

Recent alumni

1. Dr. Nimisha K.



Dr. Nimisha K
Assistant Research Officer
Directorate of Ayurveda Medical Education,
TVM, Kerala, India

Research interest:

- Design and synthesis of conjugated small molecules and polymers
- Morphological engineering of microporous conjugated polymers
- Fine-tuning optoelectrical features of developed polymeric systems
- Nanocomposites and nanoaggregates of conjugated polymers
- Energy devices and bio-medical applications

Research area:

Thesis Title: Synthesis, characterization and fine-tuning of optoelectrical properties of modified poly(1, 3, 4-oxadiazole)s for optoelectronics and nonlinear optical applications

- Synthesis and characterization of 1, 3, 4-oxadiazole based π -conjugated polymers using dehydrocyclization technique
- Analysis of optoelectrical and electrochemical features
- Band-gap engineering of developed 1, 3, 4-oxadiazole systems via nanocomposites and nanoaggregates formation
- Morphological engineering of thiophene based microporous conjugated polymers via coupling synthesis strategies
- Development of semiconducting active layers for optoelectronic and sensor devices

Publications

- **K. Nimisha**, G. Unnikrishnan, E. Shiju, K. Chandrasekharan, Facile Synthesis and Fine-tuning of Optical Properties of Amino Phenyl Activated Poly(1, 3, 4-Oxadiazole) Conjugated System, *Polym.Bull.* **2017**, DOI : 10.1007/s00289-017-2190-0.
- **K. Nimisha**, G. Unnikrishnan, E. Shiju, K. Chandrasekharan, Optical, Morphological and Mechanical Features of Nitrophenyl Supported Poly(1, 3, 4-Oxadiazole)s and Their Nanocomposites with TiO₂, *RSC. Adv.* **2016**, 6, 115132-115144.

- **K. Nimisha**, G. Unnikrishnan, Synthesis and Evaluation of Properties of Poly(p-phenylenevinylene) Based 1, 3, 4-Oxadiazole Systems for Optoelectronics and NLO Applications, *Polym. Int.* **2016**, 65, 1221-1231.
- **K. Nimisha**, E. Shiju, K. Chandrasekharan, G. Unnikrishnan, Synthesis, Characterization and Fine-tuning Optical Properties of Soluble π -Conjugated Polymers Containing Nitrophenyl Supported 1, 3, 4-Oxadiazole, *J. Mater. Sci.* **2016**, 51, 4748-4761.
- **K. Nimisha**, G. Unnikrishnan, Synthesis and Characterization of Novel π -Conjugated Polymers Containing Oxadiazole Unit for Optoelectronic Devices as Blue Emissive Layers, *Indian J. Adv. Chem. Sci.* **2014**, 2, 16-18.
- **PATENT: K. Nimisha**, G. Unnikrishnan, Polymer Conjugate and a Process for Preparing the Same, *2650/CHE/2015*, May 27, **2015**.
- **BOOK CHAPTER: K. Nimisha**, G. Unnikrishnan, Transport through Polymer Membrane, 1st Edition, Chapter 8, **2018**, 119-158, Imprint: Elsevier, eBook ISBN 9780128098851.

2. Dr. Janisha Jayadevan



Research interest:

- Graft copolymerization of polymers using redox initiators
- Functional modifications of natural rubber latex
- Preparation and characterization of biomembranes
- Drug release studies through biomembranes

Research area:

Thesis Title: Physico-chemical Modifications of Natural Rubber Latex for Drug Release Applications

- Enhancement of the colloidal stability of NRL by suitable chemical modifications (Graft copolymerisation of a hydrophilic monomer dimethylaminoethyl methacrylate (DMAEMA) onto NR particle in latex stage)

- Deproteinization of NRL using urea, a surfactant and acetone followed by centrifugation for the removal of allergenic proteins
- Graft copolymerisation using an optimised system to address the issue of colloidal stability subsequent to deproteinization
- Physical modification of grafted deproteinized NRL (15GDNRL) by blending with hydrophilic polymers viz; poly(vinyl alcohol) (PVA), hydroxypropyl methylcellulose (HPMC) and sodium carboxymethylcellulose (SCMC)
- Examination of the potential of the physico-chemically modified NRL to function as a drug carrier using model drugs viz; rhodamine B, metformin hydrochloride (MET) and ciprofloxacin hydrochloride (CIP)
- Evaluation of the effect of two pharmaceutical plasticisers viz; dibutyl phthalate (DBP) and glycerine (GLY) on the properties and drug delivery features of modified NRL systems
- Biocompatibility examination and drug release studies using (MET) and ciprofloxacin hydrochloride (CIP)

