Environmental assessment of plasticizer contamination in leachate sediments from open dumpsites in Sri Lanka

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In Sri Lanka, open landfilling predominates, producing leachate that carries plasticizers from degrading plastics and accumulates in sediments through adsorption. Plasticizers such as Bisphenol A (BPA), Benzophenone (BP), and Di(2-ethylhexyl) phthalate (DEHP) are widely used in plastic manufacturing and have known endocrine-disrupting effects even at low concentrations. Yet there is a lack of detailed research on the occurrence and distribution of plasticizers in leachate-impacted sediments in Sri Lanka. This study investigated the abundance of BPA, BP, and DEHP in sediments from 10 major open dumpsites across the Western Province. Twenty-one sediment samples were collected and subjected to solvent extraction using dichloromethane to effectively isolate plasticizers from sediments. Extracts were analyzed using High Performance Liquid Chromatography (HPLC) equipped with a UV-Visible detector (Limit of Detection - 0.01 ppm). The analysis revealed BPA, BP, and DEHP concentrations in sediments ranged from 0 - 7045.0 µg/kg, 0 - 713.9 µg/kg, 0 - 6930.9 µg/kg, respectively. Phthalate (DEHP) was identified as the most abundant plasticizer, likely due to its strong hydrophobicity, high persistence and strong affinity to organic carbon in sediments while the highest DEHP level was observed in sediments from the Kochchikade (6930.9 ± 1690.8 µg/kg), Avissawella (3424.6 ± 771.8 µg/kg), and Karadiyana (2761.7 ± 123.9 µg/kg), attributed to comparatively high volume of plastic waste disposed and poor leachate management practices, enhancing the leaching and accumulation of plasticizers in underlying sediments. In contrast, BP and BPA concentrations show comparatively moderate levels, reflecting their relatively lower persistence. Karadiyana dumpsite exhibits elevated BPA levels (7045.0 ± 83.6 µg/kg, 720.3 ± 83.6 µg/kg), while the highest BP concentration was detected in Avissawella (713.9 ± 199.6 µg/kg). These findings show that BPA, BP, and DEHP significantly impair sediment quality in municipal solid waste dumpsites, highlighting the need for better landfill design, leachate treatment, and long-term monitoring to mitigate plasticizer contamination.

Keywords: *Bisphenol A, Benzophenone, Di(2-ethylhexyl) phthalate, Leachate-impacted sediments*

Acknowledgements: Financial assistance by the University of Sri Jayewardenepura, Research grant RC/URG/SCI/2024/14