണം, പരീക്ഷണം, നിരീക്ഷണം:

‘ഭാസ്കരമേനോൻ’ലെ ശാസ്ത്രാവബോധത്തിന്റെ സഞ്ചാരവഴികൾ

ഡോ. ഷീമി പോൾ ബേബി

അസി. പ്രൊഫസർ, മലയാളവിഭാഗം, യു. സി. കോളേജ്, ആലുവ

പ്രബന്ധസംഗ്രഹം:

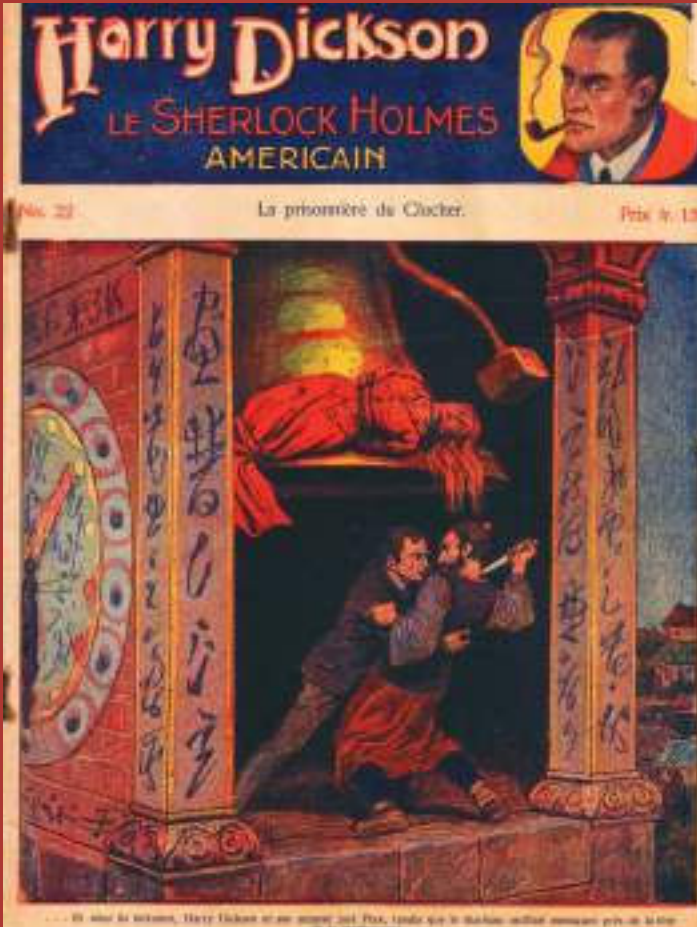
ആഖ്യാനപാടവം കൊണ്ടും ആവിഷ്കരണതന്ത്രംകൊണ്ടും സാമ്പ്രദായിക സങ്കല്പങ്ങളെ വിനീർമ്മിതിയ്ക്ക് വിധേയമാക്കിയ കുറ്റാന്വേഷണസാഹിത്യം പുനർവായന ആവശ്യപ്പെടുന്ന മേഖലയാണ്. ശാസ്ത്രത്തെ സംബന്ധിച്ച ധാരണകളെ മലയാളിയുടെ ഭാവനാമണ്ഡലവുമായി ചേർത്തിണക്കുന്നതിൽ അപ്പൻതമ്പുരാന്റെ അപസർപ്പകനോവലായ ‘ഭാസ്കരമേനോൻ’ മാതൃകയാകുന്നു. ആധുനികമായ ലോകക്രമത്തിന്റെ രൂപപ്പെടലിൽ ശാസ്ത്രം പ്രാമാണ്യജ്ഞാനത്തിന്റെ മറുവായ്ക്കായി സ്വീകരിച്ചുകൊണ്ട് ദേശരാഷ്ട്രങ്ങളുടെ അതിർത്തികളെ ഭേദിച്ച് മനുഷ്യൻ പര്യവേഷണങ്ങൾ ആരംഭിക്കുകയും സ്ഥിരചൂഷണവ്യഗ്രത നിലനിർത്തുകയും ചെയ്തതോടെ ആധുനികതയുടെ യൂറോപ്യൻ മാതൃക കോളനി നാടുകളിലും വ്യാപിച്ചു. തദ്ദേശീയവും ആധുനികവുമായ സാഹചര്യങ്ങൾ പ്രധാനമായി കണ്ട് കേരളീയധുനികതയിലേക്കുള്ള ചുവടുമാറ്റം ഇതിന്റെ തുടർച്ചയാണ്. പരമ്പരാഗതമായ അന്വേഷണരീതിയിൽ നിന്നും വേറിട്ട് കാര്യകാരണയുക്തിയിലുറച്ച അന്വേഷണരീതിശാസ്ത്രം മലയാളസാഹിത്യത്തിൽ അവതരിപ്പിച്ചുകൊണ്ട് അഭ്യസ്തവിദ്യരും ശാസ്ത്രതല്പരരും വായനാസമൂഹത്തിന്റെ രൂപപ്പെടലിനെ സാധ്യമാക്കിയ അപ്പൻതമ്പുരാന്റെ ‘ഭാസ്കരമേനോൻ’ലെ ശാസ്ത്രസഞ്ചാരപഥങ്ങളെ വിശദീകരിക്കുകയും കേരളീയധുനികതയുടെ പുതുഭാവുകത്വത്തെ രൂപപ്പെടുത്തുന്നതിൽ കുറ്റാന്വേഷണസാഹിത്യങ്ങൾക്കുള്ള പങ്ക് വ്യക്തമാക്കുകയുമാണ് പ്രബന്ധത്തിൽ.

