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Synthesis and characterization of conducting polymer based nanocomposite and their photocatalytic activity for degradation of methylene blue dye

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Presently, one of the most essential issues in pollution control from an environmental and biological point of view is the removal of toxic chemicals from waste water. Photocatalysis has appeared as one of the most promising techniques amongst the wide variety of approaches to degrade menacing waste materials, specifically organic compounds, to less noxious or less harmful materials. Recently, conducting polymers with extend π-conjugated electron systems have been extensively explored for their electronic and optoelectronic properties as photocatalysts materials. The present investigation highlights the facile synthesis of Polyaniline (PANI) based nanocomposites doped with metal oxide nanoparticles such as Co_3O_4, $SrTiO_3$ etc. via *in-situ* oxidative polymerization technique using ammonium persulfate (APS) as an oxidant in acidic medium for the photocatalytic degradation of methylene blue dye. Field Emission Scanning Electron Microscopy (FESEM), Transmission Electron Microscopy (TEM), Thermogravimetric Analysis (TGA), X-ray diffraction (XRD), UV-vis spectroscopy, BET and Fourier Transform Infrared Spectroscopy (FTIR) measurements were used to characterize the prepared nanocomposite photocatalysts. The photocatalytic efficiencies of the photocatalysts were examined by degrading Methylene Blue (MB) under UV light and visible-light irradiation. The results showed that the degradation efficiency of the composite photocatalysts that were doped with metal oxide nanoparticles were higher than that of the undopedpolyaniline. In summary, the studies demonstrate the facile and distinctive route to synthesize metal oxide doped polyaniline nanocomposite with large specific surface area, uniform nanopore distribution, and good photocatalytic performance, through an *in situ* oxidative polymerisation procedure. Metal oxide nanoparticles doped into the matrix of PANI homopolymer demonstrated enhanced photocatalytic activity indicating the synergistic phenomenon between the conducting polymer and the semiconducting metal oxides. The proposed technique may be used for the synthesis of numerous nanocomposites materials, with other conducting polymers addressing the present day issues of environmental pollution caused by various organic pollutants.

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Development of a novel antimicrobial essential oil based natural hydrogel wound dressing

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Wound dressing can be developed from traditional passive materials that focused on moisture management and active ingredients delivery in the local wound environment. In this work, new biomaterial wound dressings was developed based on gelatin containing herbal substances (essential oil), a substance from the plant *Eupatorium adenophorum* Spreng (Crofton weed) that used as traditional wound healers. The *E. adenophorum* essential oil was first identified the chemical composition by using GC-MS analysis. The principal components of the oil were p-cymene (16.23%), bornyl acetate (11.84%), amorpha-4, 7(11)-diene (10.51%). The hydrogel wound dressing containing essential oil was then characterized for their antibacterial activity against Gram-positive and Gram-negative in order to elucidate their potential for use as antibacterial wound dressings by using agar disk diffusion methods. The result showed that *E. adenophorum* essential oil and the essential oil-loaded gelatin hydrogel inhibited the growth of the test pathogens, *Staphylococcus aureus* and *Staphylococcus epidermidis* and increased with increasing the initial amount of essential oil in the hydrogels which confirmed their application as antibacterial wound dressings. The physical properties such as gel fraction, swelling and weight loss behavior, water vapor transmission rate (WVTR), release characteristics and tensile strength were investigated to evaluate the usefulness of hydrogel to wound dressing. Furthermore, the potential use of these wound dressings was further assessed in terms of the indirect cytotoxicity, *in vitro* attachment and proliferation of dermal human fibroblasts cultured in the hydrogel wound dressings.

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