

Nanosilica from Sri Lankan Vein Quartz: Synthesis, Surface Modification and Characterization

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Vein quartz is one of the most abundant minerals in Sri Lanka and it is mainly mined for porcelain and materials industries. Vein quartz is an economically viable earth resource for the production of nanosilica through chemical methods as a value added product. Nanosilica is one of the widely used nanomaterials in adhesives, sealants, paints & coatings, cement-based building materials and rubber composites as a reinforcing, thickening and flattening agent.

In this research work, pure nanosilica was synthesized by a chemical precipitation method from Sri Lankan vein quartz. Finley ground quartz was refluxed with 3 M NaOH and then 0.5 M H₂SO₄ was added drop wise to adjust the pH of the solution to be around 8.0 to precipitate nanosilica. X-ray diffraction (XRD) data indicated that the natural Sri Lankan vein quartz is highly crystalline and pure. Energy dispersive X-ray spectroscopy (EDX) data confirmed that vein quartz comprises pure silicon oxide with less impurities. Scanning electron micrographs (SEM) data showed that synthesized nanosilica particles from vein quartz were in the agglomerate form with average particle size of 50 nm. XRD data showed a strong broad peak around 22.14° (2θ) indicating synthesized nanosilica was in amorphous form. Fourier transform infrared spectroscopy (FTIR) data indicated the structural change from crystalline silica (in vein quartz) to amorphous silica by the absence of a sharp peak at 695 cm⁻¹ in the FTIR spectrum of nanosilica synthesized. Silica nanoparticles were subjected to surface modification by oleic acid (C₁₈H₃₄O₂). Thermo gravimetric analysis (TGA) graph indicated the thermal decomposition of oleic acid in functionalized nanosilica with a significant weight loss between 350 °C to 400 °C. FTIR data showed that modified nanosilica with oleic acid indicated a carbonyl stretching peak of an ester bond at 1711 cm⁻¹, which confirmed the ester bonding between silanol group and the carboxylic group of the oleic acid.

Keywords: vein quartz, Sri Lanka, nanosilica, nanomaterial, oleic acid

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