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മലയാളപ്പച്ച

ഭാഷ, സാഹിത്യം, സംസ്കാരം

14-ാം ലക്കം



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അസിസ്റ്റന്റ് പ്രൊഫസർ, മലയാളവിഭാഗം, യു.സി. കോളേജ്, ആലുവ

പ്രബന്ധസംഗ്രഹം

മലയാളത്തിലെ ആധുനികാനന്തരകുറ്റാന്വേഷണരചനകളുടെ മികച്ച മാതൃകയായ ടി.പി. രാജീവന്റെ 'പാലേരിമാണിക്യം ഒരു പാതിരാക്കൊലപാതകത്തിന്റെ കഥ' എന്ന നോവലിന്റെ സൗന്ദര്യവും രാഷ്ട്രീയവും അപഗ്രഥിക്കുന്നതാണ് ഈ പ്രബന്ധം. കുറ്റകൃത്യങ്ങളുടെ സാമൂഹികചരിത്രപശ്ചാത്തലത്തെ വിലയിരുത്തുവാൻ നോവലിസ്റ്റ് പിൻപറ്റിയിരിക്കുന്ന ഓർമ്മകളുടെ രാഷ്ട്രീയത്തെ, വാമൊഴിചരിത്രത്തിന്റെ സാധ്യതകളിലൂടെ അന്വേഷിക്കുവാനാണ് ഇവിടെ ശ്രമിച്ചിരിക്കുന്നത്. കുറ്റകൃത്യത്തെ ഒരു ഭാഷാശാസ്ത്രപ്രശ്നമായി നോക്കിക്കാണുന്ന നോവലിസ്റ്റിന്റെ സമീപനത്തെയും ഇതിൽ പ്രശ്നവൽക്കരിക്കുന്നുണ്ട്. സ്വതന്ത്രാനവേഷണത്തിന്റെ വഴിയും പൊരുളുമായി കുറ്റാന്വേഷണത്തെ വികസിപ്പിക്കുന്ന 'പാലേരിമാണിക്യം' നോവലിനെ, വ്യത്യസ്തകാലങ്ങളിലൂടെയും പാരമ്പര്യത്തുടർച്ചയിലൂടെയും നീങ്ങുന്ന വ്യവഹാരമെന്ന നിലയ്ക്കാണ് ഇവിടെ പരിശോധിക്കുന്നത്. കുറ്റാന്വേഷണരംഗത്തെ നൂതനസാധ്യതകൾ തുറന്നിടുന്ന 'പാലേരിമാണിക്യം' കുറ്റാന്വേഷണവ്യവഹാരങ്ങളിലെ പെൺനോട്ടത്തെ കൂടി ഉൾക്കൊള്ളുന്നു എന്ന് ഈ പ്രബന്ധം സാക്ഷ്യപ്പെടുത്തുന്നു.

താക്കോൽവാക്കുകൾ: വാമൊഴി ചരിത്രം (Oral History), അപഗ്രഥനാത്മകകഥ (Analytical Story) ആധുനികാനന്തര ക്രൈം നോവൽ (Post Modern Crime Novel), കൊളോണിയൽ ആധുനികത (Colonial Modernity), രാഷ്ട്രീയരൂപകം (Political Metaphor)

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വിജ്ഞാനകൈരളി

കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട് പ്രസിദ്ധീകരണം



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Teacher Satisfaction with Online Teaching: An Exploration of the Role of Social support

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Abstract

The present study aimed to investigate the relationship between Burnout, Social support with Job satisfaction of high school teachers in the context of online teaching and to identify the best predictor of Job satisfaction. The study was done on 77 high school teachers (39 females, 38 males) who have been using online teaching methods for the last 6 months and belong to the age range of 22-50 years. Following a survey research design, measures of Burnout, Social support, and Job satisfaction were taken using the Maslach Burnout inventory (1981), Multidimensional scale of perceived social support (Zimet, Dahle, Zimet & Farley, 1988) and Job Satisfaction scale (Dixit, 1993), respectively. Data analysis using Pearson's correlation method suggested significant moderate negative correlation between Burnout and Job satisfaction and a moderate positive correlation between Social support and Job satisfaction. Results of multiple regression analysis revealed a significant contribution of Social support as well as burnout in influencing Job satisfaction (43 per cent). Social support emerged as the most significant predictor of Job satisfaction. Practical implications of the findings are discussed.

Keywords: Burnout, job satisfaction, social support, online teaching

Introduction

Learning and teaching methodologies have undergone tremendous changes with the advent of the COVID-19 pandemic. Online teaching became inevitable in India in a situation when the Government introduced lockdown with all educational institutions closed and there was no opportunity for teachers or students to be physically present in classroom settings. The sudden shift from the traditional mode of teaching to the not much familiar technological mode has been challenging for both teachers and students. Researchers and educationalists across the world have been trying to understand the

effectiveness of different methods of online learning and teaching (Joshi, Vinay, & Bhaskar, 2020). So, the impact it has on students and teachers has also been a matter of discussion among educationists (Varanasi, Vashistha, Kizilcec & Dell, 2020). Most of the teachers were new to the technical aspects of using the online mode of teaching though they have been exposed to the internet tools. So, teachers have reported a lack of experience in online teaching, difficulty in communicating with students in the online mode, getting their attention, eliciting responses from them, and poor academic performance of students as causing difficulty in online teaching (Ma, Chutiya, Zhang,

A Review of Indian Research on Cognitive Retraining as Interventions on Children with Learning Disabilities .

Anjali Sudhindran and Seena Mathai

Abstract : Learning disability is a neuropsychological condition that is characterized by deficits mainly to receive, process and retain information , while preserving normal IQ in an individual. The disorder being neuropsychological in nature, allows the manipulation of deficits through cognitive retraining. The review article presents a few Indian researches done in the area of learning disability. Nine studies were found to be applicable to the topic and were reviewed in detail. The main objective of this paper was to review studies pertaining to CR used as an intervention conducted in India. The aim was to bring into focus the nature of the studies conducted in India and their efficacy in fulfilling their objectives they set out to fulfill. Nine studies were included that fulfilled the purpose of this review paper. Of the nine, three were review papers; one case study and five were randomized controlled trials. Due to the few number and different nature of the studies, statistical analysis couldn't be attempted. The results of all the studies showed improvement from cognitive retraining being implemented. The studies seemed to suggest a combination of remediation and cognitive retraining as a better predictor of success for intervention in children with learning disability. A common finding was the small size of the sample used which creates problems for generalization of results. The papers act good as models to further designing of interventions in the specific area of learning disability.

Keywords : . Learning disability interventions, Cognitive retraining in India, Cognitive intervention in learning disability, Cognitive rehabilitation In India, Cognitive skills improvement, Executive functions improvement.

Introduction

In the last ten years the number of dyslexic cases in India has increased exponentially (Karande et al., 2011) Currently, 10% or 30 million children are diagnosed with a learning disability. India being a multilingual country, the success of interventions in learning disability largely depends on special attention to address this aspect. Besides, a protracted awareness drive about this setback is necessary for India

This phenomenon, apart from being an obstacle to the normal teaching-learning activities, may also act as a great barrier to the persona psychological advancement of the individuals.

