PHYTOREMEDIATION POTENTIAL OF NATIVE PLANTS GROWING ON RECLAIMED COAL DUMPS

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In the formation of phytocoenoses on the reclaimed coal dumps the processes of self-growth by species most tolerant to conditions of acidification and salinization of soils play an important role. Besides, naturally occurring plant species should have an increased resistance to high concentrations of toxic substances, including heavy metals.

The purpose of this work was to study the tolerance of the prevailing forms of wild plants to increased concentrations of heavy metals and other toxic elements in soil substrates on coal dumps after their reclamation, and the prospects for using such plants for phytomining technologies.

The presented study was conducted on the basis of the Pavlograd experimental station for reclamation of disturbed lands in Western Donbass. Experimental plots were managed in the minefield area of "Pavlogradskaya" mine in 1976 where intensive deformation of the upper layers of the lithosphere and land subsidence with subsidy depth of 5–7 meters was registered. The basis of the plot was formed with a thick layer (8–10 meters) of mine rock intercharged with various topsoil layers. In total several variations of artificial soil profiles with different bulk thickness of mine rock and topsoil were created on the surface of the mine dump site to provide the following main land reclamation directions: natural overgrowing, agricultural and forest reclamation.

In this study the models of technogenic edaphotops based on capping the mine dumps with 30–50 cm layers of black-soil mass (chernozem) (variant 1) and red-brown clay (variant 2), being under natural overgrowth, were used to investigate plant ability to accumulate toxic or valuable substances from the mine dumps. Samples of soil substrates were taken from the depth 0–20 cm. Among subdominant species widespread on both experimental plots, such as *Artemisia austriaca*, *Festuca* spp., *Lathyrus tuberosus*, *Inula* sp., *Calamagrostis epigeios*, *Lotus ucrainicus*, and *Vicia* spp., the dominant species *Bromopsis inermis* was selected for chemical analysis. Soil and plant samples were treated and prepared in accordance with the standard methods for ICP-MS analysis.

It was established that pH of topsoil samples was 5.77±0.44 in chernozem in contrast to 8.38±0.09 in red-brown clay. The heavy/toxic metal concentration sequence in black soil substrates follows the order Fe > As > Mn > Zn > Cu > Cr > V > Co > Pb > Mo > Cd; in red-brown clay – Fe > Mn > Cu > V > Cr > Zn > Co > As > Pb > Mo > Cd, whereas the pollution index calculated as the ratio between the metal concentration in sample and its maximum permissible concentrations (MPC) indicates high level of chernozem pollution by As (pollution index in the range from 613.27 up to 1077.97), Fe (20.7), Zn (4.1), Co (3.0), Cu (2.4) and red-brown clay – by Fe (28.8), As (8.3), Cu (2.2) and Co (1.0).

Chemical analysis of the toxic substances in tissues of *Bromopsis inermis* growing on both chernozem and red-brown clay shows similar tendency for accumulation of heavy/toxic metals in the order Mn > Fe > Zn > Cr > Cu > Co > Pb > V > Mo > As > Cd. However, the values of the heavy metal transfer factor from soil in plant were established as below zero with maximum for Mo (0.84). It should be noted that the highest values of transfer factor were revealed for Re (1.04–1.19 in variant 1 and 1.0–1.42 in variant 2) and Rh (1.16-1.40 and 1.41–1.44 correspondently). For Ge the transfer factor was equal 0.044–0.137 (in variant 1) and 0.02–0.77 (in variant 2).

Thus, *Bromopsis inermis* growing on the reclaimed coal dumps is identified as a plant tolerant to heavy metals and other toxic substances and can be a good candidate for using in some phytomining techniques for phytoextraction (phytoaccumulation) of target valuable elements.

Key words: Phytoremediation, Coal Dump, Naturally Occurring Plants, Bioaccumulation