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Polyaniline supported CdS/CeO_2/Ag_3PO_4 nanocomposite: Synthesis, characterization and photocatalytic activity for methyl orange dye degradation

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In the present work, different types of photocatalysts in single, binary and ternary systems with different molar ratios (1:1, 2:1, 3:1 and 4:1) of CdS: CeO_2/Ag_3PO_4 was synthesized by co-precipitation method. Polyaniline supported CdS/CeO_2/Ag_3PO_4 nanocomposite was also synthesized by "*in situ*" chemical oxidative method. Crystal structure, surface area, morphology, band gap energy, functional groups, optical properties and electron transfer of the as-synthesized photocatalysts were characterized by using XRD, BET, SEM-EDX, UV/Vis, FTIR, PL and EIS instruments, respectively. Photocatalytic activities of single, binary, bare and supported ternary nanocomposite were evaluated by using aqueous solution of model pollutant methyl orange dye (MeO) as well as a real sewage sample solution collected from Bahirdar Textile Share Company. Photocatalytic activities of ternary CdS/CeO_2/Ag_3PO_4 (1:1, 2:1, 3:1 and 4:1 molar ratios) nanocomposite were found to be higher than those of single and binary counterparts. The effect of operational parameters such as pH, initial dye concentration and photocatalyst load in MeO dye degradation were investigated by using polyaniline supported CdS/CeO_2/Ag_3PO_4 (PAST) nanocomposite. At optimum operating conditions, photodegradation efficiencies of the bare (CCA4) and supported (PAST) ternary systems were found to be 83.71 and 93.99%, respectively. The effect of different scavengers suggest that •$O2^-$ and •OH are the principal species involved in the decolorization of MeO. Supported photocatalyst also exhibited a relatively higher efficiency on the photodegradation of MeO than real sewage sample solutions which is about 93.44 and 70.74%, respectively. The reusability of supported photocatalyst was tested and only about 20% decrement was observed after four successive runs. Photocatalytic degradation of MeO dye follows the pseudo first order kinetics for the entire as-synthesized nanocomposite. The results also suggest that the PANI supported CdS/CeO_2/Ag_3PO_4/GCE nanocomposite could act as excellent electron transfer medium and enhance electron transfer.

Speaker Biography

Tigabu Bekele Mekonnen, he had completed his MSc at the age of 25 years from Haramaya University. He is now an instructor in Mekdela Amba universty, Ethiopia. He done his research at Nanocomposite and Nanotechnology.

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