Neuropsychological Functions in Obsessive-Compulsive Disorder: A Single Case Study.

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ABSTRACT

Several researches have demonstrated cognitive impairments in Obsessive-Compulsive Disorder (OCD) and also contributed to the possibility of cognitive retraining. The present study aimed to explore the effectiveness of a 2-month cognitive retraining program on prospective memory and other neuropsychological functions in OCD. It is a single case study. The patient was assessed using Obsessive-Compulsive Inventory- Revised (OCI-R), Royal Prince Alfred Prospective Memory Test (RPA-ProMem) and NIMHANS Neuropsychological battery. The patient was assessed before and after the cognitive retraining program (3-month and 6-month follow-up sessions were also assessed). The results reveal that the patient has benefitted from cognitive retraining program and showed improvement in both prospective memory and its associated neuropsychological functions. The patient also showed improvement in the clinical symptoms of OCD.

KEYWORDS: Cognitive impairment, obsessive-compulsive disorder, effectiveness, cognitive retraining, prospective memory, neuropsychological functions.

INTRODUCTION

Obsessive-compulsive disorder (OCD) is a chronic disorder combined with obsessions (intrusive, distressing and rapid thoughts or images) and compulsions (repetitive behaviours and recurrent mental acts to relieve anxiety). The lifetime prevalence of OCD is 2.5% [American Psychiatric Association (APA), 2000]. There are different subtypes of OCD: contamination/washing, harm/checking, hoarding, & symmetry/ ordering (Mckay et al., 2004). Although OCD is associated with poor social, personal, and occupational functioning (Ruiz, et al., 2017) there were several researches suggesting impaired neuropsychological functions in OCD (Chamberlain et al., 2006; Kuelz et al., 2004). The cognitive areas which were studied in OCD are memory, attention, set shifting-ability and executive function. Literature reviews depict memory failures as a general feature of patients with OCD (Olley et al., 2007; Muller & Robert, 2005; Cuttler & Graf, 2007, 2008, 2009; Harris et al., 2010). Several researchers have found deficits in working memory (Chamberlain et al., 2007; Purcell et al., 1998a), prospective memory (Nedeljkovic et al., 2009; Harris et al., 2010; Jaafari et al., 2013., Bhat et l., 2018), verbal learning and memory (Sawamura et al., 2005) and visual learning memory (Savage et al., 1999; Savage et al., 2000; Shin et al., 2014). Deficits in executive functions with respect to OCD was also studied (Omori et l., 2007; van der Linden et al., 2005) and studies have demonstrated deficits in response inhibition (Abramovitch et al., 2011; Sottocorno et al., 2011; Morein-Zamir et al., 2010; Page et al., 2009; Chamberlain et al., 2007,2006), Planning (Cavedini et al., 2010; Diamond, 2013; van Passel et al., 2016; van den Heuvel et al., 2005) and set-shifting ability (Miyake et al., 2000; Goodwin & Sher, 1992; Omori et al., 2007; Okasha et al., 2000) are common in patients with OCD.

Revisiting three anxieties of Kerala's development- Growth, Education and Gender Justice

ANN GEORGE

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Kerala is a state that has received national and international attention for its high human development achievements. But not everything was rosy, and several scholars have pointed out the limitations and lacunas of the state's development experience. This paper looks into three such anxieties on the state's development model, expressed nearly two decades ago. The three concerns taken in this paper are the state's economic growth, education and gender justice. In this paper, the author revisits these anxieties to examine whether there is persistence or progress on the considered issues. This paper is based on secondary data and literature. Both promising and persisting facets of the three dimensions are pointed out.

Keywords: Kerala, growth, migration, education, exclusion, gender justice

Kerala is a state which has received both national and international attention ever since the United Nations- Centre for Development Studies publication drew attention to the high achievements in education and health of the state (UN & CDS, 1975). It was often referred to as the Kerala model of development. They referred to the attainment of human development indicators even without robust economic growth. Kerala's achievements are located in its history of *public action*. Amartya Sen has highlighted the role of public action in bringing about Kerala's social achievements. Kerala received an early start in educating its people, be it through the introduction of a modern system of education by the princely states of Travancore and Cochin, be it the role which Christian missionaries played and the various social reform movements of the late 19th and early 20th-century demanding education for its members. In the post-independence period, the role of the Communist Party assumes special importance in setting the pro-poor development agenda of the state and to some extent, the agenda of other political parties. The government adopted several pro-poor measures, which are believed to have resulted in Kerala's kind of development. But not everything was rosy, and several scholars pointed out the limitations and lacunas of the state's development experience.

This paper looks into three anxieties on the state's development model, expressed nearly two decades ago¹. The three concerns taken in this paper are the state's economic growth, education and gender justice. The first research question concerns the apprehensions expressed about the state's growth. As the state's growth is believed to be fuelled by migration, scholars have expressed anxiety on whether such growth is sustainable and vulnerable to conditions in Gulf countries. This is an opportune time to look into the issue as the state is currently facing a considerable decline in emigration. The second question is on education in the state. While lauding the quantitative achievements in education, concerns were raised on the quality of the same and tendencies to exclude the weaker sections of society in educational mobility. The paper examines the current status of this. The final question is on gender justice in the state, where queries were raised decades before on the 'myth of the high status of women in Kerala. In this paper, the author revisits these anxieties to examine whether there is persistence or progress on the considered issues. This paper is based on secondary data and literature. Observation-based on personal experience is made in the footnote.

Economic growth of Kerala: Vulnerable to Gulf conditions?

