

Synthesis of Silica Nanoparticles Derived from Oil Palm Boiler Ashes Using Sol-gel method

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Abstract:

Oil palm boiler ash is a solid waste resulting from burning palm fiber, empty fruit bunches, and shells. The ash produced from the boiler still contains 40-60% silica. To isolate and obtain silica nanoparticles from palm oil boiler ash, there are several methods including leaching and sol-gel methods. Silica nanoparticles can be used in very different materials, such as paints, membranes fuel cells, separator batteries, adsorbent, catalysts, and drug delivery systems. This study investigates a method to produce highly pure silica nano particle from boiler ashes using sol-gel method modified with cetyltrimethylammonium bromide (CTAB) as surfactant modifier. The raw material was chosen from Crude Palm Oile (CPO factory in Lampung with the silica content 61,108%. Extraction and characterization of SiO₂ nanoparticles obtained from boiler ash by washing treatment with the presence of hydrochloric acid to remove metal impurities, followed by alkaline extraction with sodium hydroxide to obtained natrium silicate, hydrolysis, aging process with the presence of CTAB and butanol for 8 hours, centrifugation, freeze drying, and calcination at 450°C. The obtained SiO₂ nanoparticles were characterized by Fourier Transform Infra-Red Spectroscopy (FTIR) and Transmission Electron Spectroscopy (TEM). SiO₂ using the sol-gel modified with CTAB resulted nanoparticles at approximately 10 nm and was confirmed by FTIR at the peak at wavelength 1040 cm⁻¹ and 820 c-m-1.