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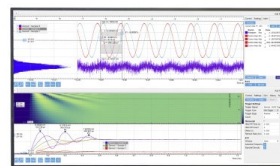
Enhanced Absorption in Thin Film Silicon Solar Cell Using Plasmonic Nanoparticles: An FDTD Study

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Abstract. Solar energy is a clean and renewable energy source that has the potential to replace fossil fuel with effective conversion of solar energy to electrical power. Research into thin film solar cells has been of priority because of the lower usage of semiconducting material and thereby lower cost. But the thin film solar cells may also result in low device efficiency caused by inefficient absorption. Researchers are still looking for a better design of solar cell for enhanced performance in terms of light trapping and photocurrent. Various methods have been proposed for enhanced light trapping and efficiency. The nanostructured metal particles in solar cells is shown to produce absorption enhancement due to localized surface plasmon. In this context, we perform a numerical investigation on the broadband light absorption enhancement in thin-film plasmonic solar cell with nanoparticle array over the silicon layer using Finite Difference Time Domain (FDTD) method. The choice of proper metal nanoparticles, size of nanoparticles and interparticle spacing are crucial in the study. Silver and gold are most studied materials due to their surface plasmon resonances located in the visible range. Aluminium is an abundant material whose surface plasmon resonance is located in the UV region. We performed a detailed investigation into the effect of nanoarray of silver, gold and aluminium nanoparticles over the silicon layer of the plasmonic thin film solar cell on the broadband absorption enhancement of the solar cell. The obtained result were compared for ascertaining the choice of material, size and interparticle spacing for optical absorption enhancement.

INTRODUCTION

Solar cells is a source of energy with potential to replace fossil fuels if effective conversion of sunlight to clean electrical power is achieved. Silicon has been the preferred material of choice for solar cells owing to its low cost, abundance on earth, and non-toxicity [1, 2]. First generation solar cells that are currently dominating the solar cell market are typically made from thick crystalline semiconductor wafers which demand about 40 per cent of cost of a solar module [3, 4]. In order for large scale implementation, the production cost still needs to be significantly reduced and efficiency substantially increased. Thin film Si solar cells are a good choice towards reducing cost because of low cost of materials and processing [5, 6]. In thin film solar cell technology, silicon thin film of thickness in the range 1-2 μm is deposited on cheap substrates such as glass, plastic or stainless steel. However, these thin film solar cells have ineffective absorbance near bandgap and research aimed at increasing efficiency of these solar cells are still ongoing [7, 8, 9]. In this perspective, the absorption enhancement of silicon on addition of metal nanoparticles over the silicon layer of a silicon solar cell is systematically investigated numerically via Finite Difference Time Domain method. The enhancement factor with each type of nanoparticles is calculated to study the improvement in silicon absorption of the solar cell on the addition of metal nanoparticles such as silver, aluminium and gold.

METHODOLOGY

Schematic of configuration used for the study is shown in figure 1. The metal nanospheres are deposited periodically on the silicon substrate. Here, d is the diameter of the particle and p is the period or the interparticle spacing. Silver, gold and aluminium are considered in this study due to the localized surface plasmon properties of these metal nanoparticles. The absorbing layer is silicon because of the wide range of application monocrystalline silicon solar cells have. The optical parameters of silicon, silver, gold and aluminium are from Palik et. al. [10]. The simulations were performed using a commercial FDTD software package, Lumerical FDTD (version 8.22.2072), available from Lumerical Inc. [11]. This photonic simulation software FDTD from Lumerical, uses the Finite-Difference Time-Domain (FDTD) method [12, 13, 14] for solving Maxwell's equations in complex structures. The incident source is a uniform plane wave with a wavelength range 400-1100 nm. The simulation study uses perfectly matched boundary layers absorbing boundary condition on the upper and bottom boundaries of the computational domain that absorb the
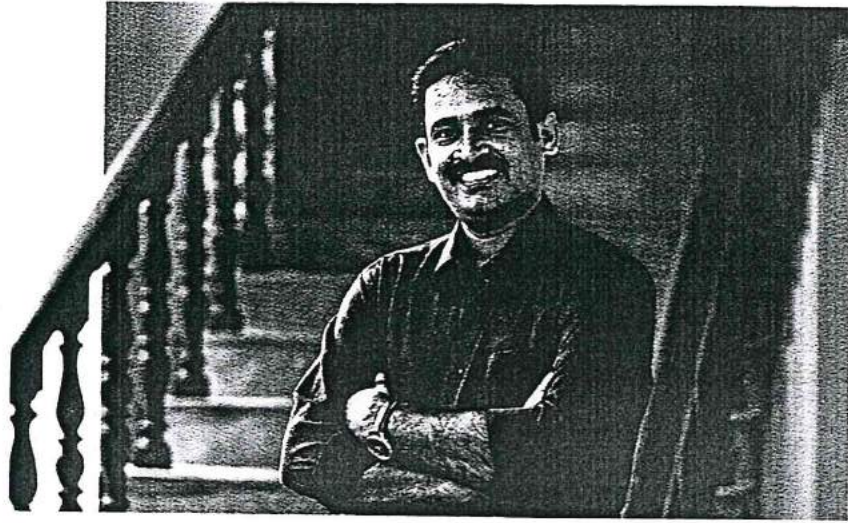
കാഴ്ചയും കാഴ്ചപ്പാടും

വിമർശനാത്മക വീണ്ടുവിചാരങ്ങൾ

ഡോ. എം. ഐ. പുന്നൂസ്

സമകാലികലോകം അഭിമുഖീകരിക്കുന്ന സാമൂഹിക, സാംസ്കാരിക പ്രതിസന്ധികളെ തെളിഞ്ഞ മൂല്യബോധത്തിന്റെ വെളിച്ചത്തിൽ വിലയിരുത്തുന്ന പഠനങ്ങൾ. ഏതു വിഷയം പ്രതിപാദിക്കുമ്പോഴും അതിന്റെ മർമ്മത്തിൽ തൊട്ടുകൊണ്ട് ആരംഭിക്കുകയും പടിപടിയായി അതിന്റെ വിവിധ മണ്ഡലങ്ങളിലേക്ക് പ്രവേശിക്കുകയും ചെയ്യുന്ന സമീപനമാണ് ഇതിലുള്ളത്. നിരാഡോപമാണ് അതിന്റെ ശൈലി; ആർജ്ജവം വിടാത്തതാണ് ആവിഷ്കരണം. ഒരു നിമിഷം തിരിഞ്ഞുനിന്ന് ചിന്തിക്കാതെ പോകാൻ സമ്മതിക്കാത്തതാണ് ഓരോ അധ്യായവും. ഈ തിരി കൈയേൽക്കാൻ മൂല്യബോധമുള്ള ഏതു വായനക്കാരനും സന്തോഷമായിരിക്കും.