Kerala model was celebrated initially because of its high social development despite low economic growth. For almost thirty years, the state's economic growth trailed much below the national average from the late fifties till the latter half of the 1980s (Chakraborty, 2004). Low economic growth, in turn, had fiscal implications on the state and the level of employment. A change in the trend of low economic growth is observed from 1987 to 88. The state showed a higher growth rate from 1987 to 88, which has continued since then. The growth rate of the state domestic product at constant prices during the period 1987-88 to 2000-01 rose to 6.0 per cent as against 1.88 per cent between 1971-72 and 1986-87. The growth rate during the period 2000-01 to 2006-07 was still higher at 8.1 per cent, which was more than that for the country (7.1 per cent) (Government of India, 2009). Kerala's growth

¹ The author had compiled Kerala's development narratives as part of her doctoral work. (George, 2012)

Gandhi and the Indian Constitution: Realising the Idea of a Village-based Polity

G. Geethika

Abstract

As India celebrates seven decades of its commitment to constitutionalism, we revere the invaluable contributions of the Constituent Assembly in drafting a state of the art document. As we all understand, the Constitution of India is an amalgam of relevant ideas from constitutions across the world. Mahatma Gandhi played a crucial role in the setting up of the Constituent Assembly and was also a significant influence on the Constitution makers. Yet, upon an enquiry into the constitution, one cannot be but intrigued by how callously and superfluously his thoughts have been reflected in the Indian Constitution. This paper proposes to critically inquire into the nature and scope of how Gandhian principles, specifically, the idea of village-based state-building, has been addressed by the Constituent Assembly, Indian Constitution, and independent India.

Keywords: Mahatma Gandhi, Indian Constitution, Grass root Democracy, Decentralisation, Panchayati Raj

I. Introduction

On 26 November 2020 India celebrated Constitution Day¹, concluding the 70th anniversary of adopting the Indian Constitution. Our Constitution has been revered the world over for many reasons. Scholars have extensively studied the significance of the efforts put in by the stalwarts of Indian independence movement in drafting the Constitution and how far it has stood the test of time in fostering democracy in the nation for seven decades. The contribution of each member of the Constituent Assembly² is invaluable, commemorated and cherished by the country. The Constitution is the lengthiest³ and was drafted by adopting relevant ideas from constitutions of many other countries. Yet, it has been reprimanded by many scholars, then and now, that our Constitution severely fails to reflect the vision and mission postulated by the Mahatma.

This paper is structured into three parts. Firstly, we will attempt to understand Mahatma Gandhi's notions about a constitution for independent India, and his vision about a village-centric grass root democracy. Then, the paper shall explore how far the constitution makers have sought inspiration from him while drafting the constitution. Finally, the paper proposes to critically enquire into the nature and scope of the assimilation of Gandhian principles in the Indian Constitution and the extent of incorporating Gandhian perspectives in State building in the past 70 years of independent India. The inquiry is centered on the predominant and certainly the most celebrated political facet of the Gandhian perspective of State building, the Panchayati Raj system. In 2018 we completed 25 years of nation-wide adoption of decentralized governance through the monumental 73rd and 74th constitutional amendments and the Panchayati Raj Act, which came into force on 24 April 1993.⁴ Primarily, the paper argues that the Constitution of India is predominantly short of his grand vision and aims to understand the reasons for the void.

II. Gandhi's Vision on a Constitution for India



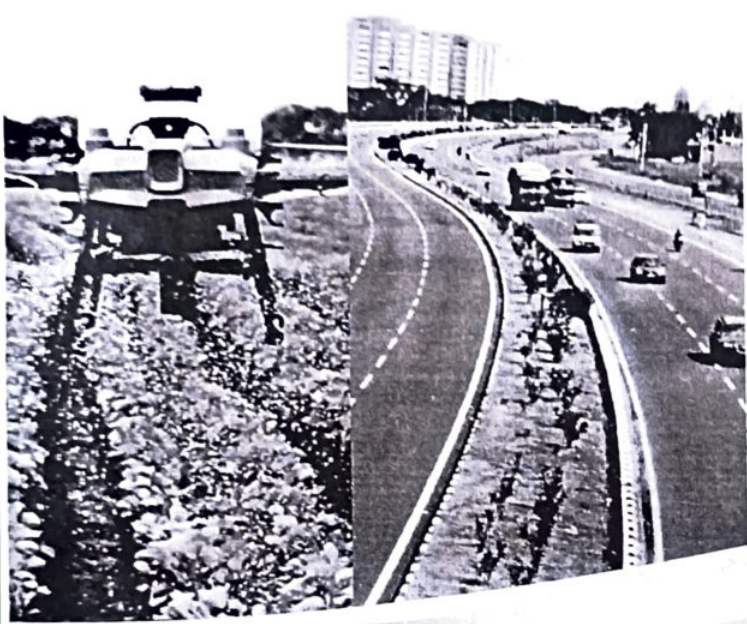
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വൈജ്ഞാനിക സമ്പദ്ഘടന
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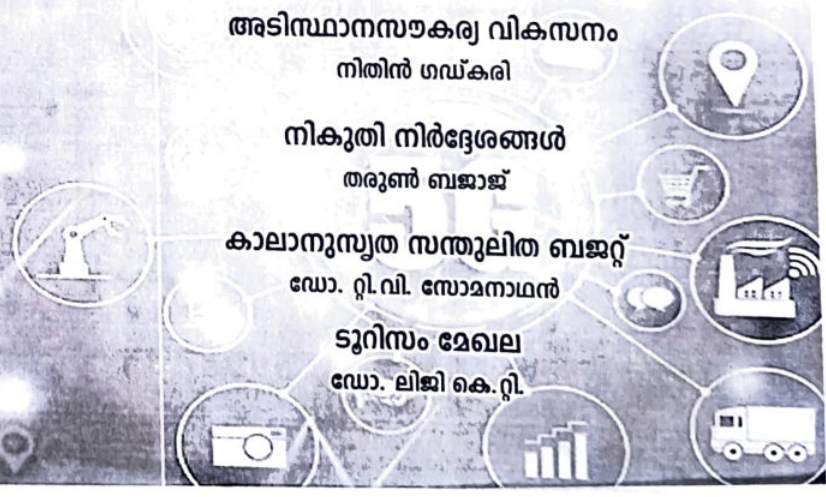
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സാങ്കേതികവിദ്യയുടെ ചിറകിലേറി

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കോവിഡ് മുന്നോട്ടെ വ്യാപനം, 5 സംസ്ഥാനങ്ങളിലെ തെരഞ്ഞെടുപ്പ്, പൊതുവെയുള്ള ഒരു സാമ്പത്തിക തളർച്ച എന്നിവയുടെ പശ്ചാത്തലത്തിൽ അവതരിപ്പിച്ച 2022-23 വർഷത്തെ കേന്ദ്രബജറ്റ് വളരെ ശ്രദ്ധയാകർഷിക്കുന്ന ഒന്നാണ്. ഭാരതത്തിന്റെ വളർച്ച ത്വരിതപ്പെടുത്തുവാനും, മുന്നോട്ടു കൊണ്ടുപോകുവാനും സാഹചര്യമൊരുക്കുന്ന പ്രഖ്യാപനങ്ങൾ ഈ ബജറ്റിൽ കാണാവുന്നതാണ്. എന്നാൽ ജനങ്ങളുടെ നിലവിലുള്ള സാമ്പത്തികസാഹചര്യം മെച്ചപ്പെടുത്തുവാനും, പ്രത്യേകിച്ചു ഹ്രസ്വകാലത്ത് (Short Run) ഒരുമാറ്റം കൊണ്ടുവരുവാനും സാധിക്കുന്ന പ്രഖ്യാപനങ്ങൾ കുറവാണ്.

