

Mining iron ore from tailings with minimal use of process water

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ABSTRACT

Iron ore tailings contained typically 40 to 50% Fe can be beneficiated to iron ore products containing 54 to 60% Fe. The impurities are comprised of clay, quartz and cristobolite and TiO₂. Goethite and hematite are also present. At high concentration of 55-60 wt% solids, the tailings displayed high yield stress and viscosity and cannot be pumped over long distance. Composite additives comprising of NaOH, phosphate-based additives and sodium metasilicate were found to reduce the viscosity and yield stress very significantly by a few orders of magnitude. The yield stress of 100 Pa can be reduced to almost zero. At this state, dilution of the tailings with its process water to 40% solids caused the coarse and high density iron ore particles to separate from the colloidal fractions located in the supernatant after a few minutes of sedimentation. Separation by decantation produced a sediment with a Fe content of 54% from tailings with 47% Fe. Another tailings sample with 48% Fe was beneficiated to > 57% Fe using this NaOH-metasilicate-polyphosphate additives and employing an additional a washing step. The use of another composite additives, NaOH and polyphosphates, increased beneficiated product Fe content to > 60% from the same tailings. With the current iron ore spot price of more than USD\$150 per tonne, the cost of this treatment process even including a desalination step if necessary, is relatively insignificant. This study has given tailings an economic value that should be exploited as soon as possible.