The relationship of magnetic induction of soil with the content of heavy metals and humus in the soil

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Magnetic characteristics of soil are closely related to soil properties and can serve as indicators of soil condition in natural and anthropogenic environments. It is known that magnetic properties of soils depend on the content and distribution of certain iron oxides and hydroxides in soils horizons [1]. The profile of sod-podzolic soil is strongly differentiated by the content of magnetic fractions with their decreases in the lower horizons. The predominance of iron compounds in the upper horizons can be explained by the action of organic matter: humus fixes particles containing iron in the soil and prevents them from leaching to the lower horizons.

The purpose of our study was to identify the relationships of the magnetic field induction with the functional soil parameters responsible for the soil quality in the urban ecosystem. This allows low-cost tracking of soil degradation and changes in soil quality under anthropogenic influence.

The induction of the soil magnetic field (TI) was studied in situ using samples of urban-podzolic soil (UP) on fluvioglacial deposits and urban-sod-carbonate podzolic soil (USCP) on fluvioglacial deposits taken in the park of the Novokosino district (the Eastern Administrative District of Moscow) in 2019.

The dependence of the intensity of magnetic induction, on the content of iron, cobalt, nickel, copper, zinc, lead, and the total content of heavy metals (HMe), as well as humus content in the soil layers of the test areas was studied.

Studies of magnetic soil properties were carried out using the author's device and created programs for studying magnetic induction of soils [2]. Analytical studies were conducted in the Testing Laboratory Center (ILC) of the V. V. Dokuchaev Soil Institute.

Large values of magnetic field induction in the layers of the soil profile of UP soil (from 60 to 63 μTI) were determined in comparison with the values of magnetic field induction in the soil layers of USCP soil (from 59.29 to 58.28 μTI). The total content of soil HMe was maximum in USCP soil at lower values of the magnetic induction (57.8 - 60 μTI), while HMe were not detected in these soils at high values of the magnetic field induction. The decrease in the total content of HMe (including iron) with depth was revealed in USCP soil. A positive correlation of the content of heavy metals: iron, copper, lead, nickel, cadmium with the content of humus was determined.

A nonlinear dependence of the magnetic field induction on the humus content was found in the range from 57.8 to 63 μTI for samples of both soils (UP and USCP soils) with extreme regions of the magnetic induction value of about 60 μTI and humus content of 7.75 % and 7.73%.

References

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