- പ്രൊഫ. എം. തോമസ് മാത്യു

ഫോക്ലോർ ചിന്തകളുടെ സാംസ്കാരിക തനിമയും പൈതൃകവും പാരമ്പര്യവും പ്രകാശിപ്പിക്കുന്ന പഠനങ്ങളുടെ സമാഹാരമായ ഈ കൃതി മലയാളത്തിലെ സാഹിത്യവിജ്ഞാനീയശാഖയ്ക്ക് മുതൽക്കൂട്ടായിരിക്കുന്ന ഒരു പുസ്തകമാണ്. പല സന്ദർഭങ്ങളിലായി എഴുതിയ പഠനങ്ങളാണ് ഇതിന്റെ ഉള്ളടക്കമെങ്കിലും ഇതിലെ പതിനഞ്ചു പഠനങ്ങളുടെയും അന്തർധാര സാഹിത്യ വിജ്ഞാനീയത്തിന്റേതാണ്. ഒരു ചരടിൽ കോർത്തണക്കിയ മട്ടിൽ ഈ പുസ്തകത്തിലെ വ്യത്യസ്ത പഠനങ്ങൾ ചരിത്രത്തിലൂടെയും മിത്തുകളിലൂടെയും സംസ്കൃതികളിലൂടെയും ഊളിയിട്ടിറങ്ങി സരസ്വതീനദിയുടെ അജ്ഞാതമായ അന്തർധാര കണക്കെ അനർഘമായ ഒരു സാംസ്കാരിക ഭൂമിക സൃഷ്ടിക്കുകയാണ്. ഇതിനെ സാഹിത്യവൈജ്ഞാനികം എന്നുതന്നെ വിശേഷിപ്പിക്കുന്നതാവും ഉചിതമെന്നും പറയാതെ വയ്യ.
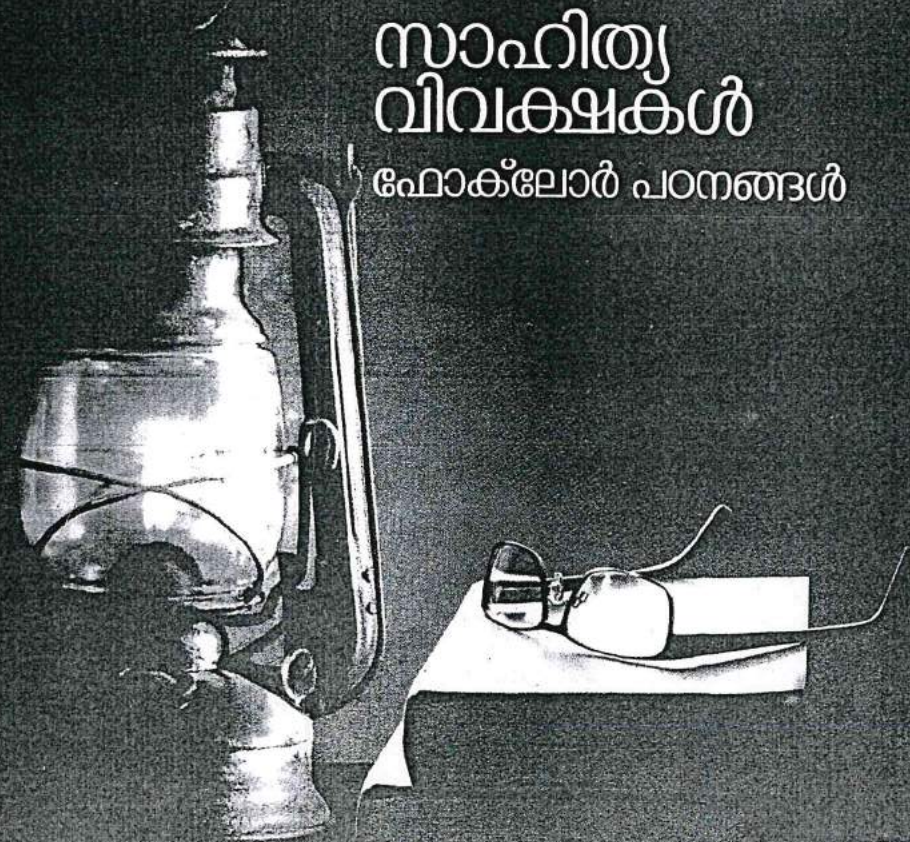
–ഡോ. പോൾ മണലിൽ

ഡോ. എം. ഐ. പുന്നൂസ്

EXPRESSIONS
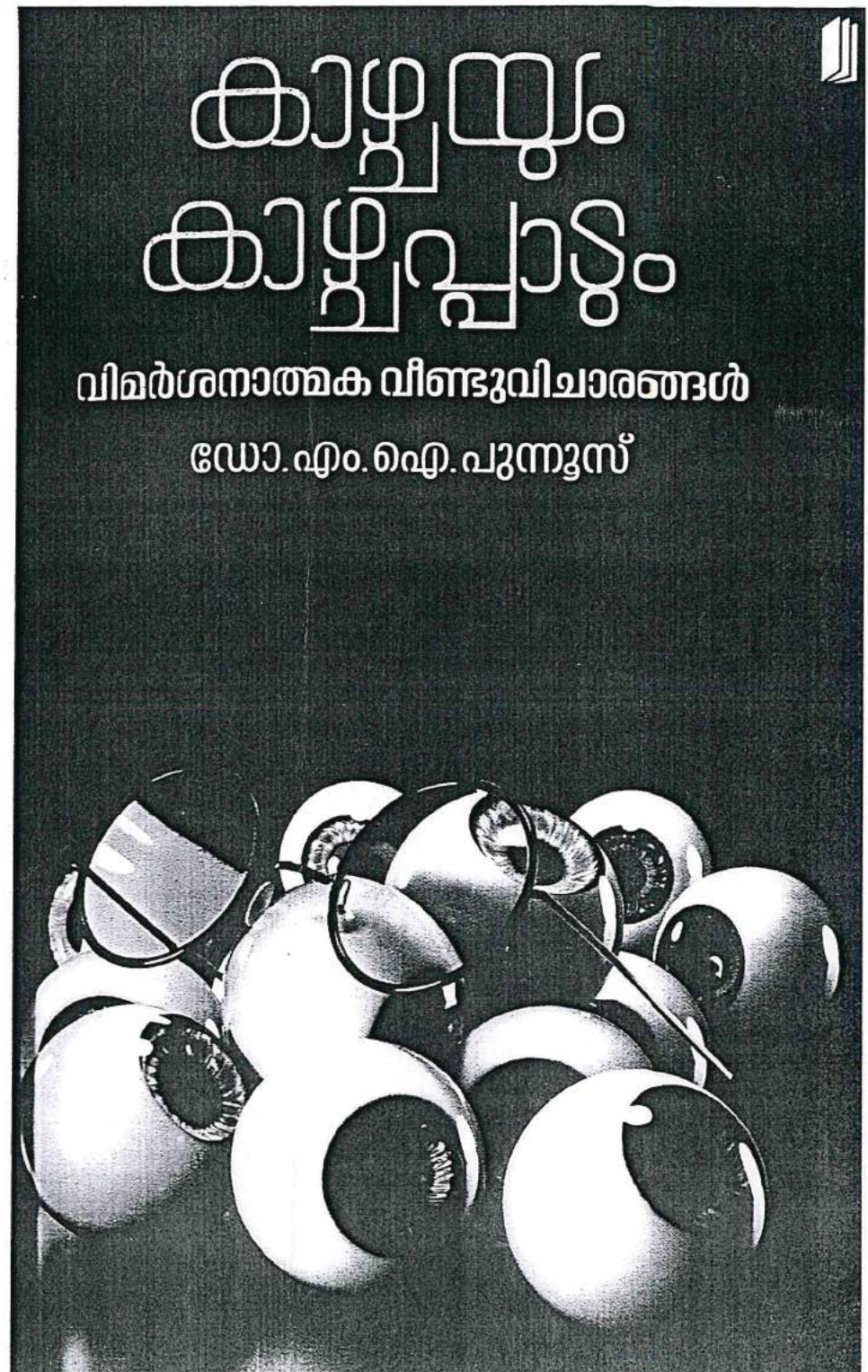
മിത്തും ചരിത്രവും:
സാഹിത്യ വിവക്ഷകൾ
ഫോക്ലോർ പഠനങ്ങൾ

ഹോങ്കോങ്ങ്
ഇൻഡോനേഷ്യൻ
ഡയറിക്കുറിപ്പുകൾ

ഡോ. എം. ഐ. പുന്നൂസ്

ചരിത്രപാരമ്പര്യം കൊണ്ടും സാംസ്കാരിക വൈവിധ്യം കൊണ്ടും സമ്പന്നമായ രണ്ട് ഏഷ്യൻ രാജ്യങ്ങളിലേക്ക് നടത്തിയ യാത്രകളുടെ സവിശേഷാനുഭവങ്ങൾ. പരിസ്ഥിതി, പുരാവൃത്തം, പ്രാചീന മനുഷ്യനിർമിതികൾ, ഭാഷ, ഭക്ഷണം തുടങ്ങി ഭിന്ന മനുഷ്യസംസ്കാരങ്ങളുടെ വൈവിധ്യമാർന്ന കാഴ്ചകൾ തെളിമയറ്റ ഭാഷയിൽ പരിചയപ്പെടുത്തിയിരിക്കുന്നു. ഒപ്പം, രണ്ട് രാജ്യങ്ങളുടെയും ചരിത്രം, രാഷ്ട്രീയം, സംസ്കാരം, ഭൂമിശാസ്ത്രം തുടങ്ങിയ വിഷയങ്ങളിലേക്ക് വെളിച്ചം വീശുന്ന ബഹുസ്വരതയാർന്ന പ്രതിപാദനവും.

