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Phytotechnologies for Use and Reconstitution of Contaminated Sites

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Abstract : Green chemistry concept is focused on the prevention of environmental pollution caused by human activity. However, there are a lot of contaminated areas in the world which pose a serious threat to ecosystems in terms of their conservation. Therefore in accordance with the principles of green chemistry, it should not be forgotten about the need to clean these areas. Furthermore, the waste material often contains the valuable components, the extraction of which by traditional wet chemical technologies is inefficient both from the economic and environmental protection standpoint. Wherein, the plants may be successfully used to 'scavenge' a range of metals from polluted land sites in an approach allowing to carry out both of these processes – phytoremediation and phytomining in conjunction. The goal of the present work was to study bioaccumulation ability of floating macrophytes such as water hyacinth and pondweed toward Hg, Ba, Cd, Mo and Pb as pollutants in aquatic medium and terrestrial plants (birch, reed, and cane) towards gold and silver as valuable components. The peculiarity of ongoing research was that the plants grew under extreme conditions (pH of drainage and pore waters was about 2.5). The study was conducted at the territory of Ursk tailings (Southwestern Siberia, Russia) formed as a result of primary polymetallic ores cyanidation. The waste material is mainly presented (~80%) by pyrite (FeS_2) and barite ($BaSO_4$), the raw minerals included FeAsS, HgS, PbS, Ag_2S as minor ones. It has been shown that water hyacinth demonstrates high ability to accumulate different metals, and what is especially important – to remove mercury from polluted waters with BCF value more than 1000. As for the gold, its concentrations in reed and cane growing near the waste material were estimated as 500 and 900 $\mu g \bullet kg^{-1}$ respectively. It was also found that the plants can survive under extreme conditions of acidic environment and hence we can assume that there is a principal opportunity to use them for the valuable substances extraction from an area of the mining waste dumps burial.

Keywords : bioaccumulation, gold, heavy metals, mine tailing
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