Search for a sustainable way of exploiting black shale ores using biotechnologies

Final Report Summary - BIOSHALE (Search for a sustainable way of exploiting black shale ores using biotechnologies)

The BIOSHALE project was a European research initiative that mainly aimed to define innovative biotechnological processes for the ecologically efficient exploitation of black shale ores; these are normally rich in organic matter and carbonates that handicap metal recovery by conventional techniques.

More specifically, the project objectives consisted of:
1. evaluation of geological resources;
2. selection of metal-bearing components and biological consortia which would be tested;
3. assessment of bioprocessing methods and determination of complementary hydrometallurgical processing tools for metal recovery;
4. use of innovative analytical tools based on molecular biology for the characterisation and monitoring of bacterial communities;
5. risk assessment relative to management of waste material from the new processing routes;
6. technical and economic evaluation of novel processes, ranging from mining to metal recovery, including social and environmental impacts.

Two types of materials from selected test sites, in Poland and Finland, were analysed. A third site, where the ore had been actively mined in the past but which was no longer exploited, also served as a case study. The assessment of alternative options took into consideration the situation of the target sites. In addition, a detailed evaluation, including strengths and weaknesses of the proposals, was carried out, with promising results.

In parallel to the development of bioprocess options, significant scientific progress was achieved in other fields: the identification of metal carriers, the development of bioleaching technologies, the analysis of bacterial adhesion and the attempt to identify novel microorganisms, the simulation of heat transfer in the processes of interest, and others. Furthermore, a global environmental impact
evaluation was prepared for the periods before, during and after mining activities, using an appropriate tool that was developed by the project consortium. The formulated proposals were analysed, along with conventional solutions, and a comparison of the associated environmental impacts was performed.

Finally, various activities for the dissemination of the results were carried out, including publications, presentations in conferences and international events, press releases and television appearances.

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