STUDYING THE POSSIBILITY OF USING RED-BROWN CLAY FOR RECLAMATION OF COAL WASTE DUMPS

Nataliia Podpriatova[1], **Iryna Klimkina**[1] **and Hermann Heilmeier**[2]
[1]*National Technical University "Dnipro Polytechnic",Dnipro, Ukraine*
[2]*TU Bergakademie Freiberg, Institute for Biosciences, Biology/Ecology Unit, Freiberg, Germany*
Natalia.podpryatova@gmail.com

The coal mining industry, as the source of the main fuel resource and the main energy resource, has particular importance for Ukraine. The largest coal regions of Ukraine include Donetsk, Lviv-Volynskyi and Dnipropetrovsk brown coal ponds. Their total area is 3% of the total area of Ukraine.

The coal dumps are formed after deep excavation works and the processing of rock extracted from great depths. They can include rock with elements in reduced form, such as Fe^{2+}, S^{2-}, Mn^{2+}, Cu^{+}, other elements and compounds. The surface of dumps quickly reacts with oxygen from atmosphere. The inclusions of pyrite (FeS_2) convert into Fe^{3+} and sulfuric acid as a result of oxidation. Dumps should be reclaimed or can be used as secondary mineral resources for the avoidance of formation of lifeless landscapes.

The main task of reclamation is to create biologically productive areas of the earth's surface with the necessary conditions for plant growth. The layers are usually applied in the following order: clay screen, layer of mine rock, potentially fertile soil and fertile soil. Black soil is widely used as the fertile soil layer. However, this method has disadvantages and relatively high cost.

The present study was conducted on the basis of the Pavlograd experimental station for reclamation of disturbed lands in Western Donbas located near the mine "Pavlogradska". The objective of the presented study is the quality of soil from two reclaimed plots of coal dumps from mine Pavlogradska. The 50 cm bulk layer of black soil has been heaped on the first plot; 50 cm red-brown clay layer has been heaped on another plot.

The purpose of the study is to determine the total salt content of experimental plots and consider the prospects of using the red-brown clay as top soil for coal dump reclamation.

The soil samples were selected according to the current ISO 4287:2004 and ISO 10381-2: 2004 in the range of 0–70 cm depth in increments of 10 cm in triplicate. They were dried in a muffle furnace; soil water extraction was received in the ratio of 1:10. The pH index of water extraction was determined according to GOST 17.5.4.01-84. The electrical conductivity (EC) was determined according to ISO 11265:2001. For the determination of the organic substances the method of dry burning according to the State Standard of Ukraine Б В.2.1-16:2009 was used. Total and dissolved content of the elements were measured using inductively coupled plasma mass spectroscopy (ICP-MS). Samples preparation was performed by acidic melting according to ISO 11464:1994 and the State Standard of Ukraine ISO 14869-1:2005.

The results have shown that black soil salinity is much more intense than in clay. Index of conductivity significantly increases at the depth of 20–30 cm. However, EC index of red-brown clay remains unchanged at the depth of 40–50 cm. The clay pH is higher than that of the black soil. Results obtained from analyses of content of NO_3^-, NH_4^+, PO_4^{3-} have shown that both clay and chernozem are poor of mineral nutrition of plants. Clay has significantly higher total contents and water-soluble contents of Mn and Co in comparison with chernozem. Moreover, in some cases, the total content of heavy metals in chernozem exceeds its concentration in clay-soil mixtures almost twice.

Thus, according to the obtained results, the processes of vertical salt transport in chernozems are faster and also have a greater ability to accumulate heavy metals than clay. The above factors give grounds for considering clay to be used as an alternative variant of the fertile layer for the reclamation of coal dumps.

Key words: Coal Waste Dumps, Reclamation, Red-Brown Clay