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Occurrence and abundance of microplastics and plasticizers in landfill leachate from open dumpsites in Sri Lanka

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ABSTRACT

This is the first attempt that investigate the abundance of plasticizers in leachate sediment in the scientific literature, alongside the debut effort to explore the abundance of microplastics and plasticizers in landfill leachate and sediment in Sri Lanka. Microplastics in sizes ranging from $\geq 2.0-5.0$, $\geq 1.0-2.0$, and $\geq 0.5-1.0$ mm were extracted from the leachate draining from ten municipal solid waste open dump sites and sediment samples covering seven districts. Microplastics were extracted by density separation (Saturated $ZnCl_2$) followed by wet peroxide digestion and the chemical identification was conducted by Fourier Transform Infrared spectroscopy. Plasticizers were extracted to hexane and analyzed by high-performance liquid chromatography. The total mean microplastic abundance in leachate was 2.06 ± 0.62 mg/L whereas it was 363 ± 111 mg/kg for leachate sediments. The most frequently found polymer type was polyethylene (>50%), and white color was dominant. The average concentration of bisphenol A (BPA), benzophenone (BP) and diethyl-hydrogen phthalate (DHEP) in leachate was 158 ± 84.4 , 0.75 ± 0.16 and 170 ± 85.8 $\mu\text{g/L}$ respectively. Furthermore, BP and DHEP in leachate sediment was 100 ± 68.3 and 1034 ± 455 $\mu\text{g/kg}$ respectively. As landfill leachate is directly discharged into nearby surface and groundwater bodies that serve as sources of drinking water, the study highlights the potential concerns of microplastic and plasticizer exposure to the surrounding Sri Lankan community through consumption of contaminated drinking water. Therefore, there is a timely need of develop the effective waste management and pollution control measures to minimize the possible threats to both the environment and human health.

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