സെന്റ് തോമസ്
മിത്തും ചരിത്രവും
ഫോക്ലോർ പരികല്പനകൾ

ഡോ. എം. ഐ. പുന്നൂസ്

സെന്റ് തോമസുമായി ബന്ധപ്പെട്ട് കേരള ക്രൈസ്തവർക്കിടയിലും പൊതു സമൂഹത്തിലും പ്രചാരത്തിലുള്ള ദത്തങ്ങളുടെ അവതരണവും അവയിലൂടെ കടന്നുപോയപ്പോഴുണ്ടായ ഉൾത്തെളിച്ചങ്ങളുടെ ക്രോഡീകരണവുമാണ് ഈ കൃതിയുടെ ഉള്ളടക്കം. പാഠങ്ങളിലും പാഠഭേദങ്ങളിലും അടയിരിക്കുന്ന അധികാരപ്രയോഗങ്ങളും അപരത്വവൽക്കരണവുമാണിത് ചർച്ചചെയ്യുന്നത്. സെന്റ് തോമസ് കേരളത്തിൽ വന്നുവോ ഇല്ലയോ എന്നു തീർപ്പുകല്പിക്കുന്ന ഗ്രന്ഥമല്ലിത്. മറിച്ച്, സെന്റ് തോമസ് കേരളത്തിൽ വന്നുവെന്ന് വിശ്വസിക്കുന്ന ജനസമൂഹത്തിന്റെ സംസ്കാരനിർമ്മിതികളുടെ ചരിത്രമാണ്. കഥനങ്ങളെയും മോട്ടിഫുകളെയും ഗ്രന്ഥകാരൻ തത്ത്വദീക്ഷയോടെ ശേഖരിച്ചിരിക്കുന്നു. രീതിശാസ്ത്രഭദ്രതയോടെ വർഗ്ഗീകരിച്ചിരിക്കുന്നു. ലഭ്യമായ ദത്തങ്ങളെ സൈദ്ധാന്തികമായി വ്യാഖ്യാനിക്കാൻ കഴിയുന്നത്ര ശ്രമിച്ചിരിക്കുന്നു. പ്രാദേശികചരിത്രമെന്നോ പുരാവൃത്തചരിത്രമെന്നോ ജനസംസ്കാരചരിത്രമെന്നോ നിങ്ങൾക്കിതിനെ ജാനുഷീകരിക്കാം.

