Nano-Porous Iron Yttrium Oxide Particles Synthesis as Value Addition to Sri Lankan Garnet Sand

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Garnet sand is a variety of mineral sands which is widely distributed in the southern coastal line of Sri Lanka with large minable quantities. However, these sands have limitedly use in industries, and more applications and products should be studied. In this study, natural garnet sand, which was collected from Pulmoddai, Sri Lanka was used to synthesize nanoporous iron yttrium oxide nanoparticles as it has wide range of applications such as magnetic nanofilters and nanoabrasives. The X-Ray diffraction (XRD) analysis revealed that the garnet sand consists of almandine variety ($Fe_3Al_2Si_30_3$). First, 5.000 g of powdered garnet sand was refluxed with 60 ml of 10 M HCI solution at 90 °C. The digested solution was filtered and 2 % NaOH was added dropwise to the filterate until the pH becomes 14 in order to precipitate iron hydroxide and heated at 80 °C to dissolve hydrated aluminium. Then, the dry precipitate was dissolved in 10 M HNO_3 and mixed with yttrium hexahydrate trinitrate solution. Later, the mixture was mixed with citric acid and pH was controlled to 2 using aqueous ammonia. The solution was heated at 80 °C until a light brown xerogel is formed. Finally, the xerogel was calcined at 800 °C for 5 h. Synthesized nanoparticles were characterized by XRD, Fourier Transform Infrared (FT-IR) spectroscopy and Scanning Electron Microscopy (SEM) techniques. The SEM data revealed the nano-porous structure with 100 rim pore size, while FT-IR and XRD results confirmed the $FeYO_3$ composition of the nanomaterial. This work can be extended to study the dye adsorption of the iron yttrium oxide nanoparticles, encapsulation of the nanoparticles in the porous structure of synthesized particles and its potential applications, its magnetic property and enhancing the filteration property of the particles.

Keywords : Garnet, Sand, Yittrium Iron Garnrt, Nanoporous