തെരഞ്ഞെടുപ്പ് മുന്നിൽ കണ്ടുള്ള പ്രഖ്യാപനങ്ങൾ തീരെക്കുറവ്, കാർഷികമേഖലയിൽ കഴിഞ്ഞ കാലങ്ങളിൽ നിന്ന് വലിയമാറ്റം വരുത്തുവാൻ ഉതകുന്ന പ്രഖ്യാപനങ്ങൾ കുറവ്, എന്നിങ്ങനെ ചില പ്രത്യേകതകൾ ഉണ്ടെങ്കിലും എല്ലാ മേഖലകളെയും ഒന്ന് സ്പർശിച്ചു പോകുവാൻ കേന്ദ്രധനകാര്യമന്ത്രി നിർമ്മലാ സീതാരാമൻ ശ്രമിച്ചു. എന്നത് നാം കാണുകയും വേണം. അടിസ്ഥാനസൗകര്യങ്ങൾ വിപുലമാക്കുവാൻ പിഎംഗതി ശക്തിക്ക് കീഴിൽ പുതിയ ധാരാളം പദ്ധതികൾ അവതരിപ്പിക്കുകയും അതിനുവേണ്ടി പണം മാറ്റിവെയ്ക്കുകയും ചെയ്തിരിക്കുന്നു. അടുത്ത 25 വർഷം, രാജ്യം സമാത്യന്തരത്തിന്റെ നൂറാം വർഷം ആഘോഷിക്കുമ്പോൾ അടിസ്ഥാന സൗകര്യങ്ങൾ വേണ്ടവിധത്തിൽ വിപുലപ്പെടുത്തുവാൻ ലക്ഷ്യംവെയ്ക്കുന്ന ക്രിയാത്മകമായ പദ്ധതികൾ രേഖപ്പെടുത്തിയിരിക്കുന്നു. റോഡ്, റെയിൽവേ, ലോജിസ്റ്റിക്സ് (Logistics) എന്നീ മേഖലയുടെ സമഗ്രമായ വികസനത്തിന് 20,000കോടി രൂപയോളം മാറ്റിവെച്ചിരിക്കുന്നു. ദേശീയപാത വികസനവും സംസ്ഥാന പാതകളുടെ വികസനവും ധാരാളം ഗുണങ്ങൾ (Externalities) സമ്പദ്ഘടനയുടെ വികസനത്തിനൊരുക്കുക എന്നത് പ്രധാന ലക്ഷ്യമാണ്.

കാർഷിക മേഖലയിലേക്ക് വലിയ തുക മാറ്റിവെച്ചില്ലെങ്കിലും ധാന്യങ്ങളുടെ സംഭരണത്തിനും നാണ്യവിളയ്ക്കും മറ്റുമായി ഏകദേശം 2.4 കോടി രൂപ നീക്കി വെച്ചിരിക്കുന്നു. കാർഷിക മേഖലയുമായി ബന്ധപ്പെട്ട് പുതിയ സംരംഭങ്ങൾ (Start Ups) തുടങ്ങുവാനുള്ള പദ്ധതികളും ബജറ്റ് വിഭാവനം ചെയ്യുന്നു.

ചെറുകിട, ഇടത്തരം മേഖലയ്ക്കും പണം നീക്കിവെച്ചിരിക്കുന്നു എന്നതും നാം മനസ്സിലാക്കേണ്ടതാണ്. വിദ്യാഭ്യാസമേഖലയെ കൂടുതൽ ഡിജിറ്റൽ (Digitalisation) ആക്കുവാൻ പ്രാധാന്യം നല്കുന്നതോടൊപ്പം വിദ്യാഭ്യാസം കൂടുതൽ ഓൺലൈൻ (online) ആക്കുന്നതിനുവേണ്ടി പ്രദേശിക ചാനലുകൾ വികസിപ്പിക്കുവാനുള്ള പ്രഖ്യാപനങ്ങൾ ബജറ്റിൽ കാണാവുന്നതാണ്. ജല, സൗരോർജപദ്ധതികൾക്കായി പ്രത്യേക വിഹിതം, ഇലക്ട്രിക് വാഹന മേഖലയ്ക്കായി പ്രത്യേകനയങ്ങളും രൂപീകരിച്ചിരിക്കുന്നു. ഇത്തരത്തിൽ സമസ്തമേഖലകളെയും പരാമർശിക്കുന്നത് കാണാവുന്നതാണ്. എന്നാൽ 2022-23 വർഷത്തിലെ ബജറ്റിന്റെ പ്രധാന സവിശേഷത അല്ലെങ്കിൽ പ്രത്യേകമായ ഊന്നൽ ലഭിച്ചിരിക്കുന്നത് ഡിജിറ്റൽ മേഖലയിലാണ്. അതുകൊണ്ട് തന്നെ ഈ വർഷത്തിലെ ബജറ്റിനെ ഒരു ഇ-ബജറ്റായി കാണുന്നവർ ധാരാളമുണ്ട്. ചില പ്രധാന പ്രഖ്യാപനങ്ങൾ ചുവടെ രേഖപ്പെടുത്തുന്നു.

