

Condition of copper and organic matter in the soil contaminated with metal remediation of humic substances.

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The aim of this study was to investigate the forms of copper and transformation of organic matter in the soil under the influence of humic substances (potassium humate, which was obtained from coal). The object of research was the top layer of soil model field experience.

Field experiments were carried out in 10-liter plastic containers. The upper layers were constructed artificially as mixture of loam, sand and peat. Below it was a layer of loam, then gravel and under it we installed lysimeters. The experiment was conducted in 3 settings: 1) control, 2) control + Cu, and 3) control + Cu + potassium humate. Copper was deposited into upper layer at soil column construction as dry powder ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$), which is 1000mg per kg. Humic substance was introduced on surface as liquid form.

The focus was the state of the copper and organic matter of solid and liquid phase. In the solid phase pH, carbon content, the molecular-mass distributions for the organic matter, total (HNO_3 conc. + H_2O_2 ; decomposition in a microwave oven) and acid-soluble (1H HNO_3) copper content, sequential extraction of copper (1 M MgCl_2 , acetate buffer pH 4,8 (AAB), 1% EDTA) were determined. For liquid phase characteristics aqueous extract was obtained and identified therein: pH, total activity and copper content and water-soluble organic matter (WOM) amphiphilic properties.

The introduction of copper is accompanied by a decrease in pH in soils from 7 to 6,3. The introduction of the humic substance softens this effect. Introducing humic preparation gives an increase in carbon at 0.5%. HS and copper has no significant effect on the molecular-mass distribution of solid organic matter.

Only about 4% introduced copper accounted for the exchangeable form (MgCl_2) for the variant only copper contaminated. Copper, mainly precipitated as hydroxides, moved in an AAB extract. And compared with the exchangeable forms its quantity increases by 10 times. Still more copper goes into an extract of EDTA, about half of the total. That is, the introduction of humic substances increases the amount of copper associated with organic matter in complexes with high stability constants. The total amount of copper of the results of extraction is 88-96% of the all total content.

Water-soluble copper contains only 0.5% of the total. But the introduction of humic substances increases the amount of water-soluble copper is 3 times. This is due to the increase in the content of the WOM by 2.5-3 times, both due to the hydrophobic and hydrophilic fractions of WOM. And this leads to a sharp reduction in the activity of copper in the liquid phase.

Dual effect of introducing humic substances was obtained on the results of the work. On the one hand the introduction of humic substances contributes the immobilization of copper by increasing the fraction associated with organic matter in the solid phase. On the other hand the introduction of humic substances contributes the mobilization of copper in the liquid phase due to the increase of WOM.