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Synthesis and characterization of structural and luminescence properties of TiO₂ nanoparticles for water treatment application

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Introduction
Solar water treatment is a low-technology solution that works to capture the heat and energy from the sun to make water cleaner and healthier for human use and consumption. The oxide nanoparticles synthesized by several methods appears more and more useful because these nanoparticles have good electrical, optical and magnetic properties that are different from their bulk counterparts [1]. Titania nanoparticles have received much interest for applications such as optical devices, sensors, and photocatalysis [2]. There are several factors in determining important properties in the performance of TiO2 such as particles, crystallinity and the morphology. TiO2 nanoparticles were synthesized by a simple sol-gel method. The structure and morphology of the synthesised nanocrystalline TiO2 were characterized by XRD, SEM, UV and PL. The effect of some parameters such as hydrolysis rate, concentration amount of the precursor constituents, and annealing temperature were investigated.
Results
A representative scanning electron microscopy image of the TiO2 nanoparticles synthesized presented in Fig. 1, indicates that the sample is composed of roughly spherical surface aspects. The anatase to rutile structural phase change occurs when annealed at a temperature greater than 500 ℃ when evaluated from X-ray diffraction pattern intensities of (101) and (110) peaks, respectively. Annealing samples at high temperature improves crystallinity as confirmed by both SEM and XRD measurements. It was observed that the band gap of TiO2 varied from 2.49 and 3.26 eV while the crystallite sizes calculated using the Scherrer equation obtained from each set of synthesis conditions changed from 8 to 10 nm with variation of hydrolysis rate. The emmissions spectra (λexc= 325 nm) of TiO2 nanoparticles for different hydrolysis rate display peaks at 336, 381 and 486 nm and the broad emission peak at about 381 nm is attributed to band gap transition.

Are you currently a postgraduate student? (Yes/No)

No

At what level of studies are you currently? (Hons/MSc/PhD)

N/A

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