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Spectroscopic properties of water soluble organic matter in artificial soil formed at a power plant from slag-ash deposits*

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Abstract

This study presents an evaluation of the properties of water extractable organic matter (WEOM) contained in anthropogenic soils, formed by superimposing four types of surface layers (0-40 cm) containing mixtures of organic and mineral waste on ash-slag mixture (the subsoil) left after coal combustion. After 12 years, selected properties of topsoil and subsoil horizons were analyzed. The topsoil had the texture of sand and loamy sand, conducive to water filtration. It was rich in organic matter, its pH was neutral or slightly alkaline, and its C:N ratio was usually optimal for soil organisms. The subsoil (40-60 cm) was strongly alkaline and often had the texture of loam, restricting water filtration. The WEOM fraction was evaluated by UV-Vis spectroscopy, fluorescence and delayed luminescence in order to disclose the variety of structural properties, which enabled an evaluation of its potential migration properties into the profile. The WEOM studied is poorly humified, which was predicable because of the short duration of the process (12 years). Structurally simple particles of low molecular mass are preferentially transported deeper into the ash-slag layer. Also, local activity of microbes and release of dissolved organic matter (DOM) from plant root excretion may be the sources of a large contribution of WEOM in ash-slag subsoils. WEOM components of greater molecular mass are retained in surface layers. WEOM transportation into the soil profile depends on the type of organic material, chemical and mineral components of different layers. The addition of ash significantly limits soil permeability, while bark is a sorbent of water including water-dissolved substances.

Keywords: fluorescence, luminescence spectroscopy, powder X-ray diffraction technique

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