Curriculum Vitae

Dr. Shivendra Singh

Ph.D.

Personal Information

- Date of Birth : 10-03-1995 (dd-mm-yyyy)
- Nationality : Indian
- Gender : Male
- Language : English, Hindi
- Permanent Address : B-12 Nanda Road Adarsh Nagar, Delhi-110033, India
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Academic Qualifications

Ph.D. in Chemistry (July 2019 – October 2024) from Indian Institute of Technology Indore, India

Thesis Title: Designing of Optically Active Self-Assembled Nanostructures toward Environmental Remediation and Catalysis

M.Sc. in Chemistry (August 2016 – July 2018) CPI: 8.16/10
Indian Institute of Technology Mandi, India

B.Sc. in Chemistry (honors) (July 2013 – June 2016) Percentage: 75.71%
Ramjas College, (Affiliated with the University of Delhi), New Delhi, India

12th with Physics, Chemistry, Mathematics, English and Computer Science (2011–13) Percentage: 90.20%
Modern Public School, Shalimar Bagh, Delhi (CBSE Board)

Research Experience and Interests

M.Sc. Project (September 2016 – June 2018)

I did my M.Sc. Project on the topic "Single-molecule analysis of fluorescent carbon dots towards localization-based super-resolution imaging" under the guidance of Prof. Chayan Kanti Nandi at IIT Mandi. During my two-year M.Sc. project, I synthesized various metal and carbon nanoparticles (NPs); However, my main focus was on the synthesis of near-infrared (NIR) emissive carbon dots (CDs). Herein, I synthesized red emissive CDs from o-phenylenediamine and purified them into red, green, and blue components through column purification. Subsequently, the systematic and in-depth characterizations of crude CDs revealed the presence of a molecular fluorophore (~ 80%) in the synthesized CDs. In this work, we tried to elucidate the origin of fluorescence in CDs. We observed that crude CDs are often a mixture of CDs, quasi-CDs, and molecular fluorophores, which contribute

to their fluorescence. This work (Absorption and Emission of Light in Red Emissive Carbon Nanodots) was published in Chemical Science (Chem. Sci., 2021, 12, 3615).

Ph.D. (July 2019 – October 2024)

I did my Ph.D. at IIT Indore under the guidance of Prof. Tushar Kanti Mukherjee in the Department of Chemistry. My doctoral research was primarily focused on the optoelectronic and photophysical study of NP-embedded hybrid coacervates, a new type of optically active composites formed by integrating inorganic (nanoparticles) and organic polyions. My doctoral works cover synthesizing and characterizing various NPs and utilizing them to formulate different NP-embedded coacervates. These hybrid coacervates possess membraneless architecture and can sequester a wide range of foreign molecules such as proteins, enzymes, dyes, etc. The role of their confined and membraneless architecture was explored as catalytic nanoreactors for carrying out different chemical and enzymatic transformations. My aim to carry out sustainable catalysis led me to utilize the charged aqueous interface of CTAB micelles to host Eosin Y as a low-cost photocatalyst to carry out the photo-oxidative coupling of arylamines to their corresponding azo compounds. The present approach was the second photocatalytic and the first report for the metal-free and aqueous synthesis of azo compounds without unwanted by-products. My keen interest in investigating and studying new problems has also led me to establish the mechanism for the direct generation of singlet oxygen in the aqueous medium under the irradiation of 370 nm LED and its role in the transformation of arylamines to azoaromatics without any catalyst. I am also utilizing the direct generation of singlet oxygen to develop sustainable strategies for other organic transformations.

Technical and Research Skills

- I am proficient in using a wide range of instruments such as UV-vis and fluorescence spectrophotometer, FTIR, SEM, TEM, time-correlated single photon counting (TCSPC), LC-MS, HR-MS, GC-MS, NMR, EPR, Confocal imaging, XPS, cyclic voltammetry, etc.
- I am also well-versed in the synthesis of various nanoparticles, their composites, NP-embedded hybrid coacervates, and their detailed characterization.
- I am also very experienced in techniques like solvent extraction, column chromatography, and analysis of organic products during catalysis.
- I also have experience using electrochemical instruments and Schlenk lines.
- I am proficient in using Microsoft Office and OriginPro software for data analysis.

