

Narayan Das

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EDUCATION

Indian Institute of Science Education and Research Kolkata

PhD, Polymer Science

Dissertation: *Multi-tasking Unique Copolymers for Imaging Toxicants and Enzymes for Health Care Applications*

Supervisor: Prof. Raja Shunmugam

Kalyani, India

July 2018 – May 2024

Indian Institute of Technology Bombay

Master of Science (M. Sc), Chemistry | CGPA: 7.1/10

Dissertation: *Studies on cycloaddition of substituted oxidopyrillium species.*

Supervisor: Prof. Viswakarma Singh

Mumbai, India

July 2015 – June 2017

Ramakrishna Mission Vidyamandira

B. Sc, Chemistry | Marks: 61%

Belur Math, India

July 2012 – May 2015

RESEARCH EXPERIENCES

Indian Institute of Science Education and Research Kolkata

Research Associate, Supervisor: *Prof. Raja Shunmuga*

Project-1: Biodegradable block copolymer to detect and remove polyfluoroalkanes

Project-2: Biodegradable stimuli-responsive polymer that will have both anti-cancer and anti-bacterial activity

India

May 2024, present

Indian Institute of Science Education and Research Kolkata

Ph.D (Polymer science), Supervisor: *Prof. Raja Shunmuga*

India

May 2024, present

- Designed & synthesized unique polymer to detect biologically harmful toxicants like copper, hydrogen sulfide, hydrazine, and hypochlorite ions.
- Developed norbornene-based copolymers which show analyte-induced reversible morphological transformation from spherical to twisted-rod self-assembly
- Developed a new unique hyper-branched polymer for both anti-bacterial and anti-cancer drug delivery in the hypoxic and bacterial environment
- Design and synthesize the norbornene and glycidol-based bottle brush copolymer and its application in viscosity modifiers, self-healing gel, and adhesives.
- Biodegradable polymer for viscosity modifier

RESEARCH SKILLS

- Design and the synthesis of multifunctional, stimuli-responsive small molecules and controlled polymeric systems with diverse applications which include sensing, drug delivery, gels, adhesives, and porous polymer
- Polymerization techniques: Hands-on experience in the design and the synthesis of the control polymeric architecture which includes Radical polymerization, Reversible Addition fragmentation Polymerization, Ring Opening Polymerization, Ring Opening Metathesis polymerization, and Anionic Polymerization
- Characterization techniques: NMR, Mass spectrometry, Gel Permeable Chromatography, Advanced Polymer Chromatography, UV-Vis Spectroscopy, Fluorescence Spectroscopy, Confocal Microscopy, Dynamic Light Scattering (DLS), Differential Scanning Calorimeter (DSC), Circular Dichroism (CD), Thermal Gravimetric Analysis (TGA), Rheology, Scanning Electron Microscope (SEM), Atomic Force Microscopy (AFM), Transmission Electron Microscopy (TEM).
- Hands-on experiences in invitro cell culture
- Perfected in interpreting complex data, preparing manuscripts, and crafting compelling scientific reports

RESEARCH INTEREST

- Functional polymer for energy storage, Molecular photoswitches, optoelectronics, and Light responsive soft matter
- Stimuli-sensitive functional adhesives, sustainable smart materials, Bottle brash polymer, Sustainable polymer for the environment

- Design and synthesize the small molecule and polymer-based colorimetric and fluorometric sensing probe to detect biologically and environmentally harmful toxicants.
- Analytes induced morphological transformation of the polymeric aggregates and its applications in the biological field
- Water-soluble stimuli-responsive small molecule and polymeric architecture for anticancer and antibacterial activity and targeted drug delivery
- Biodegradable supramolecular and polymeric hydrogel for the application of self-healing, dye removal, and antibacterial activity

CONFERENCE PRESENTATIONS

Indian Institute of Science Education and Research Kolkata, India

April 2022

DCS Day, Department of Chemistry,

Poster presentation- Engineering a Bromophenol Derivative for Rapid Detection of $\text{Hg}^{2+}/\text{CH}_3\text{Hg}^+$ in Both Environmental and Biological Samples through a Unique Activation Process

International Conference on Polymer Science & Technology (SPSI - MACRO - 2022)

November 2022

Indian Institute of Science Education and Research Pune, India,

Poster presentation- pH Induced Twisted Rod-shape Aggregation of Fluorescein Derived Polynorbornes: a Unique Selective Sensor for NaOCl

International Conference on Polymer Science & Technology (SPSI - MACRO - 2023)

November 2023

Indian Institute of Technology-Guwahati, India

Poster presentation- Naphthalene-Derived Hyperbranched Polymeric Aggregates for Monitoring Azoreductase Activity Under Hypoxic Conditions

Indian Institute of Science Education and Research Kolkata, India

November 2023

Symposium on polymer science, Department of Chemistry, Poster presentation- Caprolactone Based Biodegradable Polymer for Selective, Sensitive Detection and Removal of Cu^{2+} ions

