

Title of the Talk: Abundance and Characterization of Microplastics in Different Water Matrices and Their Removal from Sewage Systems by Sustainable Tertiary Treatment Processes

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Abstract:

Microplastics (MPs) are tiny plastic particles measuring less than 5 mm in size and are considered as emerging hazardous micro-pollutants globally owing to their pervasive presence in the environment and potential ecological and human health hazards. Atmosphere is regarded as a significant pathway for MPs global cycling, while land-based sources including discharge from sewage treatment plants (STPs) are acting as a prominent route for their re-entry into the riverine systems. Though MPs abundance and removal efficacy in different secondary treatment technique-based STPs have been extensively studied worldwide, such studies are scarce in Indian conditions. In this context, the first segment of the talk intends to provide the first evidence of MPs deposition in rainwater (wet atmospheric MPs deposition) in the selected urban and peri-urban areas of India, highlighting their characteristics, potential sources, and transport factors in the environment. Additionally, a comprehensive assessment of MPs abundance, distribution, characteristics, and their removal efficacy in the selected secondary treatment technique-based STPs like activated sludge process (ASP), aerated lagoon (AL), sequential batch reactor (SBR), moving bed biofilm reactor (MBBR), fluidized aerobic bioreactor (FAB), upflow anaerobic sludge blanket reactor (UASB), trickling filter (TF), and bio-tower (BT) in India will be provided. Of late, the need for sustainable tertiary treatment techniques for MPs removal has been realized due to their considerable presence in large volumes of secondary-treated sewage effluent despite the high removal efficacy of STPs. Since the coagulation-flocculation-sedimentation (CFS) system and rapid sand filtration are recognized as low-maintenance tertiary treatment techniques, it is necessary to investigate their MPs removal efficacy from secondary-treated sewage effluents. Moreover, the information on the application of either a combined system of an inorganic coagulant and an organic biopolymer as a coagulant or a biochar-integrated rapid sand filtration in removing MPs and their interaction in the aqueous matrices is scarce. In these regards, the second segment of the talk intends to deal with the removal of MPs from real-time secondary-treated effluents from MBBR and SBR-based STPs using ferric chloride (inorganic coagulant) and chitosan (biopolymer) as the coagulant aid based on the outcomes of batch experimentation with parametric effects on synthetic water containing polystyrene (PS) microbeads. Similarly, the use of cetyl trimethyl ammonium bromide (CTAB)-modified magnetic biochar, derived from locally-available biomass, as a novel adsorbent and their potential integration in a rapid sand filter to remove MPs during batch sorption and fixed-bed column studies will be also discussed. The applications of the ferric chloride-chitosan CFS system as well as CTAB-modified magnetic biochar-integrated sand filtration on the real sewage effluents spiked with PS microbeads showing efficient MPs removal highlights their practical relevance as sustainable tertiary treatment techniques for removing MPs from sewage effluents.

Brief Profile of the Speaker: Dr. Subrata Hait is an Associate Professor in the Department of Civil and Environmental Engineering at the Indian Institute of Technology (IIT) Patna, Bihar, India. He obtained his Ph.D. Degree in Civil Engineering for the research work titled “High-growth Membrane Bioreactor for Sewage Treatment Coupled with Vermicomposting of Sludges” from IIT Kanpur in the year 2011. Prior to joining as an Assistant Professor at IIT Patna in June 2012, he worked as a Senior Project Engineer at IIT Kanpur within a consortia of 7 IITs towards the Preparation of Ganga River Basin Environment Management Plan (GRB EMP), a project sponsored by the Ministry of Environment, Forest and Climate Change (MoEFCC), Govt. of India (GoI), for abatement of pollution and to restore continuous and unpolluted flow in the Ganga River. Presently, he is serving as Associate Dean Academic (PG) at IIT Patna. He has also served as the founding Head of the Department (HoD) of Civil and Environmental Engineering at IIT Patna for three years (2016-2019). His current research interests in the broad area of Pollution Prevention and Resource Recovery (P2R2) include e-waste treatment and metal recovery, organic waste management, removal of micro-plastics and emerging contaminants from aqueous matrices. He is a Fellow of the Environmental Engineering division of the Institution of Engineers, India (IEI). Also, he is affiliated with organizations like the American Society of Civil Engineers (ASCE), American Chemical Society (ACS), International Solid Waste Association (ISWA), and International Water Association (IWA). Apart from editing two books, he has authored many papers at his credit in various international journals. Apart from serving as a Reviewer for different international journals published by leading publishers including Elsevier, Dr. Hait is serving as an Academic Editor of PLOS One and PLOS Water, and an Editorial Board Member of SN Applied Sciences, Springer Nature.