

# Synthesis, Characterization and Photocatalytic Activity for Methyl Orange Dye Degradation of a Polyaniline Supported CdS/CeO<sub>2</sub>/Ag<sub>3</sub>PO<sub>4</sub> Nanocomposite

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## Abstract

In the present work, different types of photo-catalysts in single, binary and ternary systems with different molar ratios (1:1, 2:1, 3:1 and 4:1) of CdS/CeO<sub>2</sub>/Ag<sub>3</sub>PO<sub>4</sub> was synthesized by co-precipitation method. Polyaniline supported CdS/CeO<sub>2</sub>/Ag<sub>3</sub>PO<sub>4</sub> nano-composite 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 photo-catalysts were characterized by using XRD, BET, SEM-EDX, UV/Vis, FTIR, PL and EIS instruments, respectively. Photo-catalytic activities of single, binary, bare and supported ternary nano-composite 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.

Photo-catalytic activities of ternary CdS/CeO<sub>2</sub>/Ag<sub>3</sub>PO<sub>4</sub> (1:1, 2:1, 3:1 and 4:1 molar ratios) nano-composite were found to be higher than those of single and binary counterparts. The effect of operational parameters such as pH, initial dye concentration and photo-catalyst load in MeO dye degradation were investigated by using polyaniline supported CdS/CeO<sub>2</sub>/Ag<sub>3</sub>PO<sub>4</sub> (PAST) nano-composite. At optimum operating conditions, photo degradation 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 •O<sub>2</sub><sup>-</sup> and •OH are the principal species involved in the de-colorization of MeO. Supported photo-catalyst also exhibited a relatively higher efficiency on the photo degradation of MeO than real sewage sample solutions which is about 93.44 and 70.74%, respectively. The reusability of supported photo-catalyst was tested and only about 20% decrement was observed after four successive runs. Photo-catalytic degradation of MeO dye follows the pseudo first order kinetics for the entire as-synthesized nano-composite. The results also suggest that the PANI supported CdS/CeO<sub>2</sub>/Ag<sub>3</sub>PO<sub>4</sub>/GCE nano-composite could act as excellent electron transfer medium and enhance electron transfer.

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## Biography

Tigabu Bekele completed his MSc at the age of 25 years from Haramaya University. He is now an instructor in Mekdela Amba university, Ethiopia.