ACADEMIC ACHIEVEMENT

Indian Institute of Science Education and Research Kolkata, India

April 2022

DCS Day, Department of Chemistry,

Best Poster presentation- Engineering a Bromophenol Derivative for Rapid Detection of $\text{Hg}^{2+}/\text{CH}_3\text{Hg}^+$ in Both Environmental and Biological Samples through a Unique Activation Process

Indian Institute of Science Education and Research Kolkata, India

November 2023

Symposium on polymer science, Department of Chemistry

Best Poster presentation- Caprolactone-based Biodegradable Polymer for Selective, Sensitive Detection and Removal of Cu^{2+} ions

PUBLICATIONS

1. N. Das, T. Samanta, S. Gautam, K. Khan, S. Roy, R. Shunmugam. Caprolactone-Based Biodegradable Polymer for Selective, Sensitive Detection and Removal of Cu^{2+} Ions from Water. *ACS Polym. Au* **2024**, *4*, **3**, 247-254. <https://doi.org/10.1021/acspolymersau.3c00056>
2. N. Das, T. Samanta, D. Patra, P. Kumar, R. Shunmugam. A Unique Stimuli-Responsive Reversible Hierarchical Spherical to Twisted-Rod-Shape Organization from Fluorescein-Derived Polynorbornene Copolymers. *Macromolecules* **2024**, *57* (3), 976-984. <https://doi.org/10.1021/acs.macromol.3c01516>
3. N. Das, T. Samanta, S. Rajwar, R. Shunmugam. Unique Reaction-Based Polynorbornene Sensing Probes for Ultrasensitive Detection of Hydrazine in Both Environmental and Biological Systems. *Biomacromolecules* **2024**, *25* (2), 990-996. <https://doi.org/10.1021/acs.biomac.3c01079>
4. N. Das, T. Samanta, D. Patra, P. Kumar, R. Shunmugam. Engineering a bromophenol derivative for rapid detection of $\text{Hg}^{2+}/\text{CH}_3\text{Hg}^+$ in both environmental and biological samples through a unique activation process. *RSC Sustainability*, **2023**, *1* (3), 640-647. <https://doi.org/10.1039/D3SU00012E>
5. N. Das, T. Samanta, R. Shunmugam. Naphthalene-derived Hyperbranched Polymeric Nanostructure for Monitoring Azoreductase Activity under Hypoxic Environment. (*Manuscript under preparation*)
6. N. Das, T. Samanta, S. Gautam, C. Kumar R. Shunmugam. Fluorescein -based Polynorbornene with Metal-assisted Molecular Self-assembly and its application in the sensitive and selective detection of the copper ions from the environmental samples (*Manuscript submitted*).

7. **N. Das**, M. Gupta, S. Mohanti, R. Shunmugam*Hydrogen Sulfide Induced Unique Twisted-Rod Assemblies from Norbornene-based Polymer in Aqueous Environment (*Manuscript submitted*).
8. J. Singha, **N. Das**, R. Shunmugam, Nanomolar detection of hypochlorite in ground water samples by a norbornene-based polymeric sensor via unusual fluorescence turn-on response. *Journal of Macromolecular Science, Part A*, 2023, 60 (11), 751-763. <https://doi.org/10.1080/10601325.2023.2257767>
9. T. Samanta, **N. Das**, D. Patra, P. Kumar, B. Sharmistha, R. Shunmugam. Reaction-Triggered ESIPT Active Water-Soluble Polymeric Probe for Potential Detection of Hg²⁺/CH₃Hg⁺ in Both Environmental and Biological Systems. *ACS Sustainable Chemistry & Engineering*, 2021, 9 (14), 5196-5203. <https://doi.org/10.1021/acssuschemeng.1c00437>
10. T. Samanta, **N. Das**, R. Shunmugam. Intramolecular charge transfer-based rapid colorimetric in-field fluoride ion sensors. *ACS Sustainable Chemistry & Engineering*, 2021, 9 (30), 10176-10183. <https://doi.org/10.1021/acssuschemeng.1c02344>
11. T. Samanta, **N. Das**, J. Singha, R. Shunmugam, Unusual red-orange emission from rhodamine-derived polynorbornene for selective binding to Fe³⁺ ions in an aqueous environment. *Analytical Methods*, 2020, 12 (33), 4159-416. <https://doi.org/10.1039/D0AY00505C>

REFERENCES:

Professor Dr. Raja Shunmugam Polymer Research Centre, Department of Chemical Sciences, Indian Institute of Science Education and Research Kolkata, West Bengal, India, PIN-741246, Email- sraja@iiserkol.ac.in	Professor Dr. Priyadarsi De Polymer Research Centre, Department of Chemical Sciences, Indian Institute of Science Education and Research Kolkata, West Bengal, India, PIN-741246, Email- p_de@iiserkol.ac.in	Professor Dr. Alakesh Bisai Room No. 3, TRC 3rd Floor Department of Chemical Sciences, Indian Institute of Science Education and Research Kolkata, West Bengal, India, PIN-741246, Email- alakesh@iiserkol.ac.in
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Declaration:

I declare that the above statements are true to the best of my knowledge and belief.


Signature