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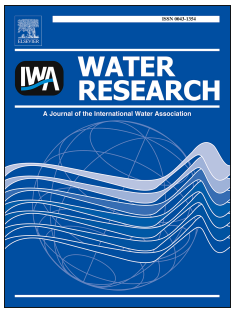

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Quaternary (Triphenyl-) Phosphonium Compounds: Environmental Behavior and Toxicity

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Note:

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Abstract

An analytical method based on high resolution mass spectrometry coupled with liquid chromatography (LC-HRMS) for 25 quaternary phosphonium compounds (QPCs) and derived phosphine oxides (POs) was developed and validated. To investigate the occurrence and fate of QPCs in the aquatic environment, water, suspended solids and sediments from the rivers Rhine and Elbe (upper and middle Elbe as well as tidal Elbe) were analyzed, as well as samples from tributaries bearing significant loads of QPCs. For the first time, the quaternary phosphonium compound tetrabutylphosphonium (Bu_4P^+) was detected. In the river Elbe concentrations were determined of up to 4.7 µg/L (surface water) and 1000 µg/kg (sediment), respectively. Analysis of a time series of suspended solids (2005-2015) showed that QPCs have been present in the Elbe and Rhine catchment for at least one decade, with partly rising tendency. A degradation experiment with Rhine sediment revealed that triphenylphosphonium compounds ($R\text{-}Ph_3P^+$) and Bu_4P^+ are persistent in contact with sediment and suspended solids and tend to sorb onto sediment particles. Toxicological studies (reactive oxygen