–ഡോ. അജു കെ. നാരായണൻ

SPCS

ഏഴാച്ചേരി
കലഹകലയുടെ ഗന്ധമാദനം

സമ്പാദനം, പഠനം
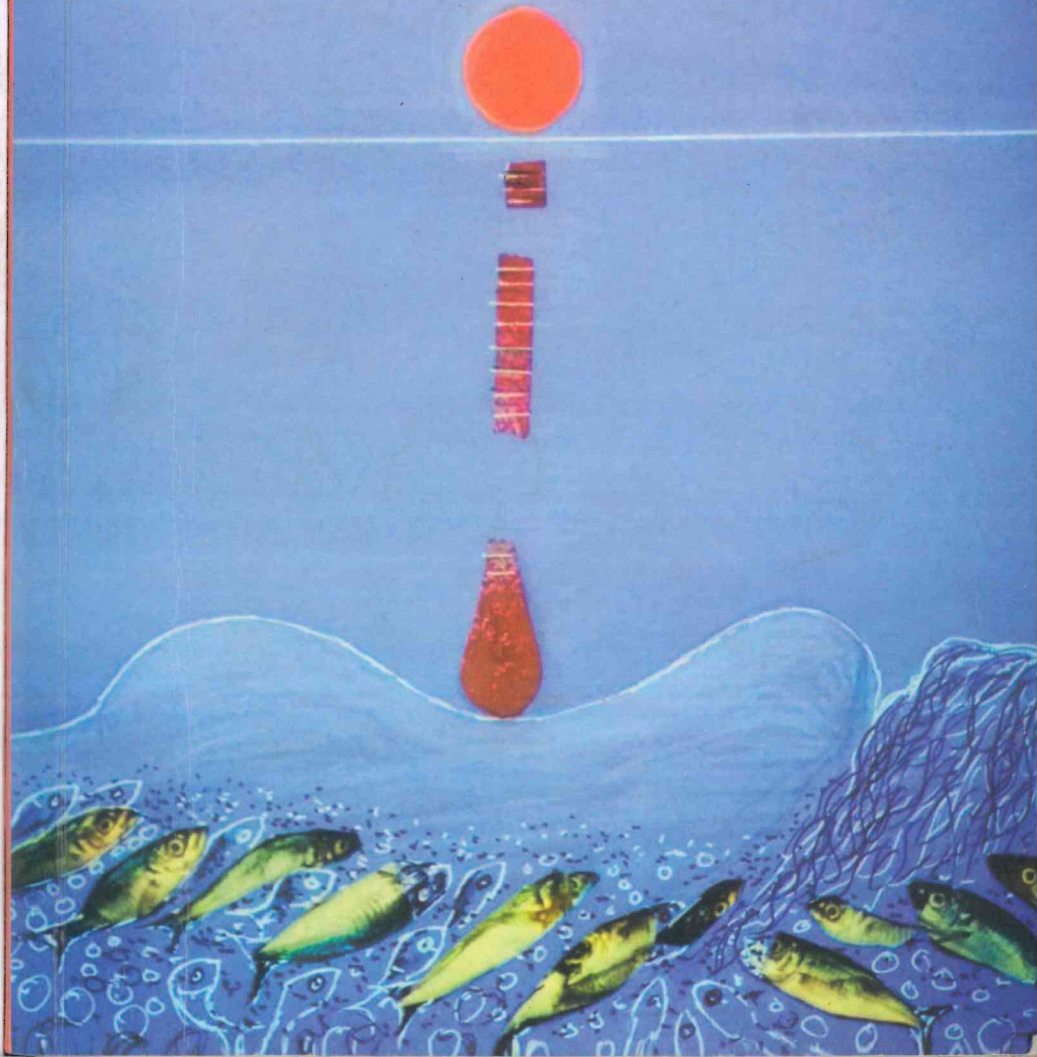ഡോ. സി. ഉണ്ണികൃഷ്ണൻ

ഭാഗം- 2

പഠനങ്ങൾ

പച്ചമണ്ണിന്റെ വീറ്

ഡോ. മിനി ആലീസ്

ഏഴാച്ചേരി രാമചന്ദ്രന്റെ കവിതകളിലെ സ്ത്രീകൾ സ്വന്തം പേരിൽ അറിയപ്പെടുന്നവരാണ്. ആശ്രിതവ്യക്തിത്വത്തിൽ നിന്ന് കുതറി മാറേണ്ടതിന്റെ ആവശ്യകതയെ നിരന്തരം അവർ തിരിച്ചറിഞ്ഞിരു ന്നു. ആദർശവൽക്കരണത്തിന്റെ തിളക്കങ്ങളോ സാമാന്യവൽക്കരണ ത്തിന്റെ അവ്യക്തതകളോ അവരുടെ ജീവിതത്തിൽ നിഴൽ വിരിക്കുന്നില്ല. ജീവിതത്തിന്റെ പ്രതിക്ലലങ്ങളോടും യാഥാസ്ഥിതികതകളോടും നേർക്കുനേർ പൊരുതുവാൻ കെൽപ്പുള്ള സ്ത്രീകളാണ് ഈ കാവ്യലോക ത്തു കടന്നുവരുന്നത്. യാഥാർഥ്യത്തിന്റെ പരിമിതികളെ കരുത്തോടെ മറികടക്കുകയും കാപട്യത്തിനും അസമത്വത്തിനും എതിരെ പ്രതിരോധം തീർക്കുകയും ചെയ്യുവാൻ അവർക്കു സാധിക്കുന്നു. ഋജുത്വവും ശക്തിയും സ്വാശ്രയബോധവും കൈമുതലായ സ്ത്രീകളെ കവിതയിൽ ആവിഷ്കരിച്ച കവിയാണ് ഏഴാച്ചേരി രാമചന്ദ്രൻ.

പേരുള്ള സ്ത്രീകളാണ് ഏഴാച്ചേരിയുടെ കവിതാലോകത്തു കടന്നു വരുന്നത്. കള്ളിയങ്കാട്ടെ നീലിയുടെ പിന്മുറക്കാരായ സ്ത്രീകളെല്ലാം സ്വാശ്രയവ്യക്തിത്വത്തിന്റെ ആൾരൂപങ്ങളാണ്. സ്റ്റെല്ല, ആലീസ്, ചിന്നമ്മു, കർമ്മലീനാ, കമലം, ജമീല, നദീറ, അമ്മിണി, യശോദ, ജീന, ജൂലിയ, റസിയ എന്നിങ്ങനെ എത്രയോ പേരുകളിൽ അവർ കടന്നുവ രുന്നു. ജീവിതത്തിലെ ഒറ്റപ്പെടലിന്റെയും പരുക്കനനുഭവങ്ങളുടെയും മുൾവേലികളെ അവർ സ്വയം മുറിച്ചുകടക്കുന്നു. ചിലർ പ്രതിരോധത്തിന്റെ കോട്ടകൾ തീർക്കുന്നുവെങ്കിലും അവസാനശ്വാസം വരെ പൊരുതി, എരി

