Use of humic substances in froth flotation processes

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Continual growing demand for metals in regular and emerging markets has led to an increasing use of chemicals and reagents in ore processing. This trend force to incur in an increasing use of commodities which inevitable leads to higher operational costs and environmental concern. The chemicals and reagents used in flotation processes especially invoke high costs of handling and disposal due to their hazardous nature, but until now, few studies have been carried out to seek possible alternatives. In order to develop a cheaper and greener processes, these hazardous materials should be replaced by more sustainable products, by-products, or wastes generated by other industries. Biosolids, cheaper and greener than chemical frothers and collectors, have been tested successfully in flotation processes. Studies of removal rates and froth flotation kinetics have been carried out independently, nevertheless a deeper understanding of the tradeoffs involved between the rates and kinetics should be obtained. This work evaluates the use of different collectors (conventional collector (CC), biosolids (and their main components), and mixtures of CC and biosolids main components) in the froth flotation of copper sulfide ores. Tests were carried out in Denver Cells, at fixed collector, frother, and pH levels, in order to estimate metallurgical and kinetic parameters. In rougher flotation tests, biosolids show to be the most efficient non-CCs, achieving Cu recoveries of 64.1%. CC achieved 76.2% Cu recoveries while none of the pure biosolids main components achieved Cu recoveries over 60%. In the kinetics studies, only the

partial replacement of CC (by 50% of Humic Acids (HAs) or biosolids) allowed a similar copper recovery once compared with CC (~81% Cu to be obtained with a fast kinetic constant of ~0.88 min?1). For molybdenum, partial replacement of CC produced better recovery and kinetics constants (k of 0.83 min?1 and R? of 66.10% for 50% CC - 50% HAs; k of 0.90 min?1 and R? of 61.79% for 50% CC - 50% biosolids). Results show that different combinations of biosolids - CC or HAs - CC could achieve optimal flotation conditions. As evaluated, an optimal combinations would allow considerable reductions in energy and chemical consumption.

Biosolids as ore collector

Copper and molybdenum concentrates

Flotation kinetics

Froth flotation collectors

Green chemistry

Recovery

copper derivative

copper sulfide

humic acid

molybdenum

unclassified drug

copper

sulfide

biosolid

byproduct

concentration (composition)

copper

cost analysis

environmental issue

hazardous waste

humic substance

molybdenum

pollutant removal

reaction kinetics

sulfide

waste disposal

Article

biosolid

cell pH

flotation

humic substance

industrial waste

kinetic parameters

metallurgy

kinetics

Copper

Humic Substances

Kinetics

Sulfides