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Remediation of metal-contaminated land for plant cultivation in the Arctic/subarctic region

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Hazardous activities and/or industries involve the use, storage or disposal of hazardous substances. These substances can sometimes contaminate the soil, which can remain contaminated for many years. The metals can have severe effects of on ecosystems. In the Arctic/subarctic regions, the Kola Peninsula (66-70°N and 28°30'-41°30'E) in Russia is one of the seriously polluted regions: close to the nickel-copper smelters, the deposition of metal pollutants has severely damaged the soil and ground vegetation, resulting in a desert area. An area of 10-15 km around the smelters on the Kola Peninsula is today dry sandy and stony ground. A great amount of financial aid is usually required to recover theland. Considering cost performance, a pilot-scale (4ha) field test was carried out to investigate how to apply municipal sewage sludge for rehabilitation of degraded land near the Ni-Cu smelter complex on the Kola Peninsula. The above-mentioned field test for soil rehabilitation was performed while smelting activities were going on; thus, the survey fields were suffering from pollution emitted by the metallurgical industry, and may continue to suffer in the future. After the composting of sewage sludge, the artificial substratum made from the compost was introduced to the test field for the polluted-land remediation, and then willows, birches and grasses were planted on the substratum.

The following remarkable points in pollution load were observed between the background field and the rehabilitation test field (e.g. polluted land): (i) the annual precipitation amount of SO42- (5668 g/ha) in the rehabilitation test field was over 5 times greater than that in the background field; (ii) the Pb amount (1.5 g/ha) in the rehabilitation test field was 29 times greater than that in the background field; (iii) the Co amount (10.9 g/ha) in the rehabilitation test field was 54 times greater than that in the background field; (iv) the Cu amount (752 g/ha) in the rehabilitation field was over 600 times greater than that in the background field; and (v) the Ni amount (448 g/ha) in the rehabilitation test field was over 1,000 times greater than that in the background field.

The lost vegetation is being restored by the formation of an artificial substratum made from sewage sludge compost. Essentially, sewage sludge is a solid waste; however, the obtained data imply that sewage sludge is a helpful raw material for land remediation even where there is a harsh climate, poor-nutrient soil and metal-pollution load. The test results presented in this abstract seem to be a good example of how to combine natural conservation (remediation and maintenance) with recycling of resources (sewage sludge).