

K Nikhila

Joint Doctoral Program: IIT Kharagpur and the University of Manchester

As quoted by Leena Patel, the author of Raise your Innovation, "**Risk comes with the territory when you are breaking new ground.**". In a progressive world driven by innovation, the invaluable pros to the human race come at the price of environmental degradation. Despite its innumerable benefits, plastic is a scientific breakthrough responsible for major environmental burdens. The pervasiveness of plastics, from their use as an additive in cosmetics to large-scale packaging, produces vast amounts of waste that enters environmental matrices and threatens the ecosystem. Plastic is found in every corner of the globe, from the depths of the ocean to the atmosphere and even at the sparsely populated poles. Waste management strategies like upcycling, recycling, incineration and landfilling have underlying impacts such as downgraded final products, GHG emissions, energy usage, space and cost constraints, which calls for sustainable management of plastic waste. Apart from the techno-economic feasibility, the policy framework and public acceptance should also be accounted for. Interventions like **polluter pays principle (PPP), extended producer responsibility (EPR), life cycle assessment (LCA) and environmental impact assessment (EIA)** need to be explored and incorporated. This is where management meets engineering, and sustainable management of resources forms the key to sustainable development.

Environmental engineering had really intrigued me since my undergraduate days when I took a course on environmental chemistry and got the opportunity to work with Prof. Sumit Mishra on the **synthesis of flocculants for water treatment using the polymer grafting technique**. The excerpt of the same work was acknowledged by **Tryst, IIT Delhi**. During my BSc, I participated and secured the '**Best paper presentation award**' at the annual symposium of **Indian Institute of Chemical Engineers (IIChe) - BIT MESRA**, which introduced me to the **application of carbon and nanotechnology in environmental remediation**.

I am happy to have made a conscientious decision to pursue my master's in environmental science and engineering, a field that provides me with a sense of success and satisfaction and positively impacts humankind. I recently submitted my master's thesis on the '**Development of a mathematical model for photocatalytic denitrification of water**'. The project included three objectives. First is to conduct photocatalytic denitrification experiments and study the effect of various parameters on the denitrification efficiency. Second, to develop a **MATLAB**

based mechanistic model followed by calibrating the rate constants and validating the developed model. During my research, I got the opportunity to learn and explore various modelling approaches like **ODE based mechanistic models, Artificial neural networks (ANN) models, Computational fluid dynamic (CFD) models and Radiative transfer models**, and optimization techniques like **root mean square error (RMSE) minimization and genetic algorithm (GA)**.

On the other hand, the coursework at **Environmental Science and Engineering department (ESED) IIT Bombay** comprised interesting subjects like **Environmental management, Municipal solid waste management, Environmental systems modelling** etc. In addition to academics, I interned with **GreenYatra** as a content writer, **ICCE** as a climate counsellor and volunteered for clean-up drives in Mumbai. As a resident of Kharagpur, I have witnessed and experienced the menace caused by the open dumping and burning of domestic waste, especially plastic. My curiosity to tackle the problem has encouraged me to take **NPTEL online courses on plastic waste management, sustainable engineering concepts and integrated waste management for a smart city by Prof. Brajesh Dubey, IIT Kharagpur**. All this instilled a keen interest in pursuing my research in plastic waste management. Academia and startups like Saahas Zero waste, Recykal, reCharkha etc., aiming to monetize the plastic waste sector, are my inspiration to make a career in the domain of my interest. I would love to develop my acumen and ability as an independent researcher and ecopreneur to bridge the gap between academia and industries.

As a budding researcher, I believe my strong foundation in environmental engineering and my research experience at various research labs and NGOs have enhanced my curiosity toward research. Upon considerable reflection, I found the topic '**Sustainable management of plastics waste**' and the **Joint doctoral program** between the two prestigious institutions **IIT Kharagpur** and the **University of Manchester**, as a catalyst for my future goals and endeavours. Being aware of the trials and tribulations encountered in a PhD program, I would like to state my willingness to work and make a worthwhile contribution toward the research objectives of this project. It would be an honour for me to work under the joint guidance of **Prof Vinay Yadav and Prof Maria Sharmina**.