OMICS Group Conferences
Accelerating Scientific Discovery

3rd International Conference and Exhibition on
Materials Science & Engineering
October 06-08, 2014 Hilton San Antonio Airport, USA

Nd,N,S-TiO_2 decorated on reduced graphene for a highly efficient visible light active photocatalyst for dye degradation: A comparison to its MWCNT/Nd,N,S-TiO_2 analogue

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Neodymium, nitrogen and sulphur tridoped titania (Nd,N,S-TiO_2) was decorated on reduced graphene oxide (rGO) and multiwalled carbon nanotubes (MWCNTs) via a simple sol-gel method. Aqueous solutions of eriochrome black T (EBT) and eosin blue shade (EBS) were used to evaluate the photocatalytic activity of the composites under simulated solar light irradiation. Degradation of the dyes was performed in single and mixed dye solutions. The reduced graphene based photocatalyst (rGO/Nd,N,S-TiO_2) displayed superior photocatalytic activity over the MWCNT/Nd,N,S-TiO_2 compositein both single and mixed dye solutions. In the single dye solutions, a maximum degradation of 99.3% and 94.6% was achieved for EBS and EBT, respectively. Moreover, a maximum degradation efficiency of 65.7% and 58.9% was attained by rGO/Nd,N,S-$TiO_2$for EBS and EBT, respectively, from mixed dye solutions. The superiority of the rGO/Nd,N,S-TiO_2 overits MWCNT based counterpartmay be attributed to better interaction with dye molecules, higher charge separation and transportation, better interaction between the rGO and tridoped titania and sufficient dispersion of the titania nanoparticles.Furthermore, radical scavenging experiments confirmed the superoxide and hydroxyl radicals as the active species during dye degradation. Total organic carbon analyses revealed a fairly high degree of complete mineralisation of both dyes.

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