

## Evaluation of multilayer co-extrusion film and other three plastic membranes as passive samplers for determination of polyhalogenated carbazoles in water

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### ABSTRACT

Passive sampling methods can provide valuable insights for monitoring hydrophobic organic compounds (HOCs) in aquatic environments. As the list of target HOCs expands, there is an increasing demand for passive samplers that can detect a broader range of these compounds. This study aimed to assess the efficacy of a three-layer co-extruded polyethylene/ethylene vinyl acetate (TLC-EVA) film alongside three existing materials (polyethylene (PE), polydimethylsiloxane (PDMS), and poly(methyl methacrylate) (PMMA)) for passive sampling of carbazole and five halogenated carbazoles (PHCZs), a group of dioxin-like chemicals, in water. The films were calibrated through batch experiments to determine the partition coefficients between the polymer and water ( $K_{PW}$ ). The performance of the samplers and the presence of PHCZs were evaluated through 7- and 14-day exposures in the Xiaoyi River, which flows through Qufu City, China. The  $\log K_{PW}$  values varied significantly among the compounds and were generally consistent across the four films, ranging from 2.73 to 4.14 for EVA, 2.65 to 4.21 for PE, 2.85 to 3.98 for PMMA, and 2.62 to 4.22 for PDMS. These findings indicate that the films can effectively function as passive samplers for PHCZs. Additionally, a comparison of  $\log K_{PW}$  results with physicochemical parameters ( $\log K_{OW}$  and  $\log K_{OC}$ ) highlighted the negative impact of halogen substituents and steric hindrance on sorption, particularly for 1,3,6,8-tetrabromocarbazole. The passive sampling reached equilibrium within the 7-day exposure period, with all PHCZs detected in the river water. Increased concentrations at urban and wastewater treatment plant outlet sampling sites suggested specific sources of PHCZs. Our results advocate for the application of multilayer co-extrusion films as a novel material for passive sampling of HOCs.

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