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Application of granular ferric hydroxides for removal elevated concentrations of arsenic from mine waters

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Arsenic is naturally occurring element in the environment. Over three hundred minerals are known to contain some form of arsenic and among them arsenopyrite is the most common one. Arsenic-bearing minerals are frequently associated with ores containing mined metals such as copper, tin, nickel, lead, uranium, zinc, cobalt, platinum and gold. In the aquatic environment arsenic is typically present in inorganic forms, mainly in two oxidation states (+5, +3). As(III) is dominant in more reduced conditions, whereas As(V) is mostly present in an oxidizing environment.

However, due to certain human activities the elevated arsenic levels in aquatic ecosystems are arising to a serious environmental problem. High arsenic concentrations found in surface and groundwaters, in some regions originate from mining activities and ore processing. Therefore, the major concern of mining industry is to maintain a good quality of effluents discharged in large volumes. This requires constant monitoring of effluents quality that guarantee the efficient protection of the receiving waters and reacting to possible negative impact of contamination on local communities.

A number of proven technologies are available for arsenic removal from waters and wastewaters. In the presented work special attention is given to the adsorption method as a technically feasible, commonly applied and effective technique for the treatment of arsenic rich mine effluents. It is know that arsenic has a strong affinity towards iron rich materials. Thus, in this study the granular ferric hydroxides (CFH 12, provided by Kemira Oyj, Finland) was applied to remove As(III) and As(V) from aqueous solutions.
The batch adsorption experiments were carried out to assess the efficiency of the tested Fe-based material under various operating parameters, including composition of treated water, solution pH and temperature. The results obtained from the fixed bed adsorption tests demonstrated the benefits of applying granular ferric hydroxides for treatment As-contaminated waters.

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