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## The adsorption characteristics of Cr and Pb by various particle sizes of microplastics high-density polyethylene (HDPE)

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Microplastics were defined as plastics that measure less than 5 mm and have strong hydrophobicity, small particle sizes, and large specific surface areas. Microplastics can serve as a carrier of heavy metals and a potential hazard in the ecosystem by biological accumulation. This study investigated the adsorption characteristics of chromium (Cr) and lead (Pb) onto microplastics based on various particle sizes. The high-density polyethylene (HDPE) was categorized into three particle size ranges (2.5 – 1 mm, 1 – 0.3 mm, and less than 0.3 mm), and batch adsorption tests were conducted with five different concentrations (0, 0.5, 1, 10, and 30 mg/L) of Cr and Pb solutions. In this study, the adsorption behaviors of Cr and Pb on all three particle sizes of HDPE were more suitable for the Langmuir model ( $R^2 > 0.99$ ) than the Freundlich model ( $R^2 > 0.90$ ). The maximum adsorption amount of Cr and Pb on HDPE ( $Q_m = 0.09$  mg/g for Cr and 0.05 mg/g for Pb) was found in the size of less than 0.3 mm, indicating that the high specific surface area may affect adsorption capacities. For three different particle sizes, the adsorption of Pb on HDPE was higher than that of Cr. This result could be attributed to the higher adsorption binding strength of Pb (1.04) on the surface of HDPE than that of Cr (0.06) due to the larger ionic radius and higher electronegativity of  $Pb^{2+}$  than those of  $Cr^{6+}$ .