PAH source identification of bank and alluvial soils

Pies, C (1,2), Yang, Y (3), Hoffmann, B. (1) , Petrowsky, J. (1), Hummel, D (1),
Ternes, T (1), Hofmann, T. (3)

(1) BfG, Federal Institute of Hydrology, Koblenz, Germany, (2) Johannes
Gutenberg-University of Mainz, Geoscience, Germany, (3) Vienna University, Dep. of
Environmental Geoscience, Austria

High concentrations of EPA-PAHs up to 100 mg/kg are analysed for bank and alluvial
soils of Mosel River. The question of the origin and environmental risk of PAHs and
their alkylated derivatives in the study area is not answered.

To determine the source of PAHs, their ratios and specific GC/MS patterns are used.
Typical ratios of parent PAHs like Phenanthrene/Anthracene or Fluoranthene/Pyrene
and ratios of parent PAHs to their related alkylated PAHs help to identify the
source. Due to the different thermokinetic character of PAHs, PAH distributions can
provide information of a pyrogenic (combustion derived) or petrogenic (oil, coal)
source (Colombo et al. 1989). Several PAHs like Perylene, Cyclopenta(c,d)pyrene and
Benzo(b)naphto(2,1-d)thiophen can act as biogenic or anthropogenic marker.

In this study 50 PAHs are analysed with Gaschromatography/Mass spectrometry
(GC/MS). The analytical method includes 16 EPA PAH, alkylated PAHs of Naph-
talene, Phenanthrene, Anthracene and Chrysene, derivatives of the Dibenzopyrenes
and marker PAH like Perylene, Cyclopenta(c,d)pyrene and sulfureous PAHs.

Coal petrographic analyses were conducted to identify coal derived particles and coal
particles in the soils.

The mineral oil content is analysed with a Gaschromatography/Flame Ionisation De-
tector (GC/FID) using the DIN ISO method 16703 and additionally support the iden-
tification of the source.

Results show two different PAH distribution patterns in the study area. Major dif-
ferences are found in the contents of Naphtalene-, Phenanthrene-, Fluoranthene- and

Pyrene. Ratios of Phenanthrene/Anthracene and Fluoranthene/Pyrene point to pyrogenic sources.

High PAH concentrations mostly correlate well with coal particles and coal derived particles. High PAH concentrations and no coal particles could be found at one sample site, where the mineral oil has a lubricant pattern. Thus, two sources are likely: 1) Disperse PAH contamination linked to former coal industry at the Saar River, a tributary of Mosel River. 2) Local anthropogenic contaminations of the river banks. In combination with detailed investigations like coal petrography and the comparison with reference samples taken from potential emission sources. Other sources have to be verified.

Colombo, J.C., Pelletier, E., Brochu, C., Khalil, M. and Cataggio, J.A. (1989). Environ. Sci. Technol. 23(7): 888-894.