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Book of Abstracts



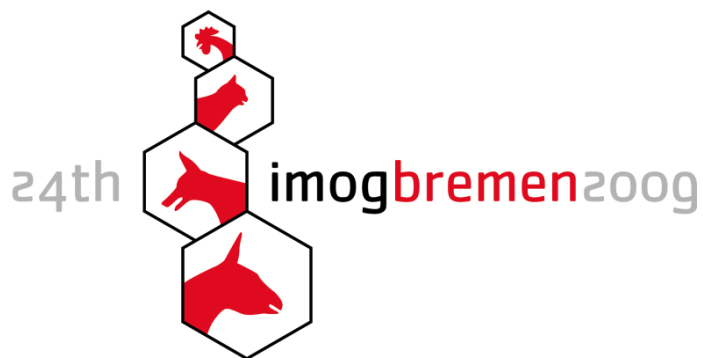
 European Association
of Organic Geochemists



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The impact of polycyclic aromatic hydrocarbons (PAHs) and their oxygenated derivatives (OPAHs) on microorganisms in soils of Angren industrial area, Uzbekistan

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Little information exists about how soils polluted with PAHs and OPAHs affects microbiological functioning of soil in natural field condition, in semi-arid regions. The present study examined the effect of PAHs, OPAHs on soil quality applying microbiological parameters. It was carried out near the Angren coal mining and power generating area in a semi-arid region of Uzbekistan. Study site was selected in order to establish a national monitoring program for assessing environmental condition of areas remote but downwind from greater emission sources. The aims of this study were to (i) to determine the spatial variation of PAHs, OPAHs in soils along a transect (ii) examine the relationships between PAH, OPAH concentration and the physicochemical and biological characteristics of the soil, and to (iii) evaluate their impact on soil microbial properties.

Soil samples were collected from 8 sampling locations (0-10 cm and 10-20 cm) in May 2005 along a 20 km NE-SW river valley transect downwind from the Angren industrial complex. The locations were, A: border of coal open pit mine, B: east of power station (4 km) C: west of power station (6 km) D: near by coal ash depository (8 km) E: recreation area, (12 km) F: near rubber factory (14 km), G: near gold refinery factory, (16 km) and H: pasture site, (20 km). Soil chemical analyses included electrical conductivity, pH, water soluble Na, Ca, and K, total soluble nitrogen and mineralizable nitrogen content. PAHs and OPAHs were quantified using GC-EI-MSD after sample extraction using pressurized liquid extraction, clean-up and fractionation on a silica gel column. The accuracy of the measurement of PAHs was validated by measuring European Reference Material "ERM-CC013a – PAHs in Soil" (Federal Institute for Materials Research and Testing (BAM), Berlin Germany). Microbiological properties were assessed by biological indicators such soil free living nematode abundance, basal respiration (R_B), microbial biomass related C and N contents, and microbial community functioning coefficients like the metabolic quotient qCO_2 , C_{mic}/C_{org} and C_{mic}/N_{mic} ratios.

There was a significant spatial dependence and differences for all soil chemical and microbiological parameters tested. PAHs and OPAHs concentration (Fig. 1) in upper soil layers (0-10 cm) were highest near the power station (C and B) followed by A (near coal mine pit) suggesting that these pollutants are derived from local stack emissions. Areas far from these emission sources had progressively lower PAH/OPAH concentration except near rubber factory (F). Deeper

soil layer (10-20 cm) had lower concentration than upper soil layer except in location (A) (data not shown). OPAHs followed similar trend as PAHs indicating that they are emitted together with PAHs. Soil micro-flora was obviously affected by PAHs and OPAHs near the pollution source. Highest total number of nematodes and number of plant parasite nematodes trophy group were found most distant from the industrial emission sources with comparatively lower PAH and OPAH concentrations (Fig.1). Positive correlations were found between PAHs and OPAHs concentrations, and soil respiration, metabolic quotient qCO_2 , while a negative one for the mineralizable N, C_{mic}/C_{org} and C_{mic}/N_{mic} ratios.

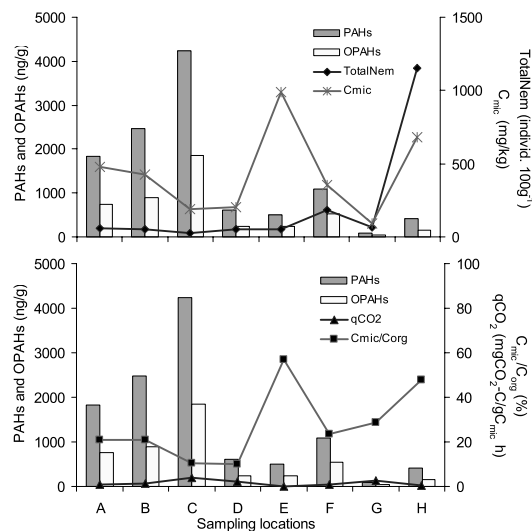


Fig. 1. PAHs, OPAHs concentration, total number of nematodes, microbial biomass, metabolic quotient and C_{mic}/C_{org} ratio distribution along the 20 km downwind transect.

We conclude that industries in the Angren industrial area have polluted the soils with high PAH and OPAH concentrations which have negatively impacted soil microbial properties and soil living free nematodes.

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