Publications

- **Janisha Jayadevan** and G. Unnikrishnan, *Preparation and Characterisation of Poly(Dimethylaminoethyl Methacrylate) Grafted Natural Rubber (PDMAEMA-g-NR)/Poly(Vinyl Alcohol) Blend Membranes*, **Indian Journal of Advances in Chemical Science**, 2 (2014) 9-11. (ISSN No.: 2320-0898 (Print); 2320-0928).
- **Janisha Jayadevan**, and G. Unnikrishnan, *Modification of Natural Rubber Latex by Grafting*, **Rubber Science**, 28(2) (2015) 178-197. ISSN No. 2454-4841(Print), 2454-485X (Online).
- Bindu M., **Janisha J.**, Hemalatha J., Unnikrishnan G., *Molecular Interactions in Silicone Rubber- nano Hydroxylapatite System in Solution Phase Probed by Ultrasonic Technique*, **Journal of Molecular Liquids** 221 (2016) 216–223.
- **Janisha Jayadevan**, Rosamma Alex, Unnikrishnan Gopalakrishnapanicker, *Chemically Modified Natural Rubber Latex-Poly(vinyl alcohol) Blend Membranes for Organic Dye Release*, **Reactive & Functional Polymers**, 112 (2017) 22-32.
- **Janisha Jayadevan**, Rosamma Alex, Unnikrishnan Gopalakrishnapanicker, *Deproteinized Natural Rubber Latex Grafted Poly(dimethylaminoethyl methacrylate) – Poly(vinyl alcohol) Blend Membranes: Synthesis, Properties and Application*, **International Journal of Biological Macromolecules**, 107 (2018) 1821-1834.

- **Janisha Jayadevan**, G. Unnikrishnan, *Novel Membranes from Physico-chemically Modified Deproteinized Natural Rubber Latex: Development, Characterization and Drug Permeation*, **New Journal of Chemistry**, 42 (2018) 14179-14187.
- **PATENT**: Application for a patent for the invention “*Novel Matrix Controlling Transdermal Patches from Chemically Modified Natural Rubber*” is under processing with TIFAC, Delhi (File No.:048/PF-PIC/2014/KSCSTE).

3. Dr. Bindu M.



Research interest:

- Nanomaterials
- Development and characterization of polymer nanocomposites
- Bio-composites
- Thin membranes

Research area:

Thesis Title: Investigation on Silicone Rubber/ nano-Hydroxylapatite Systems

- Functional modification of Silicone Rubber (SR) by nano- Hydroxylapatite (n-HA) embedding
- To study the possibility of the developed SR/n-HA systems, for bio-medical application

Publications

- **Bindu M.**, Janisha J., Hemalatha J., Unnikrishnan G., ‘Molecular interactions in silicone rubber- nano hydroxylapatite system in solution phase probed by ultrasonic technique’, *J. Mol. Liq.* **221**: 216–223 (2016)

- **Bindu M.** and Unnikrishnan G., ‘A gateway to tune the mechanical properties and surface features of silicone rubber’, Polym. Compos. DOI 10.1002/pc.24445
- **Bindu M.** and Unnikrishnan G., ‘Transport features of nano- hydroxylapatite (n-HA) embedded silicone rubber (SR) systems: Influence of SR/n-HA interaction, degree of reinforcement and morphology’, Phys. Chem. Chem. Phys. 19:25380– 25390 (2017)
- **Bindu M.** and Unnikrishnan G., ‘Modulation of dielectric and viscoelastic features of silicone rubber by nano-hydroxylapatite embedding’, New J. Chem. 42: 6441-6448 (2018)
- **Bindu M.** and Unnikrishnan G., ‘The effects of stress environment on silicone rubber (SR) embedded nano-hydroxylapatite (n-HA) systems’ (Communicated)
- **Bindu M.** and Unnikrishnan G., ‘Designing of nano-hydroxylapatite modified silicone rubber systems: Correlation with biocompatibility aspects’, (Communicated)

