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Microbial control on decomposition of radionuclides-containing oily waste in soil

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The oily wastes are formed annually during extraction, refinement, and transportation of the oil and may cause pollution of the environment. These wastes contain different concentrations of waste oil (40–60%), waste water (30–90%), and mineral particles (5–40%). Some oily wastes also contain naturally occurring radionuclides which were incorporated by water that was pumped up with the oil. For assessment of the hazard level of waste treated soil, not only measurements of contaminants content are needed, because bioavailability of oily components varies with hydrocarbon type, and soil properties. As far as namely microbial communities control the decomposition of organic contaminants, biological indicators have become increasingly important in hazard assessment and the efficiency of remediation process.
In this study the decomposition of radionuclides-containing oily waste by soil microbial communities were estimated.
Waste samples collected at the Tikchonovskii petroleum production yard (Tatarstan, Russia) were mixed with Haplic greyzem soil at ratio 1:4 and incubated for 120 days. During incubation period, the total hydrocarbon content of the soil mixed with the waste reduced from 156 $\pm$ 48 g kg-1 to 54 $\pm$ 8 g kg-1 of soil. The concentrations of 226Ra and 232Th were found to be 643 $\pm$ 127, 254 $\pm$ 56 Bq kg-1 and not changed significantly during incubation. Waste application led to a soil microbial biomass carbon decrease in comparison to control (1.9 times after 1 day and 1.3 times after 120 days of incubation). Microbial respiration increased in the first month of incubation (up to 120% and 160% of control after 1 and 30 days, correspondingly) and decreased to the end of incubation period (74% of control after 120 days). Structure of bacterial community in soil and soil/waste mixture was estimated after 120 days of incubation using SSCP method. The band number decreased in contaminated soil in comparison to untreated soil. Besides, several new dominant DNA-bands, closely related to oil degraders belonging to genera Dyella, Pseudoxanthomonas, Sinobacter and Parvibaculum, were found. Thus the microbial communities of the soil perform biological control of the destruction of contaminants supporting their functions due to structure change.