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Post operation inactivation of acidophilic bioleaching microorganisms using natural chloride-rich mine water

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Abstract. The H2020 BIOMOre project (www.biomore.info, Grant Agreement #642456) tests the feasibility of *in situ* bioleaching of copper in deep subsurface deposits in the Rudna Mine, Poland. Copper is leached using biologically produced ferric iron solution, which is recycled back to the *in situ* reactor after re-oxidation by iron-oxidizing microorganisms. From a post operational point of view, it is important that the biological processes applied during the operation can be controlled and terminated. Our goal was to determine the possibility to use natural saline mine water for the inactivation of the introduced iron-oxidizing microorganisms remaining in the *in situ* reactor after completion of the leaching process of the ore block. Aerobic and anaerobic microcosms containing acid-leached (pH 2) sandstone or black shale from the Kupferschiefer in the Rudna Mine were further leached with the effluent from a ferric iron generating bioreactor at 30°C for 10 days to simulate the *in situ* leaching process. After the removal of the iron solution, residing iron-oxidizing microorganisms were inactivated by filling the microcosms with chloride-rich water (65 g L^{-1} Cl^-) originating from the mine. The chloride-rich water irreversibly inactivated the iron-oxidizing microorganisms and showed that the naturally occurring saline water of the mine can be used for long-term post process inactivation of bioleaching microorganisms.

Highlights

- Termination of introduced microbial activity after *in situ* bioleaching is important
- Microcosms with acidophilic iron oxidizing microorganisms and ore were studied
- High strength chloride-rich mine water was used for inactivation
- Local chloride-rich mine water irreversibly inactivated acidophilic bioleaching microbes
- Local chloride rich mine water is a potential agent for irreversible inactivation

Abbreviations

PCR polymerase chain reaction

qPCR quantitative polymerase chain reaction

FIGB ferric iron-generating bioreactor