

Effects of leakage of compounds from radioactive oily waste on soil microbial community

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Abstract

The study deals with the effects of disposal of oily waste containing natural radionuclides on chemical and biological properties of different soil layers. Two wastes were used in a laboratory experiment: raw oily waste H (TPH - 575 ± 121 g kg⁻¹, ²²⁶Ra - 4403 ± 312 , ²³²Th - 2848 ± 211 , ⁴⁰K - 1276 ± 133 Bq kg⁻¹) from a production yard, and treated waste R obtained by eluting oily components from waste H. The wastes were disposed on soil columns (H-and R-columns), at the amount equalized by the concentration of radionuclides. C-columns without waste disposed were used as a control. After 30 days of irrigation, soil properties of layers 0-20, 20-40 and 40-60cm were estimated. TPH content in all the layers of H-columns was significantly higher than in C- and R-columns. Activity concentrations of ²²⁶Ra and ²³²Th in R0-20 samples were 3.5 times higher than in control samples. Soil microbial biomass decreased from the upper to the lower layer in all the columns. Significant reduction of microbial biomass in the upper layer of column H was observed in comparison with columns C and R (12, 26 and 22 mg Cmic kg⁻¹ correspondingly). Respiration activity in samples H0-20 was 2.4 and 1.5 times higher in comparison to C0-20 and Rn.20 samples. Hydrocarbon oxidizing bacterial counts was significantly higher in all the samples of H-column, whereas there were no differences in total bacteria counts. On the basis of cluster analysis of the data obtained, it was concluded that namely the oily compounds cause the alteration in microbial communities, especially in the upper layer of soil. The effect of radionuclides on soil microbiota was not observed.

Keywords

Microbial biomass, Microbial respiration, Oily waste, Soil column, Technologically enhanced naturally occurring radioactive materials (TENORM)