Use of process water in reverse cationic flotation of iron ores

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Abstract

Water scarcity worldwide and strict environmental constraints on mining industries necessitates the reuse of process water in their operations. In Chile in 2014, copper mining sector alone consumed 12.7 m^3/s fresh water for 1.189 tons of ore processing, and recycled 74 percent of the consumed water (Chilean Copper Commision 2015). A plant that does not reuse any water will require 1.9 to 3.0 m^3 of water per ton of ore processed. However, the use of process water has significant effects on flotation because the process water contains many dissolved compounds and ions that can alter the chemistry of system and the phenomena occurring at solid-liquid interface (reagent adsorption) and gas-liquid interface (bubble siz distribution and bubble coalescence). Another way to reduce the water consumption may be obtained by using the flotation process at high pulp density i.e. high solid percentage. This way to reduce the water consumption will also impact the flotation of the ores by changing the bubble-particle attachment and thus, the kinetics of flotation.

In this work we present the role of the water composition and the pulp density on the flotation kinetics and metallurgical results during reverse cationic flotation of iron ores. Results indicated that at alkaline pH ≈ 10.5 presence of individual salts and their combinations significantly reduced silica recovery. Furthermore, salts addition reduced the contact angle of quartz and zeta potential became less negative. Flotation kinetics tests showed the possibility to maintain the high silica removal level uoto 45 % of solid. Furthermore, the use of recycled water after desorption at acid and basic environment allowed to define the optimal parameter of the flotation by reducing the collector consumption by 50-75 %.