4. Dr. Sabarish R.



Research interest:

- Catalysis and separations
- Synthesis of zeolite-based catalyst for selective organic reactions
- Development of novel polymer membranes for wastewater treatment and dye removal studies

Research area:

Thesis Title: Tailoring of hierarchical zeolites with green macrotemplates and evaluation of their catalytic and adsorption activities

- Synthesis and fabrication of hierarchical zeolites by green templates
- Synthesis of zeolite/polymer membranes
- Applications of those membranes for dye removal studies

Publications

- **Sabarish R**, Unnikrishnan G, Synthesis, characterization and catalytic activity of hierarchical ZSM-5 templated by carboxymethyl cellulose, *Powder Technol*, 320 (2017) 412-419.
- **Sabarish R**, Unnikrishnan G, PVA/PDADMAC/ZSM-5 zeolite hybrid matrix membranes for dye adsorption: Fabrication, characterization, adsorption, kinetics and antimicrobial properties, *J Environ Chem Eng*, 6 (2018) 3860-3873.
- **Sabarish R**, Unnikrishnan G, Polyvinyl alcohol/carboxymethyl cellulose/ZSM-5 zeolite mixed matrix membranes for dye adsorption applications. *Carbohydr. Polym*, 199 (2018) 129-140.
- **Sabarish R**, Unnikrishnan G, Natural polymer templated mesoporous silicalite-1 and its utilization for rhodamine B dye removal. *J Mol Liq*, 272 (2018) 919-929.
- **Sabarish R**, Unnikrishnan G, Synthesis, characterization and evaluations of micro/mesoporous ZSM-5 zeolite using starch as bio template, *SN Applied Sciences*, 1 (2019) 989
- **Sabarish R**, Unnikrishnan G, A novel anionic surfactant as template for the development of hierarchical ZSM-5 zeolite and its catalytic performance, *J Porous Mat*.

5. Dr. Renu Jose



Research interest:

- Nanomaterials
- Organic electronics
- Sensors
- Electroanalytical chemistry
- Polymer composites

Research area:

Thesis Title: Natural rubber-millable polyurethane dielectric elastomers: optimization, Characterisation and fine-tuning of physic-chemical properties

- Nanofiller incorporated blends of natural rubber and millable polyurethane were developed, and then characterised in terms of free volume, thermal features and morphology
- The electrical properties such as dielectric constant, volume resistivity, dielectric loss factor and AC resistance of nanofiller incorporated NR/MPU blends were studied based on the type of nanofillers, their concentration and the frequency of the applied field. The results explained based on the improved probability for polarization after filler incorporation
- Static and dynamic mechanical analyses showed an improvement by the incorporation of fillers
- The solvent resistance found to be improved for NR/MPU with filler incorporation
- The data obtained from mechanical as well as dielectric studies indicate a significant improvement in the properties of the resultant polymer composites compared to the unfilled systems
- The experimental results obtained from mechanical as well as dielectric studies were compared with theoretical models

Publications

1. **Renu Jose**, H. B. Ravikumar, L. M. Munirathnamma, Lity Alen Varghese, G Unnikrishnan, Microstructural Analysis of Natural Rubber/ Millable Polyurethane Blends Using Positron Annihilation Lifetime Spectroscopy. *Polym. Plast. Technol. Eng.* 57 (2017)196-205.

6. Dr. Vintu M.



Research interest:

- Design and implement works related to the accelerated discovery and development of new polymers using high-output synthesis protocols

- Collect reliable data, develop new pathways and apply appropriate formulas to make predictions of new polymer materials with targeted structures and properties

Research area:

Thesis Title: Multi-functional indolo[3,2-b]carbazole based conjugated polymeric systems through palladium coupling reactions

- Development of efficient method for the preparation of functionalised indolocarbazole (ICZs) based polymers by palladium catalyzed coupling reactions
- Their characterization and structure- property evaluation using standard protocols
- Possible utilization of these polymers in organic electronics/sensing/environment- related applications