1. ബ്ലോക്ക് ചെയിൻ (Block Chain) അധിഷ്ഠിത സാങ്കേതിക വിദ്യയുടെ സഹായത്തോടെ ഇന്ത്യയുടെ ഡിജിറ്റൽ കറൻസി (Digital Currency) അവതരിപ്പിക്കും.
2. ഗ്രാമങ്ങളിൽ പെറ്റിക്കൽ ഫൈബർ ശൃംഖലയ്ക്കായി പ്രത്യേക പദ്ധതി.
3. പോസ്റ്റോഫീസുകളിൽ കോർബാങ്കിംഗ് സംവിധാനം വിപുലീകരിക്കും.
4. 15 ലക്ഷം തപാൽ ഓഫീസുകൾ മുഖേന ഇനി ഡിജിറ്റൽ ഇടപാടുകൾ നടത്താം.
5. ഡിജിറ്റൽ വിദ്യാഭ്യാസത്തിനായി പ്രത്യേക പദ്ധതി ആരംഭിക്കും.
6. ആസ്മതികൾ എന്ന നിലയ്ക്ക് 30 ശതമാനം നികുതി ക്രിപ്റ്റോ കറൻസികളുടെ മേൽ (Cryptocurrency) ചുമത്തുവാൻ തീരുമാനം.
7. ഇ-പാസ്‌പോർട്ട് വിതരണം തുടങ്ങുവാനുള്ള ശക്തമായ നീക്കങ്ങൾ ആരംഭിക്കും.
8. 5 ജി ടെലികോം സേവനങ്ങൾ രാജ്യത്ത് എത്തിക്കാനുള്ള പദ്ധതികൾ ആവിഷ്കരിക്കുന്നു.
9. സ്മാർട്ട് ഫാമിങ്ങ് പദ്ധതികൾ നടപ്പാക്കും.

ഇന്ത്യയുടെ ഡിജിറ്റൽ കറൻസി : 2022-23 വർഷത്തിലെ ഏറ്റവും പ്രധാന പ്രഖ്യാപനങ്ങളിലൊന്ന് ഇന്ത്യയുടെ ഡിജിറ്റൽ കറൻസിയുമായി ബന്ധപ്പെട്ടതാണ്. റിസർവ് ബാങ്ക് ഓഫ് ഇന്ത്യ (RBI) ബ്ലോക്ക് ചെയിൻ സാങ്കേതികവിദ്യയുടെ സഹായത്തോടെ ഈ സാമ്പത്തിക വർഷം തന്നെ ഡിജിറ്റൽ കറൻസി അവതരിപ്പിക്കും. പുർണ്ണമായും റിസർവ് ബാങ്കിന്റെ നിയന്ത്രണത്തിൽ ആയിരിക്കും പുതിയ ഡിജിറ്റൽ കറൻസി. അതു കൊണ്ടുതന്നെ ഇത് നിയമപരമായ ടെൻഡർ കറൻസിയാണ്. പേപ്പറിൽ ഇറക്കുന്ന ഒരു കറൻസിക്ക് സമാനമാണ്. ഉപയോഗിക്കുന്നവർക്ക് ഡിജിറ്റലിന്റെ സൗകര്യവും, എന്നാൽ പമ്പോടൊന്നു ബാങ്കിംഗ് സംവിധാനത്തിന്റെ കരുതലും ലഭിക്കും എന്നതാണ് ഇതിന്റെ പ്രത്യേകത. ഈ ഡിജിറ്റൽ കറൻസി എങ്ങനെ ഉപയോഗിക്കണമെന്നും, എന്തൊക്കെ കരുതലുകൾ വേണമെന്നും എന്നുള്ള മാർഗ്ഗ നിർദ്ദേശങ്ങൾ കേന്ദ്ര ബാങ്ക് നല്കുന്നതായിരിക്കും. പല വികസിത രാജ്യങ്ങൾ യു.എസ്., ചൈന, ആസ്ട്രേലിയ എന്നിവർ പുതിയ

DEVADASI SYSTEM: A CRITICAL REVIEW OF ITS HISTORICAL CHARACTER

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ABSTRACT

Devadasi system is not unique to Indian history or Kerala history. This system existed in one way or another in different parts of the world. It was a kind of subjugation of women and female body through the beautiful words like 'divine harlots'. Devadasis initially had control over their bodies and later lost it. The system can be understood as a tool developed and retained by the patriarchal society for its benefit.

Key Words: *Devadasi, Female Body, Hindu Temples*

Human society, from time immemorial, has designed and defined various customs and practices confirming a systematic social and religious life beneficial to the privileged section of the society. Religion was usually used as a facade for formation of such customs and practices irrespective of space and time. India, like most of the other ancient civilizations of the world also nurtured such religious practices like *Sati, Jati Vyavashta, Devadasi Sampradayam* etc: to mention a few. This paper intends to make a brief analysis of *Devadasi system* as a custom which gradually derived as a structure to impose patriarchal power on women weaponizing temple and religion.

Devadasi System was an important ritual existed in ancient Hindu temples. *Devadasi* system begins with the parents vowing to dedicate their daughters to the temple for atonement of their own sinsⁱ. These girls then spent rest of their lives in serving the deity in the temple. Assigned with various responsibilities related to temple, *devadasis* became integral part of ancient Hindu temples. Yet *Devadasi* system was not unique to India. The system existed in one form or another in Egypt, Greece, Rome, Babylon, Mesopotamia, China and several other ancient civilizations.

The term '*devadasi*' literally means *dasi of Deva*, a slave or maiden who is offered to the deity in a temple. Girls are dedicated to the deity during adolescence following a belief that the devoted girl is married to the temple deity. They were generally regarded as '*Divine Harlots*'ⁱⁱ. Usually extremely beautiful girls were selected as *devadasis*. They never danced out of temple even if they were offered lakhs of gold coins.

Devadasis in World History

N.M. Penzer had made detailed studies about the divine harlots in South India. Penzer opines that *devadasi* system originated in Mesopotamia. He associates it with first dynasty of Babylonⁱⁱⁱ. *Devadasi* system existed in ancient Egypt and Phoenicia. According to a stone inscription found at Tralles in Lydia, the practice of religious prostitution dates back to AD 2nd century in Greece. It is said that the noble families of Armenia used to dedicate their daughters as the maid servants of goddess *Antaeus*. The temple of Osiris and Isis in Egypt housed several child maids. These girls who adorned in gold, danced before the gods and were integral part of that culture. They were called as '*Awalim*'^{iv}. Unmarried girls were dedicated to Ammon, temple of Egyptian male deities. Ancient Greek records also attest presence of temple dancers. There were *devadasis* in the ancient temples of Rome and Babylon. Romans called them as '*Vestal Virgins*'^v. Dance festivals in Rome in the month of March were a time of celebration for *devadasis*. The 'Ewe' community of Western Africa dedicated their girls to temples. They were called as '*Kosio*'^{vi}. Men were also dedicated in the temples of Armenia and Anaitis.

