Geophysical Research Abstracts
Vol. 12, EGU2010-4580, 2010
EGU General Assembly 2010

Polycyclic aromatic hydrocarbon (PAH) sorption process to the "black carbon" (BC) component in river sediments

Jing Zhang, Jean-Marie Séquaris, Hans-Dieter Narres, Harry Vereecken, and Erwin Klumpp
Forschungszentrum Jülich GmbH, Agrosphere Institute ICG 4, Jülich, Germany (j.m.sequaris@fz-juelich.de)

The importance of BC for the long term sequestration of organic carbon is actually discussed for mitigating climate change. In this context, the role of BC as a filter or source of nutrients or toxic chemicals is questioned. The fate of polycyclic aromatic hydrocarbons (PAHs) is especially concerned.
In this study, we have investigated the binding of PAH compounds, pyrene and phenanthrene, to Yangtze River sediments. For this purpose, the PAHs sorption to pristine and preheated sediments at 375°C was studied, which allow discriminating the contributions of amorphous organic carbon (AOC) and black carbon (BC) fractions to the PAH sorption extent. An analytical procedure for the determination of PAHs in the solution phase of the batch experiments has been developed with fluorescence spectroscopy.
The PAHs sorption isotherms to pristine sediments were fitted by Freundlich and composite models as linear Langmuir model (LLM) and linear Polanyi-Dubinin-Manes model (LPDMM). The sequential application of composite models LLM and LPDMM to the sorption isotherms allows assessing the partition of PAHs into AOC and its nonlinear adsorption in the porous structure of BC. The modelling results indicate that the PAHs sorption to minor BC component of sediments (< 0.2 % TOC) is more effective than that to the major AOC component (< 1.3 % TOC). A similar sorption capacity of BC in pristine and preheated sediments is also calculated at high PAHs concentrations, which indicates that the AOC fraction does not block the micropore filling of BC. The microporous structure and the hydrophobic nature of BC component in sediments are thus factors, which create favourable energetic sites for the sorption of PAHs in the river sediments. It can also be shown that a BC molecular sieving plays an important role in the competitive PAHs sorption in a multi-solute system.

J. Zhang, Ph.D. Dissertation, RWTH Aachen, Germany, 2010
J. Zhang et al., Effects of organic carbon and clay fractions on the pyrene sorption and distribution in Yangtze River sediments (submitted).
J. Zhang et al., Pyrene and phenanthrene sorptions to Yangtze River sediments and their components in single and binary solute systems (submitted)