

# Composition of Oil Fractions in the Upper Horizons of Arctic Tundra Soils with Different Duration of Pollution

Zarina Bikmullina<sup>1</sup>, Yulia Zavgorodnyaa<sup>2</sup>

<sup>1</sup>Hokkaido University, Sapporo, Japan, <sup>2</sup>Soil Science Faculty, Moscow State University, Moscow, Russia

Petrochemical contamination of soils is a challenging issue, especially for subpolar regions where bio- and chemical degradation rate of pollutants is low (Bento et al., 2005). High-molecular-weight oil compounds, such as resins and asphaltenes, are less degradable and, thus, may affect the soil even many years after pollution termination; however, these compounds are usually ignored in environmental standardization and assessment of environment quality.

In this study, changes of oil fractions composition in upper horizons (0-20 cm) of contaminated Arctic tundra soils near the Yareiyskoe oilfield (Yamalo-Nenets Autonomous Okrug, Russia) were investigated. Samples were taken from areas near suspended wells. We assumed that the date of suspension could be considered as a date of intensive pollution termination.

An analytical method of extraction and fractionation of petroleum from contaminated soils is proposed. It successfully implements the separation of soil extracts into 3 fractions. F1 (non-polar, mostly consist of aliphatic HCs, cycloalkanes, mono-, bi- and triaromatics; eluted by hexane), and F2 (slightly polar, consist of oxidized products of HCs; eluted by chloroform) were analyzed by GC-MS. Benzene/methanol (1:1 v/v) extracted F3 was expected to include compounds such as resins and asphaltenes, and the analysis of was performed by LC-MS ((Herod et al., 2007).

Fraction composition shows changes for easily degradable compounds: relative abundance of linear alkanes decreased, whereas saturated polycyclanes shown higher percentage (fig. 1).

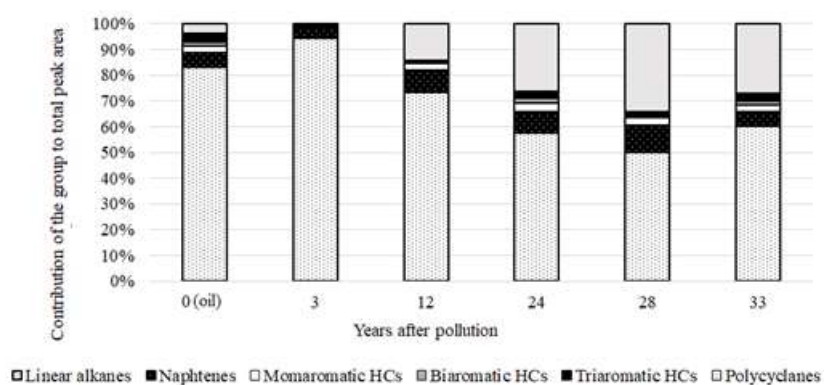


Fig. 1. Ratio of groups identified in F1

In F2, relative abundance of aliphatic-derived oxidized products increases; precursors/products ratio decreases up to 20 times (fig. 2). As contamination period rises, contribution of oxidized aliphatics becomes less, whereas oxi-PAHs start to prevail.

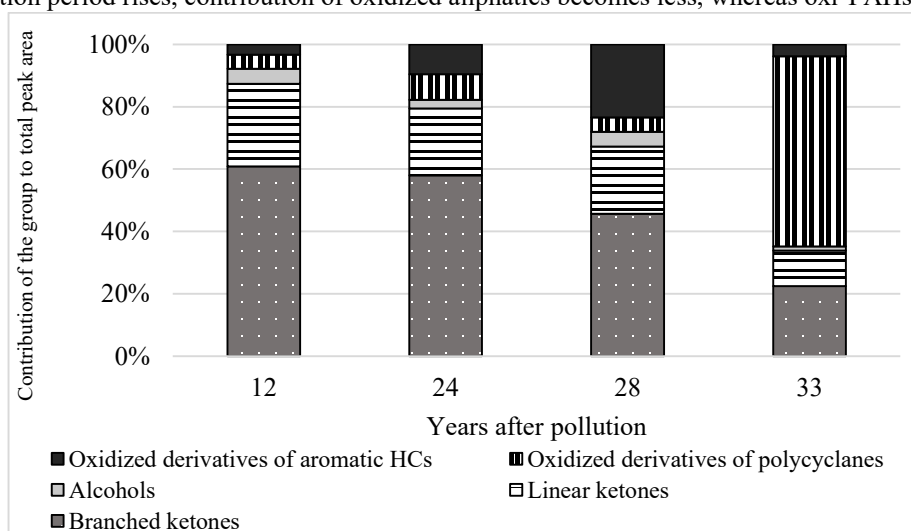


Fig. 2. Ratio of groups identified in F2

F3 analysis shows similarity of compounds' molecular weights and molecular formulae in samples with different period after pollution. The possible interpretation of these data is that total degradation of maltenes fraction in Arctic tundra soils requires much more than 30 years.

### **References**

- Bento, F.M., Camargo, F.A.O., Okeke, B.C., Frankenberger, W.T., 2005. Comparative bioremediation of soils contaminated with diesel oil by natural attenuation, biostimulation and bioaugmentation. *Bioresour. Technol.* 96, 1049–1055.
- Herod, A. A.; Bartle, K. D.; Kandiyoti, R. Characterization of Heavy Hydrocarbons by Chromatographic and Mass Spectrometric Methods: An Overview. *Energy Fuels* 2007, 21, 2176–2203.