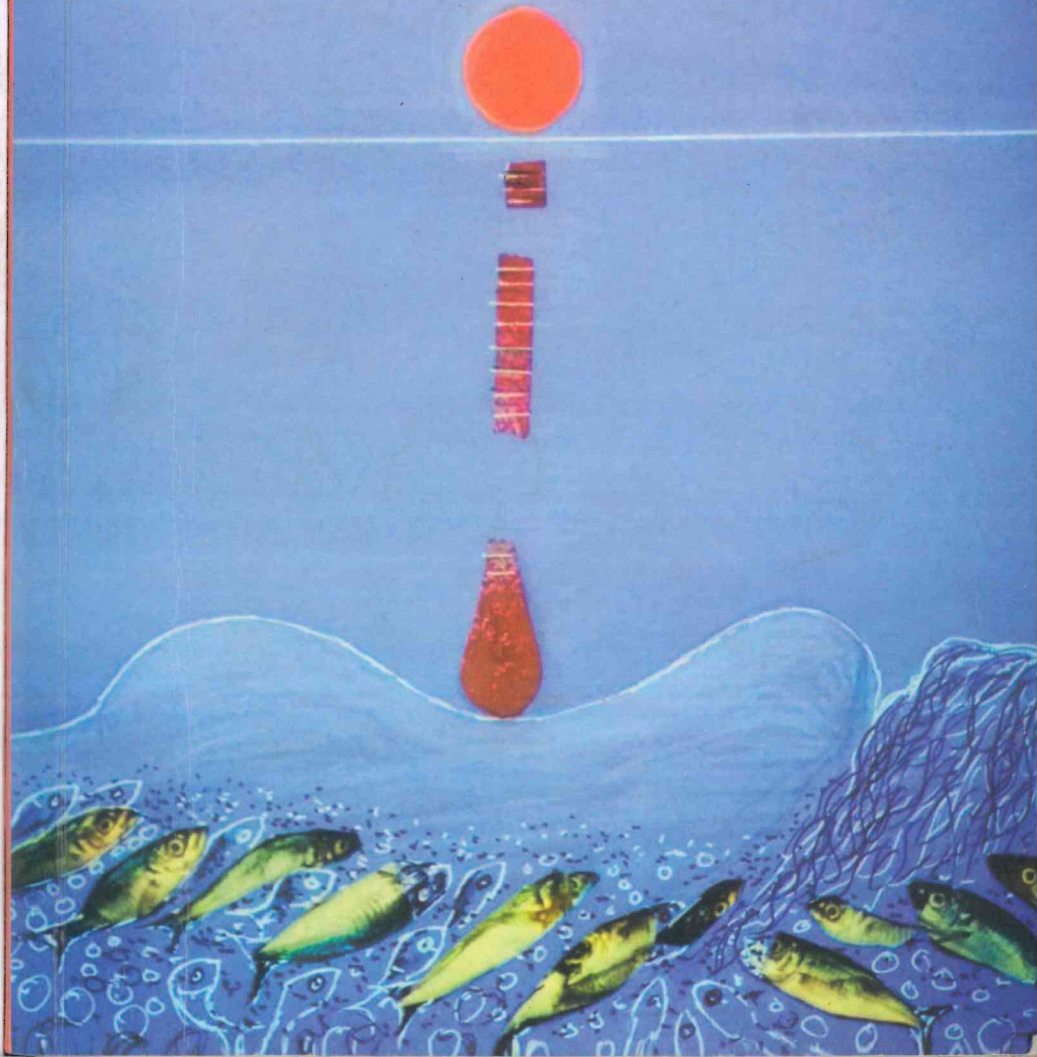# ഉപ്പുതരിശ്

മ്യൂസ് മേരി

കവിതയുടെ ലവണജലനിധി

ഡോ. മിനി ആലീസ്

ആയിരത്തിത്തൊള്ളായിരത്തിത്തൊണ്ണൂറുകൾ മലയാളത്തിലെ സ്ത്രീ കവിതയുടെ ചരിത്രത്തിലെ സുപ്രധാന ഏടുകളാണ്. അതുവരെയുള്ള, നൂറ്റാണ്ടുകൾ നീളുന്ന കവിതയുടെ ചരിത്രത്തിൽ വിരലിലെണ്ണാവുന്ന എഴുത്തുകാരികൾ മാത്രമാണുണ്ടായിരുന്നത്. തൊണ്ണൂറുകളോടെ മലയാളകവിതയിലേക്ക് പ്രാതികൂല്യങ്ങളുടെ മധ്യത്തിൽനിന്നു തെളി യിച്ചെടുത്ത സർഗ്ഗാത്മകതയുമായി കൂടുതൽ എഴുത്തുകാരികൾ കടന്നുവന്നു. രണ്ടായിരത്തിനു ശേഷം പെൺകവിതകൾ, നിറസാന്നി ധ്യമായി മലയാളകവിതാലോകത്തു നിലയുറപ്പിച്ചു. അതുവരെ കണ്ടിട്ടും കണ്ടില്ലെന്നു നടിച്ച, കാവ്യലോകത്തേക്ക് പ്രവേശനമില്ലെന്ന് അലിഖിത നിയമങ്ങളാൽ മുദ്രവെച്ച അനുഭവസഞ്ചയമാണവർ തുറന്നിട്ടത്. ദ്വന്ദ്വാ ത്മകതകളുടെ പുനർനിർമ്മാണം സാധ്യമാക്കിയ, സരളതകളിൽനിന്ന് ഗഹനതകളിലേക്ക് സഞ്ചരിക്കുന്ന ഉത്തരാധുനിക കാവ്യപ്രവണതക ളോട് ചേർന്നുനിന്നുകൊണ്ട് വളർന്ന പെൺകവിതയോടൊപ്പമാണ് മ്യൂസ് മേരിയുടെ കവിതകളും മലയാളകാവ്യലോകത്തേക്ക് കടന്നുവ ന്നത്. 'ഇസ്പേഡ് റാണി'യെന്ന ആദ്യസമാഹാരം 2008-ലാണ് പ്രസിദ്ധീ കൃതമാകുന്നതെങ്കിലും അതിലെ പകുതിയോളം കവിതകളും രണ്ടായി രത്തിനു മുൻപ് എഴുതിയവയായിരുന്നു. മലയാളത്തിലെ പെൺകവി തകൾ ഉച്ചസ്ഥായിയിലേക്ക് ഉയർന്ന കാലത്ത് അവരോടൊപ്പം മ്യൂസ് മേരിയുടെ കവിതകളുമുണ്ടായിരുന്നു. പെണ്ണിനു മാത്രം തിരിച്ചറിയാ വുന്ന ജീവിതാനുഭവത്തിന്റെ കയ്പും ചവർപ്പും മധുരവും, അവൾക്കു മാത്രമായി പതിച്ചുവെച്ച ഇടങ്ങളുടെ പരിമിത ലോകവുമായി ഈ കവി തകൾ സംസാരിച്ചു തുടങ്ങി. പെണ്ണനുഭവാവിഷ്കാരത്തിന്റെ വൈവി ധ്യപൂർണ്ണമായ തലങ്ങളാണ് മ്യൂസ്മേരിക്കവിതകളുടെ അകക്കാതൽ.

പെണ്ണിന്റെ പ്രണയകവിതകളുടെ സമാഹാരം പ്രണയപഠനങ്ങളോ ടൊപ്പം മലയാളത്തിലാദ്യമായി കടന്നുവന്നത് മ്യൂസ് മേരിയുടെ 'രഹ സ്യേന്ദ്രിയങ്ങൾ' എന്ന പ്രണയപ്പുസ്തകത്തിലൂടെയാണ്. അതുവരെ കർമ്മസ്ഥാനത്തു മാത്രം നിലയുറപ്പിച്ച പെണ്ണിന്റെ പ്രണയകർത്തൃത്വം ആവിഷ്കൃതമാകുന്ന ആ കവിതകൾ പ്രണയത്തിന്റെ രാഷ്ട്രീയത്തെ തിരിച്ചറിയുന്നവയായിരുന്നു. പ്രണയമാവിഷ്കരിക്കുന്ന പെൺസ്വര ത്തിന്റെ വ്യത്യസ്തത 'ഉപ്പുതരിശ്' എന്ന ഈ സമാഹാരത്തിലും കടന്നു വരുന്നുണ്ട്. "ഇരുവശങ്ങളിൽനിന്നുമൊരേ കാറ്റിനെ പിടിച്ചുകൊണ്ടോടി

ഉപ്പുതരിശ്

മ്യൂസ് മേരി

साहित्यिक संवाद

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प्रधान संपादक : एन. मोहनन

संपादक : सजी आर. कुरुप

सह संपादक : श्यामकुमार एस.

SAHITYIK SAMVAD

*A Festschrift in Honour of **Prof. K. Vanaja** edited by **Prof. N. Mohanan**,
Prof. Saji R. Kurup & **Prof. Shyamkumar S.***

हिन्दी एवं अँग्रेज़ी के विभाजन साहित्य में स्त्री

रूबी एल्सा जेकब

15 अगस्त 1947 को भारत का विभाजन हो गया। विभाजन के ऐन वक्त और बाद में जो नरसंहार हुआ, वह भारतीय इतिहास की एक करुण त्रासद घटना है। मौत का ड़र गहराता गया और लोगों को अपनी जन्मभूमि छोड़कर भागने को मजबूर होना पड़ा। एक झटके ने सभ्यता और संस्कृति, राष्ट्र और क़ौम सम्बन्धी अवधारणाओं में ऐसी तब्दीली ला दी कि लोग हतप्रभ-सा देखते रह गये। भारत की वर्तमान सामाजिक, साँस्कृतिक और राजनीतिक हालत के कारणों की खोज में जब जुटते हैं तो पाते हैं कि उनकी जड़ें विभाजन की त्रासदी से होती हुई इतिहास में दूर तक फैली हुई है।

विभाजन है ही ऐसा सुलगता दस्तावेज़ जिसकी एक व्याख्या या एक विश्लेषण सम्भव नहीं है। इसकी कई व्याख्याएँ हो सकती हैं और हुई भी। कई दृष्टियों से उसका विश्लेषण किये जाने की गुंजाइश है। इस तरह की व्याख्याएँ और विश्लेषण, साम्प्रदायिक सन्दर्भों और स्थितियों के हवाले देकर ज्यादातर राजनीतिक आधारों पर किये गये हैं। इस समय की स्थितियों का समीक्षक, स्वतन्त्रता सेनानी डॉ. राम मनोहर लोहिया ने इन शब्दों में कहा है– "हिन्दुओं और मुसलमानों के बीच दंगों के सिलसिले को समाप्त करने के लिए देश का विभाजन हुआ। देश के विभाजन के कारण वही चीज़ ऐसी भयंकर सूरत में प्रदर्शित हुई, जिससे बचने के लिए विभाजन को स्वीकार किया गया था। छः लाख बच्चे, औरतें और मर्द मारे गये। उन्हें मारने, बलात्कार और अत्याचार के लज्जापूर्ण और क्रूरतापूर्ण ढंग, पागलों की तरह अपनाये गये। डेढ़ करोड़ लोग उजड़े और पुनः बसने के लिए उन्हें ऐसे इलाकों में आबाद होना पड़ा, जहाँ न स्वागत करनेवाला कोई शुभचिन्तक था, न कोई पूछने वाला हितैषी। इतिहास में यह सबसे बड़े स्थानांतरण की मिसाल थी। विश्व इतिहास में ऐसा कभी नहीं हुआ। आज भी लोग आकलन करते हैं कि हिन्दुओं ने अधिक पशुता का प्रदर्शन किया था या मुसलमानों ने । (गिल्टी मैन ऑफ़ इंडियाज़ पार्टिशन– डॉ. राम मनोहर लोहिया– पृ. 33) देश विभाजन के सन्दर्भ में प्रसिद्ध अँग्रेज़ी रचनाकार, लारीकोलिंस और डोमेनिक ला पियर लिखते हैं– "अमृतसर से लाहौर तक विचित्र क़यामत का दृश्य था। 45 मील के इस रास्ते में प्रत्येक दम पर लोगों की बेबसी और बर्बरता का ही प्रमाण मिलता था। हर कदम पर मरे हुए लोगों की लाशें और बदन के हिस्से बिखरे हुए थे। गिद्धों ने इतना पेट भर खाया था कि उनसे उड़ा नहीं जाता था और कुत्ते भी आदमी के मांस से सन्तुष्ट हो चुके थे, केवल गुरदे और कलेजी खाकर लाशों के सड़ने के लिए छोड़ देते थे"। (फ्रीडम एट मिटनाईट– लॉरीकोलेंस, 1975– पृ. 379) यह एक विचित्र विरोधाभास है कि जिस दिन हमें आज़ादी मिली, उसी दिन देश का विभाजन भी हुआ। वे मूल्य और मान्यताएँ जिनके लिए स्वाधीनता संग्राम के लिए संघर्ष करते रहे, विभाजन के दिनों में और

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LNCS 13144

Distributed Computer and Communication Networks

Control, Computation, Communications

24th International Conference, DCCN 2021
Moscow, Russia, September 20–24, 2021
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Analysis of a Batch Service Queueing System Associated with Inventory Transport

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Abstract. This paper considers a single server batch service queueing system in which service is provided in at most k stages. A batch of customers is admitted for service under GBS - rule (with minimum batch size a and maximum batch size b). The customers have the choice to leave the system after service completion from any stage. The service time of a customer in a stage depends on the stage as well as the number of customers being served in that stage. The stability of such a system is investigated and key performance measures computed based on system state distribution. The time required to provide service to a batch of specified size is analyzed. An optimization problem is considered and a numerical example provided.

