Bioleaching in stirred tank reactor to process Kupferschiefer ore

Anne-Gwenaelle Guezennec, Catherine Joulian, Patrick d'Hugues

Bioleaching in stirred tank reactor to process Kupferschiefer ore

Anne-Gwénaëlle Guezennec, Catherine Joulian, Patrick d'Hugues, BRGM, Orléans, France

Abstract

The Kupferschiefer deposits host the largest known copper reserve in Europe. These black shale type ores are currently exploited in Poland through pyrometallurgical smelting. In Germany exploration campaigns were recently carried out in order to assess and prepare future exploitation of this ore deposit type. The main copper-bearing minerals are: chalcocite, bornite, chalcopyrite and covellite. This type of ore is also characterized by high amounts of carbonate and organic carbon. They can also potentially present high content of arsenic (volatile in pyrometallurgical processes). During the last years, some mining operations in the area face an increased As and C contents, and a lower Cu contents. This phenomenon leads to a lower quality concentrate as well as operating and environmental issues during smelting.

In this context, several European research projects were dedicated to the development of new bioleaching approaches as alternative and complementary routes to the conventional smelting methods for the processing of the Kupferschiefer ores (BioShale, ProMine, EcoMetals, BIOMORE). By using a multi-scale approach from molecular techniques to bench-scale small pilot continuous tests, Cu recovery from this type of ores using bioleaching was demonstrated as technically feasible and efficient. The stirred tank bio-reactor (STR) was shown as the best process option when compared to heap leaching due to the high content of carbonate in the ore. Efficient Cu leaching was obtained at 25% solid load which is quite high compared to those encountered in most of the commercial bioleaching applications in STR (between 15 and 20%). The selected consortium (mesophile to moderately thermophile) has shown a rare copper tolerance since copper content increased up to more than 40 g L^{-1} without any negative effect on the bacterial community.

This key-note lecture will present an overview of the work performed on this topic in the last decade and will discuss the new insights and future developments for the integration of bioprocess options in the metallurgical treatment of black-shale type ores.