Tooeleite, a new possibility for the fixation of arsenic from copper smelter effluent treatment plants

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ABSTRACT

Arsenic is a common contaminant found in copper concentrates, and its removal and safe disposal of arsenic from effluent streams is a major environmental issue for the copper smelters. The problem of arsenic fixation and disposal has recently intensified due to the steady increase in the average level of arsenic in copper concentrates, the development of several high-arsenic deposits and the enforcement of stringent regulations.

In copper smelters and in the roasting of high-arsenic concentrates, the arsenic is volatilized and recovered in the weak acid scrubbing solution as arsenious acid (H_3AsO_3). Various treatment processes are currently used in copper smelters for the removal of arsenic from weak acid and dust treatment bleed effluents, of which the preferred method involves the co-precipitation with ferric iron upon neutralization with the addition of lime to form arsenical ferrihydrite, with a high Fe:As molar ratio (greater than 3). However, this process has a number of drawbacks including high iron requirements and the generation of large volumes of sludge.

Tooeleite, a ferric arsenite sulphate hydrate, has been proposed as a potential phase for the fixation of the As(III) species from weak acid effluents due to its low iron requirements, high arsenic content and high arsenic removal efficiency.

This presentation will review the arsenic treatment and disposal practices currently used in copper smelters. In addition, the following will be discussed: (i) the synthesis of tooeleite under varying precipitation conditions (pH, temperature and neutralizing agent); (ii) characterization of the synthetic tooeleite precipitates using both conventional and synchrotron-based techniques; and (iii) the stability of tooeleite precipitates subjected to the US EPA leaching procedures.