



Source apportionment of hydrocarbons in soils of oil deposit (Volgogradskaya oblast', Russia)

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Soil hydrocarbons investigation is relevant nowadays, because of their ubiquitous distribution and toxicity. In polluted areas it is important to find out the sources of hydrocarbons and their apportionment. Many studies are devoted to this problem, which include many methods of statistical analysis. Studies were held on different territories in USA (Simcik, S.J. Eisenreich, P.J. Liroy, 1999; Li, Jang, Scheff, 2003), China (Zuo et al., 2007; Liu et al., 2009), Germany (Pietrogrande et al., 2011), etc. Current study was held for the part of Volgogradskaya oblast' (Russia). Soils were analysed for 11 different PAHs content.

The aim of current work is to find out the applicability of linear discriminant analysis method for source apportionment of PAHs. The work was conducted on the territory of Zhirnovskoye and Bahmet'evskoye oil deposits and Zhirnovsk town. This territory is affected by various factors, which makes it suitable for this type of investigation. The following PAHs were investigated: fluorene, diphenyl, naphthalene homologous, phenanthrene, chrysene, anthracene, pyrene, benz[a]anthracene, benz[a]pyrene, benz[ghi]perylene, perylene.

The classification was made using linear discriminant analysis method. All factors were divided into 3 groups: «oil», «biogeochemical» and «else». Thus, we can estimate the percentage of each factor contribution.

In current study two training selections were tested: selection based on formal criterion of different PAHs content (especially naphthalene homologues and phenanthrene), and selection based on field descriptions: soils, containing traces of oil on the surface, were taken for «oil» associations, background soils were taken for «biogeochemical» associations. Naphthalene homologues and phenanthrene are known to take less energy for generation (compared with some others) and to be the most common PAHs in natural environment, not affected by pyrogenic processes (Gennadiev et al., 2015, 2016). At the same time, naphthalene homologues are the main part of PAHs sum both on Zhirnovskoye deposit (according to field materials) and in some other types of oil. This makes formal criterion of PAHs quantities eligible to use.

Verification of the model was done on the example of fluvisols of floodplains of Medveditsa river, that goes through Zhirnovskoye and Bahmet'evskoye oil deposits and Zhirnovsk town. It was found, that PAHs associations in the fluvic horizons down the river are mostly affected by oil factor, while samples from upper parts of the river contain more “else” or “biogeochemical” hydrocarbons.

To conclude, linear discriminant analysis is perspective method of source apportionment for PAHs. The best results were reached using quantitative-determined selection as training.

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