Keywords: Batch service · GBS -rule · Inventory transport · k-stage queueing system

1 Introduction

In this paper, a queueing problem which arises in the transport of inventory, encountered by most e-commerce firms is considered. Due to restrictions imposed by cost and time all items to be shipped from a fixed source in a particular route will be shipped together, in batches of a certain minimum batch size (which forms the lower threshold a). Also, there will be a certain capacity restriction for the transport vessel(server), so the maximum batch size for service (which forms the upper threshold b) should be specified. So if the source is denoted by node 0, the terminal node(the last station in this route) by $k + 1$, the inventory will be delivered at nodes $1, 2..., k$, in addition to the terminal node. It is of interest to know the time required to provide service to a batch of a particular size. For simplicity, we have modeled the problem as a single server queueing system, though in real life it is a multiserver queueing system. The demands for inventory at the source are arrivals to this queueing system. The service is assumed to be provided in at most k stages as the service ends when the entire

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Taxonomy of *Cyrtophora citricola* (Forsskal, 1775) from the Western Ghats

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Abstract
The study focuses on the taxonomy of *Cyrtophora citricola* of the Western Ghats. The spider genus *Cyrtophora* Simon, 1864 belongs to the family Araneidae Clerck, 1757 and subfamily Cyrtophorinae Simon, 1895. C. citricola (Forsskal, 1775) is the type species and is the only representative of *Cyrtophora* in the New World. Specimens were collected from different sites spanning the length and breadth of the Western Ghats. Taxonomic description and illustration of the species is done. Stereomicroscope Leica M205C with advanced automontage software is used for detailed description and documentation. *Cyrtophora citricola* has more than one pair of abdominal tubercles, is colonial and abundantly found in urban landscapes. DNA barcoding with Cytochrome oxidase 1 (Cox1) marker is carried out. DNA isolation was done with Qiagen DNeasy® kit. Data analyses were conducted on TCoffee, BioEdit and MEGA5. Two extreme colour variants of *C.citricola* were sequenced to know if they were two individual species, but were confirmed to be only colour morphs. The combination of traditional taxonomy and molecular data is a good model to adopt. When species identification is complicated, the potential of DNA barcoding can be utilized. An integrated approach in taxonomy is the need of the hour.

Keywords: Taxonomy, *Cyrtophora*, Western Ghats, DNA barcoding, Cytochrome oxidase1

Charippus Thorell, 1895, a poorly studied genus of euophryine jumping spiders (Araneae, Salticidae)

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Abstract
Charippus Thorell, 1895, a poorly studied genus of jumping spiders, currently contains only two species: the type species *C.errans* Thorell 1895 from Myanmar and *C.yinae* Wang & Li, 2020 from China. However, our recent study on jumping spider specimens from Southeast Asia and China showed that the diversity of this genus is far beyond that, and at least eight new species have been discovered so far. Previous studies suggested that *Charippus* belonged to Euophryini and probably fell into the Cytaea-Euryattus Clade. However, our molecular phylogenetic analyses based on four genes (28S, 16S, ND1 and Actin5C) reveal that *Charippus* falls within the Laufeia Clade of Euophryini. In addition, somatic and genitalic characters were explored for potential synapomorphies of *Charippus* and its close relatives.

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Preparation and characterization of manganese doped hematite nanostructures for photocatalytic applications

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ABSTRACT

In this paper, a simple two stage electrochemical method is utilized to prepare manganese doped hematite nanostructures and to test its efficiency in photocatalytic applications. The structural, compositional, morphological and optical characterizations are performed with the help of X-ray diffraction and Raman spectroscopy, X-ray Photoelectron spectroscopy, Field emission scanning electron microscopy and Diffused reflectance spectra respectively. Doping with manganese has lead to reduction in bandgap and hence to improvement in photocatalytic activity.

KEYWORDS: *Anodization; electrochemical; nanostructures; doping; photocatalysis.*

1. INTRODUCTION

Removal of toxic waste from waterbodies has become a primary concern for scientists and a number of methods have been utilized to remove waste from water sources. Photocatalysis technique is a very simple and efficient method to remove contaminants from water. Hematite (α-Fe_2O_3), the most stable form of iron oxide is considered as a good photocatalyst due to its properties such as low cost, environment friendly nature and a suitable band gap [1]. But hematite has certain limitations such as low electrical conductivity and high recombination rate of electrons and holes[2,3]. Doping with different elements, nanostructuring, formation of heterostrucures are commonly preferred methods to overcome these difficulties[2]. Here we have attempted to dope manganese in hematite nanostructures by a simple electrochemical method so as to improve its performance in photocatalytic applications.

Therapeutical uses of *Syzygium cumini*, an underutilized plant of paramount significance

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Introduction

Syzygium Cumini (syn*: Eugenia jambolana, Syzygium jambolanum),* a traditional herb belonging to the family Myrtaceae is well known for its wide range of applications in the medicinal, therapeutic, pharmacological, and industrial sectors (Sahu et al, 2020). *S.cumini*, also known by the local names, jamun, black plum, blackberry, java plum, Malabar plum, and jambolan is an indigenous fruit of high commercial value (Ayyanar & Subash Babu, 2012). Jamun with its predominant geographical distribution in the tropical and sub-tropical regions of the Asian subcontinent, is also seen in Southeast Asia, China, Eastern Africa, South America, and Madagascar. The plant bears fruits once in a year and the fruits which are purple in color and sweetish-sour in taste are widely used for making jams, wines, and squashes (Swami et al, 2012). Being an excellent source of antioxidants, polyphenols, flavonoids, steroids, vitamins, alkaloids, essential oils, and mineral salts, *S.cumini* could be utilized for the treatment of a myriad of ailments (Anjali et al, 2017). Several studies performed previously have confirmed the anti-diabetic, anti-cancer, anti-allergic, anti-microbial, Anti-diarrheal, radio-protective, anti-pyretic, hepato-protective, nephroprotective, cardio-protective, gastro-protective, chemo-preventive and anti-inflammatory properties of *S. cumini* making it a plant of utmost therapeutic significance (Brito et al, 2007), (Tripathy & Pradhan, 2015), *(*Atale & Rani, 2016*),* (Singh et al, 2016), (Patil et al, 2018), (Farhana, 2020), (Gibbert et al, 2021).

The literature suggests that *S. cumini* has lots of industrial applications in addition to its medicinal uses. The presence of -Amylase, a widely used enzyme in textile, paper, distillation, and pharmaceutical industries has been identified in the fruit pulp of *S. cumini*

Extraction and partial purification of beta amylase from *Syzygium cumini* fruits

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I. Introduction

The tradition of using *Syzygium cumini,* a medicinal herb for the treatment of a wide range of ailments dates back several hundred years. *S.cumini*, also known by the local names, Malabar plum, jamun, jambolan and black plum is predominantly located in the Asian continent, but can also be found in the regions of South America, Thailand, Philippines, Malaysia, Australia and West Africa (Bijauliya et al, 2018). Belonging to the family Myrtaceae, *S.cumini* is a rich source of phytochemical constituents like polyphenols, antioxidants, vitamins, alkaloids and mineral salts, making it a plant of high therapeutical significance (Varma & Jyothilekshmi, 2021). Different parts of the plant including its seed, stem, bark and leaves are used for the treatment of a wide range of diseases due to its anti-diabetic, antioxidant, anti-allergic, anti-inflammatory, anti-hyperlipidemic, anti-pyretic, radio-protective, gastro-protective, cardio-protective, and chemo-preventive properties (Sehwag & Das, 2014). Apart from the therapeutical and pharmaceutical applications, jamun has been widely used in industries for a variety of purposes.

| A | B |

Figure 1: The figures show the ripe jamun fruits which appear purple in colour on the branches of a jamun tree.

