

Reducing waste in the iron ore industry by beneficiating slimes using new flotation regime and two-stage processing routes

The iron industry produces a considerable amount of tailings per year, due to its considerable volumes of production. The actual iron ores processing routes require the removal of slimes fractions. In addition to iron oxides and quartz, the iron ore slimes are generally composed of other minerals such as kaolinite and finely dispersed iron hydroxides which impact significantly the performance of reverse cationic flotation. In this study, we propose two stage processing route that would allow the beneficiation of iron slimes which are not successfully beneficiated, avoiding their disposal as waste. The new amidoamine reagent was tested as a collector in a two-stage route to process two samples of iron ore slimes with d50 close to 10 μm and with high kaolinite content (13 to 20 %). The results showed that it was possible to obtain iron concentrate with 66.5% iron and 48.4% mass recovery for a feed containing 48.9% Fe associated to hematite (39 %) and goethite (32 %). The collector efficiency was improved by mixing with frother for the slimes with higher goethite content of 55 %: the concentrate grade was increased from 58.8% to 64.5% with addition of the frother at the expense of reducing operation metallurgical recovery from 87.8% to 75.6%. The efficiency of the process was improved by applying an external energy impact to disperse the fine particles and clean the surface of the minerals. The new amidoamine collector does not require a depressor such as corn starch and may provide the development of new concentration routes for complex ultrafine iron ores. The combination of the amidoamine based flotation at first stage with high intensity magnetic separation allowed to develop an optimized two stage processing routes to valorize the iron ore slimes rejected to the tailings in actual flotation plant.

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