Geophysical Research Abstracts,
Vol. 11, EGU2009-7643, 2009
EGU General Assembly 2009

Relating desorption of polycyclic aromatic hydrocarbons from harbour sludges to type of organic material

K. Heister (1), S. Pols (1,2), J.P.G. Loch (2), and T. Bosma (2)

(1) Technische Universität München, Lehrstuhl für Bodenkunde, Freising-Weihenstephan, Germany (heister@wzw.tum.de), (2) Department of Earth Sciences, Faculty of Geosciences, Utrecht University, P.O. Box 80.021, 3508 TA Utrecht, The Netherlands

For decades, polycyclic aromatic hydrocarbons (PAH) cause great concern as environmental pollutants. Especially river and marine harbour sediments are frequently polluted with PAH derived from surface runoff, fuel and oil spills due to shipping and industrial activities, industrial waste and atmospheric deposition. Harbour sediments contain large amounts of organic carbon and clay minerals and are therefore not easy to remediate and have to be stored in sludge depositories after dredging to maintain sufficient water depth for shipping. The organic contaminants will be adsorbed to particles, leached in association with dissolved organic material or microbially degraded. However, compounds of high molecular weight are very persistent, particularly under anaerobic conditions, thus giving rise to the potential to become desorbed again.

PAH adsorb mainly to organic material. It has been shown that components of the organic material with a low polarity and a high hydrophobicity like aliphatic and aromatic components exhibit a high sorption capacity for hydrophobic organic contaminants like PAH. Accordingly, not only the amount but also the type of organic material needs to be determined in order to be able to predict contaminant behaviour.

In this study, desorption behaviour of the 16 EPA-PAH in two different harbour sludges from the port of Rotterdam, the Netherlands, has been investigated. The Beerkanaal (BK) site is located relatively close to the North Sea and represents a brackish environment; the Beneden Merwede River (BMR) site originates from a fresh water environment and is close to industrial sites. The samples were placed in dialysis membranes and brought into contact with water for a period of 130 days. At several time intervals, water samples were retrieved for analysis of pH, dissolved organic carbon (DOC) content, electrical conductivity and PAH concentrations. The experiment was conducted at 4 and at 20°C. Although the samples were initially treated with sodium azide to prevent microbial degradation, all samples showed oscillating concentrations of PAH over time pointing to the presence of anaerobic biodegradation. This also had an impact on the temporal development of pH, DOC and electrical conductivity. However, the concentrations of PAH desorbed were very low; for components with a molecular weight higher than pyrene, no desorption was observed at all. On a percentage basis, more PAH desorbed from the BK sample, even though the BMR sample contained an up to ten times higher amount of PAH.

In addition, the organic material of the sludges was characterised by C and N elemental and sugar analysis and 13C CPMAS NMR to see how the type of organic material influenced desorption. It was shown that the two sludges did not differ significantly in the amount but more in the type of organic material. The BK sample contained organic material which was more degraded than the BMR sample.

By combining desorption behaviour with organic material characterisation, we will show how the type of organic material influences desorption of PAH from the sediments.