

# RECLAMATION POTENTIAL OF *ROBINIA PSEUDOACACIA* L. ON MINING ROCK WITHIN STEPPE ZONE OF UKRAINE

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Western Donbass is a powerful coal-mining region in the Steppe zone of Ukraine. In this region, large areas are damaged by coal mining. The mine rocks spread all over the coal district of Dnipropetrovsk region often contain toxic inorganic contaminants. In this regard using mine rocks for biological reclamation is nowadays an important environmental issue. Tree species can accumulate heavy metals from technosoils during the whole year and transfer these elements together with other nutrients to aboveground phytomass through the vegetation period.

The goal of the research was to study the features of the accumulation of heavy metals elements group by aboveground phytomass in a deciduous woody plant.

The object of the survey was Black locust (*Robinia pseudoacacia* L.) plantation of the Ukrainian Steppe zone within reclamation station in the minefield area of "Pavlogradska" coalpit (Dnipropetrovsk region, Ukraine). The Black locust sample trees were taken from reclamation plantation on the mine rock (technosoil). For the research structural compartments of the Black locust aboveground phytomass (assimilation apparatus, trunk wood, trunk bark, fruits) were used. Mine rock was defined as unfavorable in its texture properties with excessively large plasticity and significant shrinkage ability. Mine rock's water-physical properties are porosity – 34,8 %; specific mass density – 2.52 g/cm<sup>3</sup>; volumetric density – 1.64 g/cm<sup>3</sup>. Acidity of mine rock (pH) along one meter profile was ranging from 2.61 to 5.46.

The determination of metals concentration in the technosoil was conducted employing method of Inductively Connected Plasma Optical Emission Spectrometry (ICP-OES) by the spectrometer Technologist 5100 (Agilent). Samples of the Black locust leaves, trunk wood, trunk bark and fruits were crushed into the powder state and dissolved in acid solution. There after, acid solution was filtered and analyzed for the metals content. Analysis for the heavy metals was performed in the University of Girona, Spain. Features of Black locust trees development on the experimental forest reclamation plots were defined according to translocation of the inorganic contaminants. This is a quantitative measure of the transition of heavy metal from the technosoil to the plant. The accumulation is strongly affected by the chemical composition of the soil. In the same environmental conditions, heavy metals accumulation by functional plants' parts depends on soil contamination rate.

The monitoring data to reflect the content of studied metals from mining rock plot were (mg/kg absolutely dry matter): arsenic – 25.8 ± 2.7; antimony – 1/5 ± 0.04; zinc – 56.5 ± 1.57; lead – 40.6 ± 4.58; chromium – 93.9 ± 2.21; nickel – 43.1 ± 2.53; copper – 27.5 ± 0.19; manganese – 164.5 ± 1.25; tin – 40.5 ± 1.4; cadmium – 5.3 ± 0.07; cobalt – 2.6 ± 0.03; mercury – 7.5 ± 0.04.

Excessive gross content and a significant concentration of mobile metals forms in a soil leads to their concentration in plant. Therefore, to establish the remediation potential of Black locust the biological accumulation of metals coefficient (BAC) was calculated.

Concentration of antimony was the maximum for all fractions of aboveground phytomass (BAC 0.533–1.167) with the greatest value in the leaves fraction. A slight translocation intensity (1.0 > BAC ≥ 0.1) was determined for zinc, lead, cobalt and mercury. Such metals as chromium and tin showed the lowest accumulation rate in all fractions of aboveground phytomass (BAC < 0.01). A comparative analysis of the accumulation abilities of the aboveground phytomass components showed that the inorganic contaminants are the most concentrated in the leaves fraction.

In general, *Robinia pseudoacacia* can be used for biological reclamation on the transformed areas after the coal mining. Also, this species can be used as an antimony accumulator on areas where there is soil contamination with this metal.

**Key words:** Mining Rock, Heavy Metals, Biological Reclamation, Black Locust, Aboveground Phytomass