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Characterization of some selected compost samples for the presence of microplastics and heavy metals associated with them

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Microplastics are ubiquitous in terrestrial environments as land-based sources mainly contribute to their origin. Mismanagement of solid waste can contribute to heavy loads of microplastics, which is of serious concern in Sri Lanka. The current study focuses on assessing the abundance and characteristics of microplastics from urban compost as an entry route for microplastics into the soil. Compost samples were taken from Karadiyana, Muthurajawela, and Kalutara municipal solid waste dumpsites. Microplastics were extracted in triplicates from 100 g of compost using saturated NaCl solution and sieved from 1 mm mesh size and wet peroxide digestion was carried out to remove organic matter. Microplastics were characterized based on shape, size, color, and the polymer identified using Fourier Transformation Infrared spectroscopy (FTIR). Associated trace metals were analyzed using Microwave plasma atomic emission spectrometer (MPAES), subsequent to acid digestion procedures. The most abundant microplastics fraction in compost was polyethylene fragments in size range of 2-5 mm formed due to the breakdown of plastic materials present in themunicipal solid waste. The abundance of microplastics in compost was 400, 360 and 410 particles kg−1 in Karadiyana, Kalutara, and Muthurajawela, respectively. Compared to other locations, Muthurajawela microplastics had significantly higher levels of heavy metal at concentrations of 1856, 238, 194, 406, 24 and 60 µg g−1 for Zn, Cd, Cu, Ni, Pb and Cr, respectively. Heavy metal concentration of microplastics in Karadiyana compost samples were in the range of 32, 20, 4 µg g−1 for Zn, Cu, Pb and Cr and for Kalutara samples 17, 4 and 8 µg g−1 for Cu, Pb and Cr respectively. Muthurajawela soil is acidic due to the saline peat bog and therefore heavy metal leaching is very high. Municipal solid waste compost is vulnerable to terrestrial and aquatic -microplastics upon their application in agricultural purposes. The associated heavy metals in microplastics pose a greater risk as vectors for transferring trace elements along the food chain and bioaccumulating them in higher trophic levels.

Keywords: Plastic, Marine pollution, Solid waste management, Landfill, Leach