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Butyltin sorption onto freshwater sediments: from batch experiments to the field values

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Butyltins, and most particularly TBT were widely used by the industry in the 1970s and 1980s, namely as anti-fouling paints on ships. Although banned since 2003 in Europe, surveys still point out the presence of these compounds both in coastal and terrestrial environments. The resilience of organotin (OT) compounds can be explained by their high adsorption capacity. OTs can bond easily to particulate matter and "migrate" from the water column unto the sediments where their half-life can extend to a few decades. Consequently sediments can become important organotin stores and release OT compounds during dredging operations, storms, tides or floods. Studies on OT behavior in freshwater environments, mainly sediments, are scarce in the literature compared with marine sediments. However, it is known that sorption behaviour of organotin compounds on sediments is governed by the constituents of sediments, and the composition of interstitial water in the sediments and overlying water, i.e. grain size distribution, clay minerals, organic matter, iron, aluminium (hydr)oxides and carbonate in the sediments; salinity, ionic composition, and pH of interstitial water in the sediments and overlying water.

The main objective of this work is to assess butyltin adsorption into the sediments of an intermittent river located in southern France: The Vène. Sediments were collected during high and low flow conditions and batch experiments were set up using "natural" and "crushed" sediments to assess the adsorption kinetics.

Classical batch experiments and GC-ICP-MS analysis were carried out to measure the distribution coefficient (Kd). The influence of organic substances on sorption processes for organotin species was studied and the role of grain size distribution assessed by comparing natural and crushed sediments.

The results indicated that organotin compounds are sorbed easily and quickly on freshwater sediments. The adsorption isotherm for butyltins follows the Freundlich equation which is used to describe the adsorption behaviour of non-polar organic matters. This is due to their organic substituent groups. The presence of organic matter modifies the sorption process: less OT is adsorbed onto the sediments. This leads to increased OT concentrations in solution and consequently a higher probability for assimilation by freshwater organisms. The comparison of our results to those reported in the literature for marine environments could not be carried out because of the wide differences in salinity and grain size distribution between the two environments.