Publications

1. **M. Vintu**, G. Unnikrishnan, E. Shiju, K. Chandrasekharan, “Indolo[3,2-b]carbazole-based poly(arylene ethynylene)s through Sonogashira coupling for optoelectronic and sensing applications”, *Journal of Applied Polymer Science*,136, 2019, 46940-46952
2. **M. Vintu**, G. Unnikrishnan, “Diode characteristics and metal ion sensing features of a conjugated macromolecular system based on indolocarbazole-thiophene” *Materials Science and Engineering B*, 236, 2018, 170-178
3. **M. Vintu**, G. Unnikrishnan, “Semiconducting indolocarbazole based polymer decorated with magnetic ferrofluid for efficient Cr(VI) removal”, *Material Chemistry and Physics*(Under Review)
4. **M. Vintu**, G. Unnikrishnan, Vijisha K Rajan, K.Muraleedharan, “Suzuki coupling derived indolocarbazole based macromolecule as a solid phase/ solution phase sensor for Hg²⁺: Experimental and Theoretical explorations” *European Polymer Journal*, 114, 2019, 287-297
5. **M. Vintu**, G. Unnikrishnan, “Indolocarbazole based polymer coated superabsorbent polyurethane sponges for oil/organic solvent removal”, *Journal of Environmental Management*, 248, 2019, 109344-109355

7. Dr. Sunitha K. (Part time)



Dr. Sunitha K
Scientific Officer
VSSC, ISRO, India

Research interest:

- Designing of macromolecular architectures by click chemistry strategy
- Synthesis of advanced polymers for high temperature applications
- Polymer based composite fabrication
- Synthesis of superabsorbent polymers

Research area:

Thesis Title: Synthesis and characterization of block and graft copolymers by click chemistry

- Explored click chemistry for the creation of specific molecular architectures,
- Copper catalysed azide-alkyne reaction (CuAAC), has been used to realize linear and network comb polymeric structures under mild temperature conditions.
- Evolved low temperature curable composites

Publications

1. **K. Sunitha**, S. Bhuvaneshwari, Dona Mathew, G. Unnikrishnan, and C. P. Reghunadhan Nair, Comb Polymer Network of Polydimethylsiloxane with a Novolac Stem: Synthesis via Click Coupling and Surface Morphology Architecturing by Solvents. **Macromolecules**, 50, (2017): 9656-9665.
2. **K. Sunitha**, G Unnikrishnan, C.P. Reghunadhan Nair, "Azide telechelics chain extended by click reaction; synthesis, characterisation and cross-linking". *Polym. Adv. Technol.* 30 [2], 435-46 (2018).
3. **K.Sunitha**, Dona Mathew and C P. Reghunadhan Nair, Phenolic-epoxy matrix curable by click chemistry-Synthesis, curing and syntactic foam properties. **J. Appl. Polym. Sci.**2015, 132, 41254.
4. **K. Sunitha**, Soumyamol P B, Dona Mathew, G. Unnikrishnan, and C. P. Reghunadhan Nair. Novolac-PolydimethylSiloxane comb networks as precursors for nanoSiOC ceramics: Pyrolysis studies. Revision submitted in Journal of applied ceramic technology.

8. Dr. Nishad K. V. (Part time)



Research interest:

- Bioceramics
- Bioactive materials
- Dental materials
- Calcium silicate based dental cements

Research area:

Thesis Title: Development of a new bioactive and radio-opaque hydraulic calcium silicate cement for endodontic applications

- Synthesis and characterisation of a bioactive radio-contrast material
- Preparation of new radio-opaque hydraulic calcium silicate-based dental cements
- *In vitro* bioactivity, cytocompatibility, hemocompatibility and anti-bacterial property evaluations of the cements

Publications

- Nishad, K.V., Sureshbabu, S., Komath, M., Unnikrishnan, G., Synthesis and characterization of low dimensional bioactive monetite by solvent exchange method. *Mater. Lett.* 209, 19–22, (2017).
 - Nishad, K.V., Komath, M., Unnikrishnan, G., Synthesis of strontium orthosilicate (Sr_2SiO_4) by sol-gel method for the use in endodontic cements to enhance bioactivity and radio-contrast, *Mater. Res. Express*, 6, 105401, (2019).