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CONDUCTING POLYMER/INORGANIC OXIDE NANOCOMPOSITES FOR THE PHOTOCATALYTIC DEGRADATION OF ORGANIC DYES

Industrial waste water polluted with dyes is often discharged into natural water bodies. Most of these dyes symbolize severe problems to the ecological system and the ejection of these colored wastes into natural water bodies may increase the toxicity and the chemical oxygen demand (COD).The presence of dyes in surface water also blocks solar radiation from getting aquatic organisms, which in turn affects the photosynthesis process of plants that are present in the water. This will negatively affect the balance of aquatic systems. There are many conventional methods for treating industrial effluents in waste water. Problems of renewal and difficulty in after use separation from the wastewater are the two major concerns of using this methods and materials. Many researchers regard as advanced oxidation process as the most efficient, economically feasible and applicable technology for the removal of organic dye pollutants.

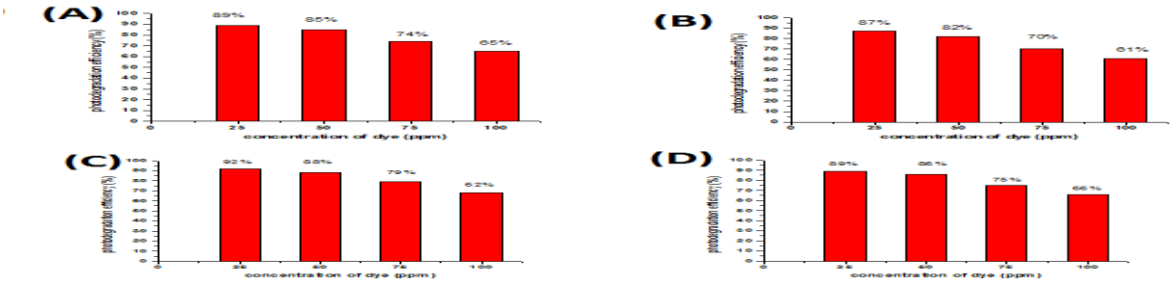
In recent years, the development of nanoscience and nanotechnology has shown remarkable potential for the remediation of environmental problems. Low dimensional nanostructured materials are of great interest due to their unique physical and chemical properties. These materials are considered as a bridge between the bulk and atomic or molecular structures. The size dependent properties of nanomaterials make them interesting and technologically important. Quantum confinement in semiconductor particles and characteristic surface plasmon resonance (SPR) in certain metal particles are some examples of size dependent properties. Compared with traditional materials, nanostructure photocatalysts have exhibited much higher efficiency and faster rates in water treatment.

This study focuses on the synthesis and characterization of ZnO ,Mn_2O_3, polyindole based nanocomposites of ZnO and Mn_2O_3. The material has been synthesized by co precipitation method, chemical oxidation method and characterized by chemical as well as instrumentals techniques. The photocatalytic activity of the material towards malachite green and congo red

dyes has been studied and confirmed using UV Vis spectrometer. The chemical resistivity of the material has been assessed in various media like acids, bases and organic solvents.

Nano ZnO obtained as pure white fine powder.Where as Mn_2O_3 was brown in colour. The poly indole was obtained as a white fine powder while the composites polyindole-ZnO and polyindole- Mn_2O_3 were brown and light green powders respectively.

All the samples of zinc oxide, manganese oxide, polyindole, polyindole-ZnO and polyindole-Mn_2O_3 nano composites were characterized using and X-ray diffraction (XRD) spectroscopy, scanning electron microscope (SEM) and Fourier transform infrared spectroscopy (FTIR). UV spectrum gives information about excitonic or inter band transition of nanomaterials. Various factors affecting photocatalytic degradation like effect of contact time,pH, amount of photocatalyst and dye concentration were investigated in two dyes namely malachite green and congo red. Figure illustrate effect of initial concentration on degradation of malachite green(MG)



Effect of initial dye concentration on the degradation of MG on (A)ZnO, (B)Mn_2O_3,(C)polyindole-ZnO (D) polyindole-Mn_2O_3

In the case of polymer composites, high degradation efficiency was observed due to the existence of the interface between polymer and metal oxides, separated electrons and holes have little opportunity to recombine again. This ensures higher charge separation efficiency and improved photo-oxidation capacity for the nanocomposites. In addition, the polymer can also absorb the UV light and generate an electron (e−) that transfers to the conduction band of metal oxide . The amount of $OH^{\bullet}$ and $O_2^{\bullet-}$ formed in the case of polymer composites is more than that formed in metal oxides. Moreover, the dye molecules can transfer from solution to the catalyst's surface and get adsorbed with an offset face-to-face orientation via π-π conjugation between dyes and aromatic regions of the polymer, and therefore, the absorptivity of dyes on polymer increases compared to metal oxides. The above study thus establishes the applicability of polymer- metal

oxide nano composites for the treatment of industrial effluents containing pollutants like organic dyes.