

PREPARATION OF HEMATITE NANOPARTICLES USING IRON ORES AT BUTTALA, SRI LANKA

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Abstract

Recently, more attention has been paid to synthesis iron oxide nano particles from naturally available low cost precursors, such as low grade iron ores. Of the synthetic iron oxide based nano-products, nano-hematite is being used in diverse of fields owing to its remarkable properties. The study aimed to investigate the potential use of the iron ores of Buttala, Sri Lanka as a source of iron for the synthesis of Hematite Nano Particles (HNP). Initially, detail mineralogy and chemistry of the iron ores were analyzed on X-Ray Diffractometer (XRD) and X-Ray Fluorescence analyzer (XRF) respectively. The ferric iron recovered from the representative powdered fractions of the iron ores via acid leaching was used as the iron precursor to synthesize HNP by applying the co-precipitation method. The yielded HNP was mineralogically and morphologically characterized using the XRD and Scanning Electron Microscope (SEM) images. The XRD results indicate that the raw iron ores are composed majorly of magnetite, hematite and goethite with subordinate spinel and ilmenite. The XRF analyses revealed that the raw iron ore samples are mainly composed of Fe₂O₃ (77.80%) with minor concentrations of Al₂O₃, SiO₂, MgO and TiO₂. The acid insoluble residue contains spinel, ilmenite and quartz indicating the complete dissolution of hematite, magnetite and goethite during the digestion. The XRD analyses coupled with SEM images of the synthesized product revealed that the product is a mixture of ε-Fe₂O₃ and α-Fe₂O₃ nanoparticles representing both spherical and irregular thin flaky morphologies. The size of these particles ranges from 90 to 130 nm. The yield of prepared HNPs is 92.57%. Hence, the iron ores at Buttala, can be potentially used as a source of iron during the production of HNPs.

Keywords: hematite nano-particles, Buttala iron ore deposit, Co-precipitation, XRD, SEM