

7th World Nano Conference

June 20-21, 2016 Cape Town, South Africa

TiO₂-Graphene Oxide (GO) Nanocomposites: Synthesis, Environmental Applications and Surface Characterization using Perichromism

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TiO₂-graphene oxide (GO) nanocomposites were successfully synthesized using a simple mixing and sonication sol-gel method with varying the rate of hydrolysis of the TiO₂ precursor. The average particle sizes of the nanocomposites were 436 ± 59 nm and 251 ± 32 nm for the samples denoted TL and TS which corresponds to large particle size TiO₂ and small particle size TiO₂, respectively. The photocatalytic activity of the as-prepared TiO₂-GO nanocomposites for methylene blue (MB) degradation was investigated under UV (λ=365 nm) light irradiation. The results showed that TiO₂-GO nanocomposites have significantly higher photocatalytic activity than blank TiO₂ (no GO). The increase in the photocatalytic activity of the samples was dependent on a number of factors such as surface acidity, surface area and the change in band gap energy. The surface acidity was measured using perichromic dyes and NH₃-TPD; both measurements are independent. The increase in overall surface acidity after the GO addition was mostly attributed to Brønsted acidity as Lewis acidity was generally lower than the blank in most samples. However, possible stacking of GO at higher concentrations resulted in the decrease in overall acidity with the increase in GO contents. Surface polarity and polarizability were investigated using perichromic dyes to study their impact on the photocatalytic activity. Other surface properties were evaluated using BET, DRS-UV, FTIR, Raman and XRD. This study provides new insights on the surface characterization of high-performance photocatalysts used in wastewater treatment, correlating these surface properties and photocatalytic activity.

Biography

Amr M. Tayel has completed his BSc in pharmaceutical science followed by MSc in chemistry from The American University in Cairo (AUC) in 2015. His MSc thesis focused on surface characterization of nanocomposite photocatalysts. He published one paper in the Journal of Applied Polymer Science. He is an associate member of the royal society of chemistry (AMRSC). He is currently a teaching assistant at The American University in Cairo (AUC), chemistry department.

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