Geophysical Research Abstracts, Vol. 8, 03626, 2006
SRef-ID: 1607-7962/gra/EGU06-A-03626

Slow and very slow desorption of PAHs from river floodplain soils: coal and coal-derived particles

Y. Yang (1), B. Ligouis (2), C. Pies (3), C. Achten (1), T. Hofmann (1)

(1) Vienna University, Department of Environmental Geosciences, Althanstraße 14, 1090 Vienna/Austria; (2) Eberhard-Karls-Universität Tübingen, Center for Applied Geoscience, Gemany; (3) Johannes Gutenberg-Universität Mainz, Applied Geology, Germany (thilo.hofmann@univie.ac.at)

Introduction: Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous hydrophobic organic contaminants in the environment. They tend to be associated with particles and are widely transported by flooding and atmospheric pathways, resulting in elevated concentrations in sediments/soils. Coal and coal-derived particles in natural sediments/soils can act not only as strong sinks for the PAHs, but also as very important sources of PAHs in sediments/soils. The understanding of the desorption mechanisms of these contaminants from the sediments/soils is very important, because this process controls their transportation, bioavailability, degradation and hence the potential risk in the environment. Therefore, our study on the desorption kinetics of PAHs was designed in order to (1) characterize the desorption of the PAHs in the soils, and further find out the dominant geosorbents for this process; (2) to elucidate the mechanism for the desorption behavior of PAHs from the river floodplain soils.

Materials & Methods: Physical separation was used, instead of chemical treatment in order to minimize the alteration of geosorbents. In this way, samples were separated into light fractions, heavy fractions, and grain size fractions. The light fraction was analyzed by organic petrography which showed a distinct abundance of coal (vitrite, fusinite, semifusinite) and other coal-derived particles such as coke. Most of them are in the form of vitrite from sub-bituminous coal, raw sub-bituminous coal and a relatively high amount of carbon-rich clayey matrices containing very small (few microns in size) coal and coke particles. Possible sources of the coal particles and the coal industry related carbonaceous particles are shipping activities on the river near the sampling site, coal mining and coal industry in the neighboring region.

Results: Very high concentrations of PAHs were found in the floodplain soils ($>$ 100 mg/kg). PAHs were determined in each grain size and density sub-fraction by GC-MS. The highest concentrations occurred in the light fractions, which are abundant of coal and coal-derived particles. The contribution of the total PAHs associated with the light particles in river floodplain soils was almost 75 %, although their mass contribution to the total soil mass was less than 5 %.

Future perspective: Desorption experiments are now performed with each sub-fraction and original soils as well. The kinetic desorption behavior of PAHs in our samples can be characterized by "slow" and "very slow" desorption. In addition, little amount of indigenous PAHs can be desorbed from these natural soils, which indicates little environmental risk. Hence, the sediment quality criteria based on the total extracted PAHs by organic solvent in the soils/sediments are under question. Details will be presented at the conference.