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Alteration of soil characteristics of Central Russian forest-steppe under the impact of ash and slag wastes from heat and power engineering

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Heat power engineering facilities belong to environmentally hazardous pollution sources. As a rule, heat power plants are arranged close to large industrial centers and coal mining sites. The pollution of surrounding landscapes by ash and slag wastes from open dumps is local.
The aim of this work is to assess the transformation degree of chemical soil characteristics near ash dump of Schekinskaya thermal power plant.
Power station exploits as a fuel the brown coal from the Moscow basin, the combustion of which generates large quantities of ash and slag wastes. The studied ash dump is located in the northeastern part of the Central Russian upland in a poorly drained hollow (near Sovetsk city, Tula region, Russia), and has an area of 1.2 sq.km. Soil samples were taken to the west of ash dump and at the reference site from the depth 0-100 cm with step 10 cm.
Ash and slag wastes is neutral (pH equal to 7.3), has a low total salt content (electrical conductivity of the water extract does not exceed 89 μS/cm) with calcium bicarbonate composition due to washing of ash from sulfates in the absence of the ash dump operation. The total content of water-soluble salts in ash wastes is 0.69 mmoL/100 g of ash (0.02%). The content of carbonates in the ash is less than 0.2%. The organic matter is presented by unburnt particles of coal and black (pyrogenic) carbon, the content of which does not exceed 0.5%.
The soil cover in the reference site is formed by podzolized chernozems under forb-grass meadows with birch and aspen and agrochernozems under agro-ecosystems. Parent material is presented by loess-like loams. The addition of ash and slag material into undisturbed soils leads to the transformation of topsoil and the formation of carbonate deposit on the soil surface.
The following results were obtained. The high content of salts of alkaline and alkaline-earth elements in ash leads to an increase of pH (alkalization by 1.6 pH units), conductivity (1.5 times above the background) in buried horizons of the soil, which is adjacent to the ash dump.
Alkaline conditions in soils around ash dumps lead to mobility reduction and accumulation of heavy metals, which prevents their downward migration in buried soils. Heavy metals have surface-accumulative distribution in technogenic-transformed chernozems. Pb (2.2 times above the regional background), Sr (1.3 times above the background) and Zn (1.2 times above the background) contribute to soil contamination. The transformation of mobile forms of heavy metals in buried soil horizons resulted in decrease of Zn mobility (17.5 times above the background level) and Pb (4.9 times above the background). Heavy metals migrate apparently with silt and dust particles in buried soil horizons. This fact is confirmed by the presence of coal and ash particles in topsoil.
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