BIOACCUMULATION OF POLYCHLORINATED BIPHENYLS IN WHITE SEA URCHINS EXPOSED TO CONTAMINATED SEDIMENTS

Eddy Y. Zeng,[*,†] James A. Noblet,[‡] and Kerry Ritter[§]

[†]State Key Laboratory of Organic Geochemistry, Guangzhou Institute of Geochemistry
Chinese Academy of Sciences, Guangzhou 510640, China
[‡]Department of Chemistry, California State University-San Bernardino
San Bernardino, CA 92407, USA
[§]Southern California Coastal Water Research Project, 7171 Fenwick Lane
Westminster, CA 92683, USA

Sediments contaminated with persistent organic pollutants (POPs) can become a reservoir from which these compounds can be transferred to benthic organisms via bioaccumulation and/or bioconcentration. An important aspect of sediment contamination by POPs is their propensity for bioaccumulation and biomagnification in organisms at higher trophic levels within aquatic food webs. Benthic organisms accumulate POPs because they live in intimate contact with and often feed on marine sediments. Therefore, a thorough understanding of the transfer of POPs from sediments to aquatic organisms is necessary for establishing meaningful sediment quality criteria. In southern California, polychlorinated biphenyls (PCBs) are known to distribute widely in aquatic sediments, but little bioaccumulation information is available by which to accurately assess their impacts on benthic organisms. In this study, the bioaccumulation of polychlorinated biphenyls (PCBs) from three amended field-contaminated sediments (with total PCB concentrations of ~ 4, 10 and 100 μg/g-dry wt) by white sea urchins (*Lytechinus pictus*) was evaluated using multiple statistical and theoretical approaches. Similarity analysis of the PCB bioaccumulation patterns, based upon the concept of ecological communities, showed that the PCB patterns in the sea urchins and source sediments were essentially identical for all three sediment concentrations. However,

[*] Corresponding author: e-mail: eddyzeng@gig.ac.cn

affinity analysis did show some preference for bioaccumulation of higher molecular weight and more hydrophobic congeners by the urchins. A nonequilibrium, steady-state bioaccumulation model was found to correctly predict the observed experimental bioaccumulation patterns. To improve the model performance, a hydrophobic term was introduced to account for the drop-off in biota-sediment accumulation factor (BSAF) profiles with log $K_{OW} \geq 6.5$. This study showed that nonequilibrium, steady-state models are far superior to equilibrium partitioning-based models for understanding the bioaccumulation of organic chemicals by sea urchins.