Service-Learning in the Era of "New Normal": Reflection on the Modes of Service-Learning and Future Partnerships

国際基督教大学
International Christian University

サービス・ラーニング・センター
Service-Learning Center

Service-Learning Studies Series No.6 (ISSN 1881-6282)
Service-Learning in the Era of "New Normal":
Reflection on the Modes of Service-Learning and Future Partnerships

4. Service-Learning Under the 'New Normals' and Beyond

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Abstract

The present paper premises itself on the understanding that we are living at a time when human societies are faced with multiple 'new normals', brought about by a variety of disruptive forces, both natural and man-made. When such disruptions compel us to change our behavior over a short-term or a long-term period, it constitutes a 'new normal.' Bearing this in mind, the paper proposes that any rethinking on the new pedagogy for SL under the 'new normal' should have a basis in flexibility than adaptability to the new learning contexts, i.e., an approach geared towards blending offline and online modes instead choosing one over the other. The paper corroborates this perspective based on the experience of conducting the International Student Exchange Service-Learning (ISESL) at UCC during the years 2018 and 2019 when the state of Kerala was hit by unprecedented floods causing massive disruptions to normal modes of functioning and installed, albeit temporarily, a 'new normal.'

Service-Learning (SL) as envisaged by Sigmon (1979) involves 'reciprocal learning' where those who receive as well as those who provide service are mutually benefitted from the experience. It is undoubtedly a pedagogical strategy which is transformative and attends to the wholesome development of students and faculty involved in it (Kahne&Westheimer, 1996; Kiely, 2005). The theme of the present monograph seeks to reconfigure the concept of SL in the context of the 'new normal' and explores the potential new pastures available to the SL educators as the old pastures become remote.

Though the 'new normal' here is a direct reference to COVID-19 pandemic, the authors of the paper would like to see it in a much broader ambit. It is an expression that has to be understood under specific contexts, delineating the characteristics of the distinct situations that constitute the 'new normal '. The paper premises itself on the understanding that we are living at a time when human societies are faced with *multiple* 'new normals' depending on where we are, brought about by a variety of disruptive forces, both natural and man-made. When such disruptions intrude into all walks of life, compelling us to change our behaviour over a short-term or a long-term period, it constitutes a 'new normal. ' Though the present 'new normal' is defined in relation to the COVID-19 pandemic that has had global impact, extreme weather events like floods,

Food for Thought

SERVICE-LEARNING RESEARCH IN ASIA

Robert Shumer
Carol Ma Hok Ka
Constance Chan Wing Yee

Service-learning researches have been growing and expanding around the world. While much of the early work was carried out in the US and Europe, such efforts have been developing in Asia for the past few decades. The use of the term, 'service-learning' was not popular, while use of community engagement, volunteerism, social services are more common among community practitioners and academics, with the rapid development of service-learning, both research and community-based programs have been growing throughout Asia over, the last decade.

One of the major movements in that part of the world has been the Service-Learning Asia Network (started in 2005), where more than 11 countries have unified to share their efforts collectively through conferences and journals. In this new book we have examples from five (5) different places: China, Singapore, Hong Kong, Indonesia, and India. These models follow a recent publication of Asian research found in the Michigan Journal of Community Service Learning, published in Summer 2019 after the 7th Asia Pacific Regional Service-Learning conference in Singapore.

The chapters represent some of the exciting work that is developing in Asia, highlighting the rich and powerful connections between universities and communities throughout the region. Excellent examples of various kinds of study, from case studies, to qualitative research, to mixed method designs are included. In addition, the focus of the studies, from student learning, community change, innovative practice, and institutional development and change are provided to illustrate the rich diversity of work occurring throughout Asia. The book is available in both English and Chinese.

CHAPTER 6

EVOKING ECO CONSCIOUSNESS THROUGH SERVICE LEARNING

Justin R. Nayagam, Thara K. Simon, and Malini Rajagopalan Nair

Service-learning links students and people from diverse arenas having a wide range of academic and socio-economic status. When the purpose is environmental protection and conservation in the tropical unprotected riverbanks of Southern Peninsular India, it becomes ingenious. Service-learning at selected riverbanks was conducted with the participation of undergraduate and postgraduate biology students to generate data on various aspects such as flora, ecological degradation, cultivation practices adopted in croplands and weed plant diversity. Service-learning helps to raise awareness on the importance of maintaining riverbanks biodiversity, sustainable use of resources, best practices in cultivation, and overall protection of riverbanks. The student groups developed practical knowledge in onsite training and were extremely delighted to receive feedback from the public and beneficiaries. The faculty and environmental activists developed leadership qualities. An Herbarium focused on the local flora became an asset to the host institution as it served as a repository of voucher specimens for further studies and identification for the public and those in the biology stream. The benefitted students learned pedagogical approaches and served as stewards locally.

Keywords: Riverbanks, Service Learning, Environment Protection, Biodiversity, Ecological Degradation

Iron Age in India
Some More Thoughts

Editors

Abhayan G.S.
Rajesh S.V.
Preeta Nayar

Iron Age in India: Some More Thoughts (English)

Abhayan G.S., Rajesh S.V., and Preeta Nayar (Editors)

The editors and publisher are not responsible for the views and opinions expressed by the individual authors in this book.

Type Setting and Cover Design: Abhayan G.S.

Front and back cover images: Dolmen at Marayoor, Kerala, and line drawings of carnelian beads from Niramakulam, Kerala

The Megaliths in Bison Valley, Idukki, Kerala: A Preliminary Report of the Explorations from 2018-2021

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Abstract: Fifteen urn burials and five cist burials of the Iron Age-Early Historic affiliation were found during a road construction at Bison Valley in Udumbanchola Taluk in Idukki District. These were systematically studied, and the site was documented. This paper gives an overview of the context of the burials and artefacts and the variability in grave goods assemblage within the site. As more and more developmental activities are commissioned in the Western Ghats by the State and individuals, buried archaeological records are being revealed at an unprecedented pace, particularly in Idukki district. More such discoveries can be expected from the site and its vicinity in the near future. A sound methodology aimed at data recovery from such sites has to be part of future salvage archaeology operations.

Introduction

Fifteen urn burials and five cist burials of the Iron Age-Early Historic (IA-EH) period were accidentally exposed during a road construction at Bison Valley in Idukki District (Figs. 1 and 2). Based on preliminary artefactual analysis, the site has been tentatively placed in the IA-EH context instead of Iron Age-Megalithic. The site was first reported by Mr. Manoj P.A. of Bison Valley in 2017. Since then, many burials have been opened and examined, and very few of these artefacts were salvaged by the local residents. The site was first documented by the present team in 2018. It was revisited in February 2021 following the discovery of more burials due to the widening of the road. A salvage archaeology operation was conducted to understand the nature of deposition of urn burials and cist burials. We also surveyed the other localities in Bison Valley and the neighbouring villages and documented menhirs, dolmens, cists and urn burials. A preliminary report of the fieldwork is given here.

Locality IV in Bison Valley Panchayat (N 10° 01' 14.40" E 077° 08' 53.31") in Udumbanchola Taluk in Idukki District has a settlement history from the Iron Age to the modern period.

