Application of triolein embedded cellulose acetate membrane (TECAM) passive sampler for determination of freely dissolved concentrations of hexabromocyclododecanes (HBCDs) in sediment porewater

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Hexabromocyclododecanes (HBCDs) are a class of widely used brominated flame retardants (BFRs) that exhibit strong hydrophobicity. The ubiquity and persistence of HBCDs in sediment have attracted significant attention because of public health concerns. The environmental fate and ecological risks of HBCDs closely depends on their phase distribution in sediments. However, little information is available regarding the freely dissolved concentrations (C_{free}) of HBCDs in sediment porewater. In this study, we developed a method to measure C_{free} of HBCDs in sediment porewater using triolein embedded cellulose acetate membranes (TECAM). The TECAM-to-water partitioning coefficient (log K_{TECAM}) was 4.69, 4.77 and 4.63 for α-HBCD, β-HBCD and γ-HBCD, respectively. In sediments, HBCDs sorbed to the sediment solid phase accounted for more than 99% of the total chemical mass. The dissolved organic carbon (DOC)-water partition coefficients (K_{DOC}) values were derived from TECAM measurements, the log K_{DOC} values ranged from 5.77 to 6.23 for the three HBCD diastereomers, suggesting a strong tendency for HBCDs to sorb to DOC. The high sorption of HBDCs for DOC implies a potential for DOC-facilitated transport which may enhance the environmental mobility of HBCDs.