Comparative Application of Silicon- and Polyethersulfone-Based Passive Sampling to Monitor Organic Pollutants in a Tropical River

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Abstract

Contamination of water resources with organic pollutants necessitates monitoring due to the attendant negative environmental impacts. The associated risks are usually inferred by comparison of bulk concentrations (C_{total}) against established quality standards. However, C_{free} as concentration of the dissolved compound fraction better quantifies the compound transport, degradation and partitioning to organisms [1,2]. Although C_{free} can be calculated from C_{total} using for instance partitioning models, such estimation methods are often associated with uncertainties. Therefore, a method that directly quantifies C_{free} could improve the validity of the outcome. To this end, passive sampling devices (PSDs) have emerged as complementary monitoring tools as they offer various advantages: possibility for *in situ* pre-concentration of the analytes to directly determine C_{free}, low detection limits, high resolution in time and space, and relatively low operational costs.

The last decade has seen tremendous growth in PSDs development and application in various environmental compartments ranging from air to bottom sediments at the sea floor. In the present communication, we shall demonstrate a field application of two single-phased PSDs, silicone rubber (SR) and polyethersulfone (PES), in a tropical river. River Sosiani lies approximately 65 km north of the equator and meanders through forested, agricultural and urban land uses. It therefore receives mostly nonpoint source contaminant inputs through overland flow that can range in properties from polar to hydrophobic. For four weeks, SR and PES membranes were deployed in the river and used for an *in situ* broad spectrum monitoring of contaminants from two broad groups: hydrophobic organic pollutants and endocrine disrupting compounds. Specific compound classes targeted for analysis included alkylphenols, organochlorine pesticides, polychlorinated biphenyls, hormones, phthalates, and polycyclic aromatic hydrocarbons (PAHs). Of these groups, only the latter two were detected in quantifiable amounts with C_{free} ranging in SR from 0.02 to 16.71 ng/L. For evaluating, PSD-specific analyte properties namely sampling rates (R_s) and PSD-water partition coefficients (K_{pw}) were determined, which is illustrated for the example of PAHs using PES membranes.

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References

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