Academic Achievements and Awards

- Qualified various National level exams such as IIT-JAM 2016, GATE 2019, CSIR NET-JRF 2019 (AIR-76)
- Awarded prestigious Prime Minister Research Fellowship (PMRF) in June 2020
- I have vast experience presenting my research work at various national and international conferences and seminars.
- Awarded Best Poster Presentation award at In-house Symposium 2022 organized by Chemistry Department, IIT Indore
- Awarded Best Oral Presentation award at the National Conference on Scientific Ethics and Recent Advances in Chemistry (SEACS-2022) organized by DAVV Indore

- Awarded Best Poster Presentation award at Research Industrial Conclave 2023 organized by Academic Council IIT Indore
- Awarded Best Paper award for the paper titled "Metal-Free Photocatalysis at Charged Aqueous Interfaces: Boosting the Photocatalytic Oxidative Coupling of Arylamines to Azoaromatics under Ambient Conditions" at In-house Symposium 2024 organized by Chemistry Department, IIT Indore
- Awarded Best Poster Presentation award at the International Conference on Fundamental and Advanced Research in Chemistry (FARC-2024) at IIT Mandi.

Teaching Experience

- Trained five M.Sc. (2^{nd} year) students toward finishing their master's project at the Indian Institute of Technology Indore.
- Worked as a "Mentor" for over fifteen M.Sc. (1^{st} year) students during their rotation period of three months during my Ph.D. at the Indian Institute of Technology Indore.
- Carried out Teaching Assistantship in the Chemistry Laboratory of Bachelor of Technology (B.Tech.) at the Indian Institute of Technology Indore from August 2019 to December 2019.
- Carried out Teaching Assistantship for Physical Chemistry Tutorials of Bachelor of Technology (B.Tech.) at Indian Institute of Technology Indore from January 2020 to March 2020.
- Taught different courses to M.Sc. (1^{st} and 2^{nd} year) students at Devi Ahilya Vishwavidyalaya, Indore, from August 2020 to July 2024 (50–60 hours/year) under PMRF fellowship guidelines.

Publications

1. Singh, S.; Vaishnav, J. K.; Mukherjee, T. K. Quantum Dot-Based Hybrid Coacervate Nanodroplets for Ultrasensitive Detection of Hg^{2+}. *ACS Appl. Nano Mater.* **2020**, *3*, 3604–3612

2. Soni#, N.; Singh#, S.; Sharma, S.; Batra, G.; Kaushik, K.; Rao, C.; Verma, N. C.; Mandal, B.; Yadav, A.; Nandi, C. K. Absorption and Emission of Light in Red Emissive Carbon Nanodots. *Chem. Sci*. **2021**, *12*, 3615–3626 (#: Equal contribution)

3. Saini#, B; Singh#, S.; Mukherjee*, T. K. Nanocatalysis Under Nanoconfinement: Metal-Free Hybrid Coacervate Nanodroplet as Catalytic Nanoreactor for Efficient Redox and Photocatalytic Reactions. *ACS Appl. Mater. Interfaces* **2021**, *13*, 51117–51131 (#: Equal contribution)

4. Singh, S.; Rao, C.; Nandi, C. K.; Mukherjee, T. K. Quantum Dot-Embedded Hybrid Photocatalytic Nanoreactor for Visible Light Photocatalysis and Dye Degradation. *ACS Appl. Nano Mater.* **2022**, *5*, 7427–7439

5. Patel, C. K.; Singh, S.; Saini, B; Mukherjee, T. K. Macromolecular Crowding-Induced Unusual Liquid-Liquid Phase Separation of Human Serum Albumin via Soft Protein-Protein Interactions. *J. Phys. Chem. Lett.* 2022, *13*, 3636–3644

6. Singh, S.; Mukherjee, T. K. Coacervate-Based Plexcitonic Assembly toward Peroxidase-like Activity and Ultrasensitive Glucose Sensing. *ACS Appl. Mater. Interfaces* **2023**, *15*, 25524–25535

7. Singh#, S.; Agarwal#, V; Sarma, T.K; Mukherjee, T. K. Metal-Free Photocatalysis at Charged Aqueous Interfaces: Boosting the Photocatalytic Oxidative Coupling of Arylamines to Azoaromatics under Ambient Conditions. *Green Chem.*, **2023**, *23*, 9109–9114 (#: Equal contribution)

8. Singh, S.; Mukherjee, T. K. Photosensitizer-Free Singlet Oxygen Generation via a Charge Transfer Transition Involving Molecular O_2 toward Highly Efficient Oxidative Coupling of Arylamines to Azoaromatics. *Chem. Sci.* **2024**, *15*, 13949–13957

9. Singh, S.; Dutta, S.; Mukherjee, T. K. Leveraging PS-free Generation of Singlet Oxygen toward Catalyst-Free Organic Transformations. (**Manuscript under preparation**)

10. Singh, S.; Gupta, K.; Mukherjee, T. K. Multifunctional CD-Embedded Coacervates for the Effective Detection, Removal, and Degradation of Pharmaceutical Contaminants. (**Manuscript under preparation**)

References

1. Prof. Tushar Kanti Mukherjee
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2. Prof. Chayan Kanti Nandi
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3. Prof. Satya S. Bulusu
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Declaration

I hereby declare that the details stated above are true and correct to the best of my knowledge.

Shivendra Singh