

Montmorillonite/TiO₂ Advanced Hybrid Material Using Sri Lankan Clay: Preparation and Characterization

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Montmorillonite (MMT) is a naturally occurring crystalline silicate clay mineral. Nano titanium dioxide (nano-TiO₂), particularly in the anatase form, is a photocatalyst under ultraviolet (UV) light. Nano-TiO₂ is thus added to paints, ceramics, tiles, or other products for its sterilizing, deodorizing and anti-fouling properties and is used as a hydrolysis catalyst.

The objective of this research is to enhance the photocatalytic activity of TiO₂ by forming a hybrid material with MMT. Therefore, montmorillonite/TiO₂ advanced hybrid materials was prepared using montmorillonite clay from Murunkan deposit in Sri Lanka. The cation exchange capacity (CEC) of Murunkan clay was found as 65 meq/100 g. Raw materials, intermediate products, and the MMT/TiO₂ hybrid material were analyzed using X-ray diffraction (XRD), energy dispersive X-ray spectroscopy (EDX), scanning electron microscopy (SEM), and Fourier transform infrared spectroscopy (FTIR). XRD and EDX data analysis revealed the presence of TiO₂ in the hybrid material as anatase form. According to XRD and SEM data analysis average particle size of the nano TiO₂ was found to be 60 nm. SEM images showed that the microstructure of the clay has not been destroyed during the formation of the MMT/TiO₂ hybrid material. UV-Visible spectroscopy was used to measure the effectiveness of the photocatalytic activity of the hybrid material versus nano TiO₂ for the degradation of methyl orange. In this experiment methyl orange was used as a model organic pollutant. Experimental results showed that after 4 hours MMT/TiO₂ hybrid material degraded 92% of methyl orange while nano TiO₂ has only degraded 67% under diffused light. The synthesized MMT/TiO₂ advanced hybrid material exhibited much higher efficiency in degrading methyl orange compared to the same weight of nano TiO₂ alone.

Keywords: *montmorillonite, Sri Lanka, nano titanium dioxide, hybrid material, photocatalysis*

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