Relative Polymer Abundance of Microplastic Particles in Two Central New York Lakes

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Abstract

Plastics have an increasing role in our everyday lives and, unfortunately, an increasing presence in freshwater ecosystems. The extent of freshwater pollution and harm caused by microplastics is still unknown. Chemical determination of polymer types found in freshwater allows for the investigation of potential sources and pathways, aiding in the development of preventative measures and regulatory action. This work will consider how relative polymer abundances in freshwater monitoring can inform regional sources and, subsequently, infrastructural improvements for microplastic capture or source abatement. In this study, we characterize the polymer type of over 800 particles collected from surface water samples taken in 2019 and 2020 from two freshwater lakes in Central New York (US), Onondaga and Skaneateles Lakes, in addition to the major tributaries of Onondaga Lake. Skaneateles Lake is relatively pristine and provides a source of unfiltered drinking water for the city of Syracuse. In contrast, Onondaga Lake is historically polluted and has a higher potential for microplastic contamination from nearby developed areas, wastewater effluent discharge, and combined sewer overflows. Various sampling methods, including both bulk and volume-reduced samples, were used for sample collection. Chemical analysis was performed using ATR-FTIR in combination with the software OpenSpecy. Polyethylene was the most abundant polymer type found in both lakes. The relative abundance of polymers differed in samples taken from one of Onondaga Lake's major tributaries, Onondaga Creek, potentially owing to differences in the sampling method used. The Inner Harbor and an upstream site were more abundant in polypropylene and synthetic resins, respectively. These findings are put into further context with respect to potential sources, global plastic production, and the impact of polymer density on microplastic capture.

Keywords: Collection methods, chemical analysis, polymer type, microplastic capture

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