Exponentially Biased Discriminant Analysis Based Classification of Covid 19 Chest Images Using Generalized Regression Neural Network

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Abstract—Classification is always an interesting problem in the field of computer vision. In a two class problem, there will be an uncertainty in the classification of adjacent images of two classes. To avoid this uncertainty, an exponentially biased discriminant analysis is proposed for the classification. Initially, the entire database is projected to an exponentially biased space. In this space the data is more separated than the original space. Discriminant analysis is then used to classify the objects in this new space. After the training, the test data are approximated to this space using Generalized Regression Neural Network. The proposed algorithm is evaluated using the database of Covid 19 chest images. A better accuracy is observed for the proposed method by comparing with the normal discriminant analysis. But, this accuracy may not be a very good value. Better scientific approaches on the selection of the exponential biasing may give better classification accuracy.

Index Terms—Exponential Biasing, Discriminant Analysis, Generalized Regression Neural Network (GRNN), Covid 19, Class Separability.

I. INTRODUCTION

In two classes of classification, the identification of Covid 19 from chest pictures is a recent research subject. The person with very high symptoms of Covid 19 should get urgent treatment. Otherwise, it may affect the life of the patient. The chest images of Covid 19 affected patient should have features different from that of a Covid negative patient. If a technology can identify Covid 19 from chest pictures more accurately, it will aid doctors in making a more accurate and timely diagnosis of the condition. It will reduce the effort of other type of testing procedures and provide urgent treatment to the patient. This paper proposes a classification of Covid positive chest images and Covid negative chest images using an exponentially biased discriminant analysis using Generalized Regression Neural Network (GRNN).

The classification of adjacent images of two classes is always difficult. There is always an uncertainty in classification of these images. The classification of these images is very important since the correct classification of these images will be highly reflected in the accuracy. Figure 1 depicts the uncertainty in classifying two classes in the top two dimensions of Linear Discriminant Analysis (LDA). Inside the circle, there
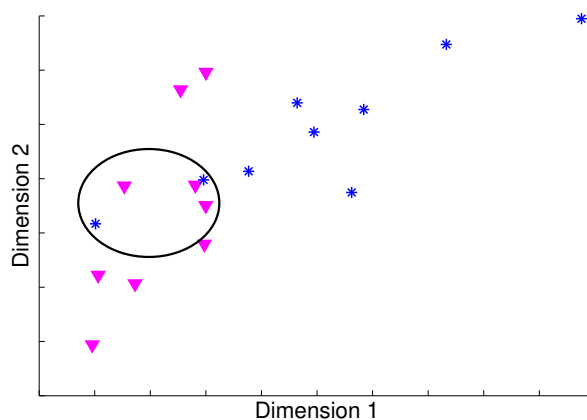

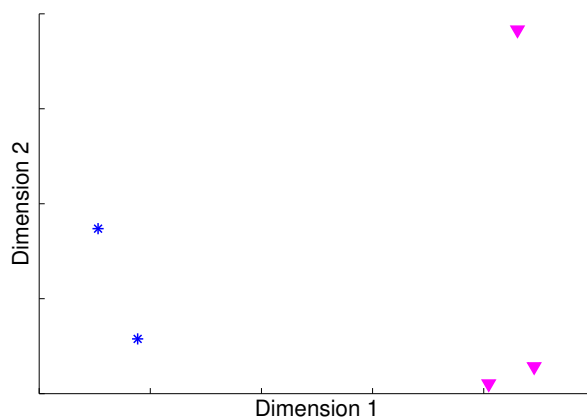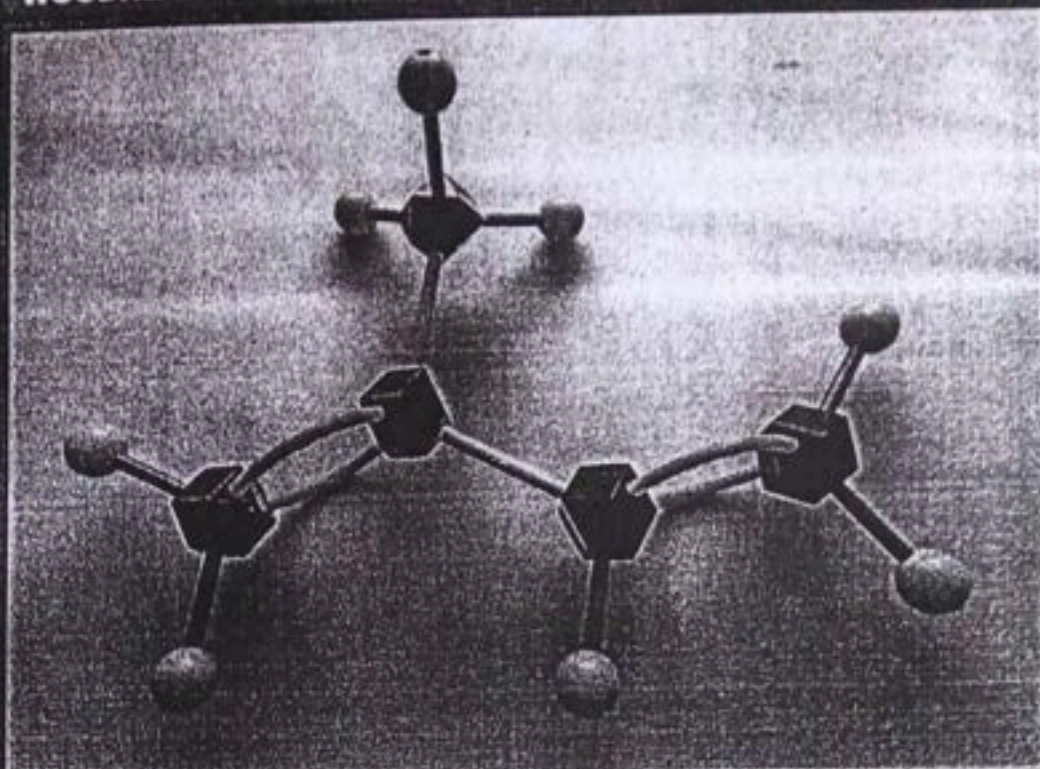Fig. 1. Uncertainty in classification of two classes [1].

Fig. 2. Uncertainty in classification of two classes [1].

CHEMISTRY, MANUFACTURE, AND APPLICATIONS OF NATURAL RUBBER

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Utilization of carbon allotropes with special reference to carbon nanotubes and graphene for the high performance of natural rubber

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Abstract

Carbon is the most studied element of the nano era. Carbon adopts a wide range of allotropes, such as graphite, diamond, fullerene, carbon nanotubes (CNTs), graphene (GE), and amorphous carbon. These carbon structures have been explored for the last few decades and find applications in various fields of science and technology, especially in the form of polymer nanocomposites. Natural rubber (NR) being the crucial material in industrial applications, has been studied and examined for the improvement of both physical and electrical properties with these carbon materials. In this chapter we give a brief description of the types, structures, and shapes of different allotropes of carbon in the first section with a detailed discussion on NR/CNT and NR/GE nanocomposites in the following sections. The role of processing methods in improving the state of dispersion of CNTs and GE in NR has been discussed along with the effect of incorporation of these nanomaterials on the mechanical and electrical properties of the resulting nanocomposites. Some potential applications and prospects for future development of these high-performance materials have been included at the end of this chapter.

Keywords: Carbon allotropes; graphene; carbon nanotubes; natural rubber; mechanical properties; high performance applications

8.1 Introduction

Carbon has been the subject of intense interest from researchers for decades. It is most familiar as a black solid like graphite, coal, and charcoal, or as the hard, crystalline diamond form. The name is derived from the Latin word for charcoal, *carbo*. It is found in the Earth's crust at a concentration of 480 ppm, making it the 15th most abundant element in the Earth's crust. It is found in form of calcium carbonate

NANOSCALE PROCESSING

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Nanocomposites of polymer matrices: Nanoscale processing

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Chapter outline