Devadasi System In India

There were seven categories of *devadasis* in India. They are *Datta* (ദത്ത), *Vikrita* (വിക്രിത), *Bhakta* (ഭക്ത), *Bhritya* (ഭൃത്യ), *Hrita* (ഹൃത), *Alankara* (അലങ്കാര) and *Rudrakanika* (രുദ്രകന്യക) or *Gopika* (ഗോപിക)^{vii}.

The term '*Vra*' was used in Rig-Veda to denote the *devadasis*. Bhavisa Purana states that extremely beautiful girls should be donated for temple services^{viii}. Vishnupurana mentions *devadasis* like Rambha, Urvashi, and Thilothama.

Devadasi system became more prevalent during AD 3rd century in India. Dancers were present during the evening prayers at Mahakala Temple in Ujjain^{ix}. Huan Tsang, who visited India in AD 7th century, says that he saw innumerable maids at the Sun Temple in Multan dedicated by interested parents.

Devadasis In North India

In Bombay, '*Murlis*' were a kind of *devadasis* who married Khandoba in Jejuri. The *devadasi* system in Jejuri began with the Hindus who didn't have daughters vowing to submit Khandoba, if a girl child born to them. *Devadasis* of Khandoba were walking in the streets with bags full of turmeric powder. They smeared turmeric powder on the foreheads of pedestrians passing by.

Devadasi system was practiced in Orissa, eastern part of India. They were generally regarded as '*Maharis*'. The *Maharis* were present at Jagannath Temple of Puri which was famous for the dance of *devadasis*. There were about 500 *devadasis* at Somnath, a famous temple in Gujarat. *Devadasis* were also present at the Viswanatha Temple in Banaras. *Devadasis* from Banaras contributed to the construction of Dharmasalas, wells and water reservoirs. Kalhana's Rajatarangini indicates that this system existed in Kashmir in AD 8th century.

Devadasi system was adopted by the fishermen of Agra in course of time. One of their daughters would be dedicated to the god Bhairon. This custom was later symbolized with the practice of submitting dolls made of dough. This system prevailed in Sindh and Deccan also. The *devadasis* of Bombay were called as Kalavatis, Kalavantinis, Nayikins etc while they were called as Bhavins in Goa. Bernier comments about farmers in the area who believed that there would be an extra ordinary prosperity in farming with the dedication of *devadasis*^x. Every temple in Assam had a Troup of dancers. The *devadasi* system became very popular in Assam during the reign of Ahom kings. The rulers of this dynasty brought many dancer families to Assam to perform dances. The descendants of these families still exist in Assam. Celibacy was their main feature^{xi}.

Devadasis In South India

With the spread of Tantric religion and with the growing influence of temple culture, *devadasi* system flourished in South India as well. Dance and dancers gained prominence in the pooja cult which flourished with the temple centered religious life^{xii}. It is in this historical context that in A.D. 10th century, the Chola King Rajaraja Chola donated 400 *devadasis* to the temple of Tanjore and the Chalukya king built *devadasi* houses in A.D. 1112. *Devadasi* system was prevalent in the South Indian states of Karnataka, Tamilnadu, Andhra Pradesh and Kerala. In fact, *devadasis* were an integral part of South Indian temples.

Devadasis were called as *Varangana*, *Patram*, *Atiyal*, *Sule* etc... in Karnataka. Yellammapuram in Karnataka was famous for *devadasis*^{xiii}. *Devadasi* system was prevalent among the Boyar caste in Bellary, Mysore and Dharwad. *Devadasis* were reverently referred to as '*devakanyakas*' in a Kannada inscription of A.D. 800. Records show that two large reservoirs were built by two dancers in the town of Channaraja in Mysore. *Devadasis* were dedicated to the temples during the golden age of Pallava-Chola kings in South India.

The *devadasi* system came in to vogue in South India in A.D. 8th century, as evidenced by the carvings of Dharma Mahadevi, the wife of Nandivarman which belongs to the mentioned period. The Muktheswara Temple in Kanchi and the 42 *koothachis* in the temple are mentioned in the inscription. K.K. Pillai opines that *devadasis* might have associated with temple rituals in South India since A.D. 8th century^{xiv}. This system began to gain more acceptance by A.D. 10th century and came to prominence by the establishment of Brihadeeswara Temple, Tanjore by Rajaraja Chola. The major rock inscription from this temple which dates back to A.D. 1004 mentions dedication of 400 *devadasis* by Rajaraja Chola to the temple. The king gave them four streets around the temple as tax-free land. There were around hundred dancers at Kailasnath Temple of Kanchipuram.

Devadasis lived in the Hindu temples of North Arcot, Thiruchirappilli and Kumbakonam. Suchindram Temple of Kanyakumari is also a place where the *devadasis* had prominent role.

Kerala Historian Elamkulam Kunjan Pillai, marks the growth of *devadasi* system in Kerala by analyzing models of the South Indian temple civilization and *devadasi* system in Kerala's cultural history^{xv}. The temple culture in South India emerged with the arrival of Aryans. As per William Logan, temples became essence of Kerala religious life with Aryanisation in A.D. 8th century^{xvi}. Rituals started to gain significance as an act for God's favour in the temple centric community. Tantricism became common in the temples of Kerala. Socio economic life of medieval Kerala developed intertwined with temples. Apart from being centre of social, economic and religious activities, the temples also promoted artforms like dance, music and drama. *Koothambalams* were built in the temple premises of Kerala facilitating demonstration of various art forms.

So many girls became temple dancers. They were called as *Devadasis* and at times, a distorted form of the term, *Thevitichis*. The system was more prevalent in Travancore. *Devadasis* were brought from Suchindram, Bhoothapandi, Keralapuram, Chenkotta and Thiruvattar and settled permanently in Travancore. *Devadasis* were usually brought from Suchindram during the festival at the Padmanabhaswamy Temple. Therefore, Travancore became an area of influence for *devadasis* as compared to other parts of Kerala^{xvii}. The system had spread all over Kerala by 11th century.

