Pioneering Microbial Communities and Biofilm Succession on Plastic in a New York City Waterway

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When plastic polymers enter the environment via pollution, colonization by microorganisms is instantaneous. Colonization subsequently alters the physical and chemical characteristics of the plastic, as well as its potential for transport and interaction with other microorganisms across natural environments. It is important to understand the successional characteristics of microbial communities that naturally colonize plastic pollution to determine differences in functional potential, such as plastic degradation, over time and their corresponding impact on the ecosystem. To address this, environmental incubations of polyethylene and glass in a Western Long Island Sound waterway bordering New York City were performed, collecting subsamples at weekly time points for two months. Microbial biofilm succession across each time point was analyzed via 16S rRNA amplicon sequencing and microscopic image analysis. This study found that plastic-degrading microorganisms showed preferential colonization for plastic compared to glass, and the microbial community compositions as a whole differed significantly between the two substrates. In addition, plastic-degrading microorganisms colonized polyethylene at different rates according to the age of the biofilm. Little is known regarding early colonizers of plastic, and these results shed light on microbial community assembly on plastic deployed in a dense urban area characterized by heavy pollution. Insights into microbial interactions with plastic pollution are critical for developing proper pollution prevention and mitigation strategies worldwide.

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