Municipal biosolids and effluent irrigated onto land are significant sources of microplastics to the terrestrial environment in New Zealand

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Abstract

The application of biosolids and irrigation of municipal effluent from wastewater treatment plants (WWTPs) onto terrestrial soils is often an economically and environmentally preferred method to reclaim beneficial nutrients and water in order to prevent landfilling or discharge of biowaste into sensitive environments, along with reliance on synthetic fertilisers and extraction of freshwater for irrigation. Previous literature has identified WWTPs as a major source of microplastics to the environment. WWTPs are not designed to remove microplastics from sewage, and microplastics are retained in sewage sludge or released with effluent. There is a lack of knowledge of the amount and types of microplastics in municipal biowaste entering the terrestrial environment in New Zealand. This is the first study to have characterised microplastics present in biosolids and soil irrigated with effluent in New Zealand.

Biosolids were collected from five WWTPs, along with soil samples from five sites irrigated with municipal effluent. A soil sample from a reference site which had not been irrigated with effluent was collected for comparison. All samples underwent a chemical digest by a wet peroxide oxidation followed by density separations. All suspected microplastic particles were analysed by micro-Fourier transform infrared spectroscopy (μ -FTIR).

Microplastics were present in biosolids in the highest amounts, with average concentrations ranging from 0.92 - 4.96 particles/g (dry weight). In soil irrigated with effluent, microplastics ranged from 0.02 - 0.76 particles/g (dry weight). Fragments were the most common morphotype found across both sample types, with polypropylene, polyethylene and acrylic the most frequently detected polymer types. Common morphotypes detected across samples include glitter and cleaning sponge fragments, suggesting the need for greater regulation of unnecessary plastic products.

Keywords: Biosolids, effluent, soil

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