Devadasis were an integral part of Hindu community. The system was a major feature of all the Brahmin temples. There are differences of opinion among the historians about the *devadasi* system. Edgar Thurston described *devadasis* as dancing girls attached to the Tamil temples, who subsist by dancing and music and consider the practice as 'the oldest profession in the world'^{xviii}. Monier Williams described *devadasis* as they were held to be married to the god and had no other duty but to dance before his shrine. Hence they were called God's slaves (*Deva-Dasi*), and were generally patterns of piety and propriety^{xix}. Saskia. C. Kersenboom understands *devadasis* as an expressive semiotic unit which is signifying the mythical – aesthetic – cum – ritual object residing in the collective consciousness of Hindu tradition^{xx}. Marglin consider *devadasis* as a very specialized unusual group of women and one who acted as the harbingers of auspiciousness to a state and society^{xxi}. Venkatramaiah argues that some women were employed in temples as workers and those well versed in dance and music would dance and sing in the temples on certain specific occasions. They were not harlots or prostitutes. They were spinsters who might leave the service in the temples and enter into married life if they should so desire^{xxii}. Parasher Sen considered the service of women in the temples of India was an innovation of the puranic religion. But the practice of worship in the public temples was taking shape in the early centuries of the Christian Era^{xxiii}. Altekar pointed out that after the magnificent construction of the temples of the Hindu Gods, people began to feel in the course of time that there should be singing girls attached to shrines to play music on the occasions of different services and worship of the day^{xxiv}. MGS Narayan believed that the expansion of temple system and growth of Bhakthi Movement brought into existence the class of temple dancing girls^{xxv}. According to Romila Thapar, they were in origin a special and venerated group of women attendants some of whom, like the *Vestal Virgins of Rome*, were dedicated to the temple at birth or when quite young. The more talented among them were selected for the extremely difficult training for becoming a *Bharata Natyam* dancer (some of the best dancers to this day are descendants of *devadasi* families). But the system was abused, and eventually in many temples the *devadasis* de-generated into shamefully exploited prostitutes, their earnings being collected by the temple authorities^{xxvi}.

Different interpretations point to the importance of the *devadasi* system in the early days. Subsequent socio – economic - political transformations changed the status of *devadasis* to mere sexual pleasure. The domination of Brahmin Community, the domination of temple property, the rise of landlords etc. undermined the sanctity of *devadasi* system. *Devadasis* devoted to the God were forced to surrender before Brahmins, landlords and merchants for their existence. *Devadasis* were abused to the core by the then existing medieval patriarchal society of South India. Dedication of girls in adolescence to temples as servants of Gods facilitated their abuse by dominating sections of the society. Religion and temple acted as structural facilitators for patriarchy to work. Female physique transformed into a temple property under the ownership of the male Gods prevailing in the shrines.

This very concept of a feminine body transforming to a property reveals how religion acted as a weapon of patriarchal pressure/pleasure.

In later stages *devadasis* surrendered to the patriarchal dominance in the temple premises which abused them for the latter's pleasure. The system continued for centuries in a degenerated form as the feminine forces were not strong enough to destructure it while the patriarchal ideals were very powerful in preserving them. *Devadasi* system can thus be very well understood as a right reflection of how patriarchy used religion as a powerful tool for establishing and retaining male dominance over society.

ⁱ Frieda Hanswirth, *The Status Of Indian Women*, London, 1932, p.90
ⁱⁱ PK Vijayamohan, *The Institution of Devadasis In Travancore*, Journal of Kerala Studies, Vol.V, 1978, p.471
ⁱⁱⁱ NM Penzer, *Sacred Prostitution of South India*, Motilal Banarasidas, Delhi, 1888, p.88
^{iv} P Ramachandran, *The Devadasis of Travancore*, Journal of Kerala Studies, Vol.VI, 1968, p.385
^v UP Krishnamacharya, *The Place Of Devadasis In Society*, Madras, 1934, p.10
^{vi} P Ramachandran, op.cit.,p.411
^{vii} Edgar Thurston, *Castes and Tribes of South India*, Vol.II, Cosmos Publications, New Delhi, 1975, p.126
^{viii} P Ramachandran, op.cit., p.387
^{ix} AS Altekar, *The Position of Women in Hindu Civilization*, Motilal Banarasidas Publication Pvt. Ltd., Delhi, 1959, pp. 214- 215
^x P Ramachandran, op.cit., p.400
^{xi} Kaliprasad Goswami, *Devadasi: Dancing Damsel*, A.P.H.Publishing Coperation, New Delhi, 1999, p.48
^{xii} കലാമണ്ഡലം കല്യാണികുടിയമ്മ, *മഹാനിയാടം- ചരിത്രവും ആട്പ്രകാരവും*, DC ബുക്സ്, കോടയം, 1992, p. 50-51
^{xiii} പി.സരോമ, *ദേവദാസികളും സാഹിത്യ ചരിത്രവും (വിമലശ്ശമം)*, പരഭാത് ബുക്സ് ഹൗസ്, തിരുവനന്തപുരം, 2000, p. 41
^{xiv} KK Pillai, *The Suchindram Temple*, Madras, 1953, p.278
^{xv} ഇളംകുളം, *കരളചരിത്രത്തിലെ ഇരുടഞ്ഞെ ഏടുക*, എസ്. പി. സി. എസ്. പരസിട്യാകരണം, കോടയം, 1968, p. 78
^{xvi} എ ശ്രീധരമനോഹര, *കരളചരിത്രം*, എസ്.പി.സി.എസ് പരസിട്യാകരണം, കോടയം, 1970, p.60
^{xvii} പി.സരോമ, op.cit., p.48
^{xviii} Edgar Thurston, op.cit., p.130
^{xix} Saskia.C.Kersenboom, *Nityasumangali Devadasi Tradition in South India*, Motilal Banarasidars Publishers Pvt. Ltd., Delhi, 1987, p.44
^{xx} Ibid., p.45
^{xxi} Ibid., p.46
^{xxii} Lakshmi Viswanathan, *The Women Pride : The Devadasi Heritage*, The Roli Book Publishers, New Delhi, 2010, p.93
^{xxiii} Ibid., p.93
^{xxiv} A.S.Altekar, Op.Cit., p.216
^{xxv} Rajan Gurukkal, *The Kerala Temple and Early Medieval Agrarian System*, Vallathol Vidyapeedom, Kottayam, 1992, p.13
^{xxvi} Romila Thapar, *A History of India*, Vol.I, Penguin Books India Pvt. Ltd., New Delhi, 1970, p.201