Reprocessing of ferriferous nickel laterite siltation sediments into magnetic nanoparticles through coprecipitation

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ABSTRACT

Sediments from nickel laterite mines usually contain significant amount of iron which are not of economic importance. Two siltation ponds from a nickel laterite mine were sourced for their ferriferous sediments to synthesize magnetic nanoparticles by coprecipitation. Samples from each pond were leached with 12M hydrochloric acid to recover ferric ions (Fe^{3+}). A third of these leachates were reacted with sodium borohydride and reoxidised to produce ferrous ions (Fe^{2+}). The ferrous ions were then reintroduced into the ferric leachate system, and added with 2M sodium hydroxide to yield the magnetic precipitates, and separated using a permanent magnet. The precipitates were stabilised and isolated for characterisation. XRD analysis shows presence of maghemite, magnetite, and hematite. Particle size ranged from 5 to 28 nm. Under optimal conditions, the reprocessing of ferriferous laterite sediments into magnetic nanoparticles can provide sustainable means of management of mining wastes and transform it into an economically valuable resource.

KEYWORDS: magnetic nanoparticles, nickel laterite, coprecipitation, iron oxide, reprocessing