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Author: Mr. Artur Kleina
Poland

Dr. Aleksander Wasniowski
Space Garden Scientific Council, Poland
Dr. Malgorzata Perycz
Open Science Foundation, Poland
Mr. Marcin Kaczmarzyk
Rzeszow University of Technology, Poland

APPLICATION OF SACCHAROMYCES CEREVISIAE AND PENICILLIUM CHRYSOGENUM IN THE BIOLEACHING OF HEAVY METALS FROM THE METEORITIC MATERIAL (CHONDRITE TYP H) : A PERSPECTIVE TOOL FOR PRODUCING A SHIELD FROM COSMIC RADIATION

Abstract

Bioleaching is a well-known process used in mining to solubilize and immobilize some heavy metals, such as copper. Biohydrometallurgical techniques are perspective and simple bioleaching methods that would allow to obtain highly concentrated heavy metals. Chondrite is a stone of meteoritic origin, rich in Iron (Fe) and Nickel (Ni). Nickel is a good absorber of X-ray radiation, and its effectiveness depends from thickness of its layer. This potential combined with high concentration of Hydrogene atoms in fungal cells cytoplasm and walls potentially makes such a composition a good candidate to be included in a design of an anti-radiation shield of the human extraterrestrial habitat. Morover, bioleaching may result in metal-decontamination of the chondrite powder turning it into the soil-forming basis. In the present study, we compared Saccharomyces cerevisiae (SC001) and Penicillium chrysogenum (FPCH002) effectiveness in nickel bioleaching from the type H chondrite. The two species of fungi were grown in the Ni contaminated soil in a laboratory-scale reactor with the controlled pH, temperature and additional carbon and nitrogen sources. The species potential for immobilization of the Ni ions from the cultivation media was evaluated. The heavy metal levels in the residual sediments were also measured to determine the mass balance. We observed that the majority of heavy metals were transferred to and accumulated in the cellular structures, rather than released into the medium. The biomass was next concentrated with centrifugation and its potential as the X-ray radiation absorber was examined. In the paper we present the findings on the S. cerevisiae and P. chrysogenum ability to concentrate nickel and other heavy metals from the chondrite, and the X-ray absorbance properties of their biomass grown on meteoritic soil.