Microplastics and Nanoplastics: Degradation and Effects on the Environment

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Background/Objectives. Plastics have become an integral part of different consumer products such as cars and single use utensils. As a result, the production of plastics continues to grow and is expected to reach 12,000 MT by 2050. However, only 18% of plastics are recycled, 24% are incinerated, and 58% end up in landfills or are released to the environment. As the plastics reside in the environment their physical and chemical properties change causing them to become more brittle and susceptible to fragmentation and formation of microplastics and eventually nanoplastics. Microplastics vary in shape (fibers, fragments, films, etc.), size (0.1 - 5 mm), and chemical composition. Research has shown the presence of microplastics in different aquatic environments and soil, while several studies have demonstrated the negative impacts of microplastics on living organisms. Future regulation of microplastics is anticipated which will create the need for microplastics treatment and mitigation, and understanding microplastics degradation pathways will be imperative to evaluating and designing treatment technologies.

Biodegradation is one pathway of plastic and microplastic degradation in the environment. Micro-organisms, such as certain strains of bacteria, can produce enzymes that depolymerize polymeric chains. Biodegradation can be affected by various parameters such as plastic composition, environmental conditions, and type of micro-organisms. , and researchers have investigated the effectiveness of biodegradation in treating wastes containing microplastics .We will present the fundamental facts about microplastics: sources, transport pathways in the environment along with parameters affecting biodegradability of plastics in the environment and effectiveness of biodegradation in treating wastes containing microplastics.

Approach/Activities. We will summarize our conclusions from a critical review of literature to define biodegradation of plastics and microplastics. Our review will answer the following questions: 1) What are microplastics and what are the different degradation mechanisms, including biodegradation, leading to the formation of microplastics?, 2) What are the transport pathways of microplastics in the environment?, 3) What parameters affect the biodegradation of microplastics?, and 4) Is biodegradation a potentially viable treatment technology for wastes containing microplastics?

Results/Lessons Learned. This presentation will present a summary of data from several studies in the form of tables and figures. We will build knowledge on biodegradation of plastics and microplastics and discuss its implications on potential treatment technologies and the environment.