

BIOLEACHING AND BIOSORPTION OF HEAVY METALS FROM DEPOSIT BANSKÁ HODRUŠA AT THE ROZÁLIA MINE BY FUNGAL BIOMASS

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The well-being and development of society depend on several metals, including base and precious metals. Almost all heavy metals are naturally occurring compounds [1]. The usage of many metals is increasing in various applications; therefore, mining is considered the crucial sector in producing goods and infrastructure in general. Since the demand for metals is increasing and a higher proportion of ore bodies are being mined, greater quantities of waste are produced, respectively [2].

The occurrence of base and precious metal deposits in Slovakia is uneven and mostly related to the geological composition of a particular area. Mine deposit Banská Hodruša is headquartered next to the central zone of a large middle Miocene Štiavnica stratovolcano, located in Central Slovakia. Epithermal deposit of intermediate-sulphidation type is considered a vital global source of precious metals. Some examples of these deposits worldwide are Roşia Montană, Baia Mare in Romania, Banská Štiavnica in Slovakia and Beregovo in Ukraine[3]. In 1951 the deposit Banská Hodruša at the Rozália mine was opened to mine Cu, Pb and Zn from the late Rozália epithermal base. Then in the 1980s, epithermal Au-Ag-Pb-Zn-Cu mineralisation was unexpectedly discovered during the exploration of the Cu-rich. The mining deposit Banská Hodruša is composed of two parts: the western part has already been depleted, but the eastern part of the deposit is still being mined [4], [5].

Mining operations generate an excessive amount of waste containing valuable secondary resources of base and precious metals. Some of them are very important due to their limited supply, potential and economic significance. Hence, deposit Banská Hodruša at the Rozália Mine is considered an important secondary source of Au, Ag, Pb, Zn and Cu. In addition, mining waste is risky and require effective methods for recovering metals to avoid negative environmental impact.

Biohydrometallurgical methods require less energy, and any harmful gases or chemicals do not release into the environment [6].

Currently, there are two types of microbial activities that are exploited for biomining: bioleaching and biosorption. The bioleaching process is the dissolution of metals from their mineral sources by particular naturally occurring microorganisms, including fungi. The elements are extracted from a material when water is filtered

through it [7]. Biosorption is a relatively fast and reservable process that allows the removal of metals by both live and dead biomass. Because of the fungal mycelium lifestyle, they exhibit high surface compared to volume ratio; therefore, they are efficient biosorbents. Filamentous fungi are heterotrophic organisms capable of solubilising metals by the secretion of organic acids whilst tolerating their high concentrations. According to the literature, the fungal leaching and biosorption of metals have been documented. *Aspergillus* and *Penicillium* genera are considered one of the most effective in bioleaching. Also, they have a high capacity in biosorption of Cu, Pb and Zn [8], [9].

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