Mala Nath et al., J Material Sci Eng 2019, Volume 8
DOI: 10.4172/2169-0022-C1-125

Toluene assisted synthesis of ZIF-11 and multi-core-shell AgNPs@ZIF-11 composite: As an effective photocatalyst for degradation of industrial pollutants

Mala Nath and **Ramesh Chandra**
Indian Institute of Technology Roorkee, India

Novel multi-core-shell AgNPs@ZIF-11 (AZ1, AZ_2 and AZ_3) composites were synthesized by in situ encapsulation of Ag nanoparticles (150, 300 and 500 µL suspension in methanol) in ZIF-11(Zeolitic Imidazole Framework) at room temperature using binary solvent mixture (methanol and toluene) and characterized by powder X-ray diffraction (PXRD), XPS, Fourier Transform Infra-Red (FT-IR) spectroscopy, SEM (Scanning Electron Microscopy) and TEM (Transmission Electron Microscopy) images. Encapsulation of AgNPs was evidenced by TEM, SAED and ultraviolet diffuse reflectance spectroscopy (UV-DRS). The lowering of band gap of ZIF-11 from 4.36 to 4.21 eV indicates the micro-environment of AgNPs within ZIF-11 framework. Particle size of encapsulated AgNPs within the matrix of ZIF-11 was found 11.76±2.3 nm. ZIF-11 and AgNPs@ZIF-11composites are highly thermally stable up to 500°C under both air and nitrogen environments. Application of AgNPs@ZIF-11 (AZ1, AZ2 and AZ3) composites towards photodegradation of methylene blue (MB) dye has been investigated by varying the amount of catalyst (5, 10 and 15 mg) and dye concentration (1.6, 3.19 and 6.38 mgL^{-1}) at different pH (3 to 11). AZ1 (5 mg) exhibits excellent photocatalytic activity; degrades 100% MB (1.6 mgL^{-1}) at pH≥7. AZ1 also exhibits potential efficiency (86%) for the conversion of 4-nitrophenol into 4-aminophenol. Further, AZ1 can be reutilized up to three cycles with 100% efficiency while under fourth and fifth cycle it can degrade 92.12% and 72.75% MB, respectively, and therefore, it can be utilized as an efficient photocatalyst for remediation of environmental pollution.

malanfcy@iitr.ac.in

Notes: