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Contamination of agricultural lands by polycyclic aromatic hydrocarbons (Tver region, Russia)

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It is important to study sources and concentrations of polycyclic aromatic hydrocarbons (PAHs) in the agriculture soils within areas without intensive contaminations. Our studied object was soil and snow cover in the taiga zone (Tver region, Russia). A total of 52 surface (0–30 cm) and 31 subsurface (30-50 cm) soil samples, and 13 snow samples were collected in 35 soil pits, located in forest, crop and layland soils. Studied concentrations of the following 11 individual compounds: two-ring compounds (diphenyl and naphthalene homologues); three-ring compounds (fluorene, phenanthrene, anthracene); four-ring compounds (chrysene, pyrene, tetraphene); five-ring compounds (perylene, benzo[a]pyrene); and six-ring compounds (benzo[ghi]perylene). Analyses made by specrtofluorometry method at the temperature of liquid nitrogen.
The total concentrations of all PAHs in soil samples ranged from 9 to 770 ng*g^{-1} with a median of 96 ng*g^{-1}. The sum of high molecular weight PAHs was significantly lower than the sum of low molecular weight PAHs in the studied soils. The phenanthrene concentration was highest and ranged from 1.2 to 720 ng*g^{-1} (medium 72 ng*g^{-1}).
Compared PAHs reserves in snow cover (μg*m-2) with the reserves in topsoil layer (μg*m-2 in the upper 30 cm). Low molecular weight PAHs (fluorene, phenanthrene, diphenyl, naphthalene) reserves in snow was less than 20% from the reserves in the soil surface layer. High molecular weight PAHs (benzo[a]pyrene, chrysene, perylene, pyrene and tetraphene) reserves in snow was about 50-70% from the reserves in soil surface layer. High molecular weight PAHs (benzo[ghi]perylene and anthracene) reserves in snow was more than in topsoil.
PAHs vertical distribution in soil profiles was statistically examined. The total concentration of all PAHs decreased with depth in all studied forest soils. In the arable soils was no significant trend in domination of PAHs total concentrations in the plowing and subsoil layers. The ratio of topsoil to subsoil concentrations of PAHs is different for differ congeners. Contents of phenanthrene and fluorene predominantly increase with the depth. Content of high molecular weight PAHs (benzo[a]pyrene, anthracene, tetraphene, perylene and pyrene) predominantly decreased with the depth. Other PAHs congeners have indistinct profile distributions in studied pits.
Based on studied results PAHs divided to associations with different concentrations, sources and vertical distribution in soils: a) phenanthrene and fluorine; b) naphthalene, diphenyl; c) pyrene, benzo(a)pyrene, tetraphene, perylene, chrysene; d) anthracene and benzo(ghi)perylene.

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