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Green waste immobilized Ag/Cu feather like Bi-matrix on garment dye decomposes and their bio-efficacy

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ABSTRACT

This paper describes a simple phyto-remediation of feather-like silver/copper bi-matrix (BMs) was constructed by employing *pommagrant waste peel* (PWP) extract as crucial role of reducing agent and chelating agents. Numerous strategies, including UV–Visible, XRD, SEM-EDX, and TEM and BET isotherm were used to analysis the optical, structural, surface area and functional properties. Ag/Cu BPNMs of TEM characterization shows feather-like architectural features with constrained size and shape. The Ag/Cu co-catalytic nanoparticles have a particle size of 34–64 nm. The photocatalytic efficiency of Ag/Cu BMs was investigated using a garment dye, Congo red (CR), at successive time intervals under halogen lamp exposure. For Ag/Cu bimetallic nanoparticles, the photocatalytic degradation rate was recorded to be 100% after 40 min which is caused by adsorption of Congo red dye molecules on Ag/Cu and their degradation by reactive oxygen species (ROS). ROS are free hydroxyl radicals such as $^{\bullet}OH$ and $O_2^{\bullet}$ ions that have high oxidizing capacity. The developed Ag/Cu BMs shown effective bacteriostatic action against many infections.

1. Introduction

Recently, the environmental pollution caused by various organic dyes and pigments are led to the frontier challenges for the researchers. It is estimated that about 15% of the world total production of the dyes are lost in the textile effluent during dyeing processes (Wendler et al., 2017). Hence, there is an increasing global awareness concerning the crisis to find an efficient wayside., photo catalytic degradation, which has attracted significantly to sort out these environmental issues, since which provides us the greener approach (Umrao et al., 2014; Liu et al., 2011).

Heterogeneous photocatalysis is considered an emerging destructive technology that leads to the total mineralization of diverse organic contaminants, in which the degradation of the contaminating compound dissolved in water occurs by the action of semiconductor materials irradiated by light, mainly ultraviolet. Some of the most used photocatalyst metallic semiconductor materials are TiO_2, ZnO, SnO_2, ZrO_2, V_2O_5, WO_3, CeO_2, and g-C_3N_4, as well as several mixtures of these have been studied. However, highly dispersed noble metal nanoparticles are also common to achieve high performance for photo catalytic degradation of organic dyes and pigments (Zhang et al., 2016; Chauhan et al., 2011; Nisha et al., 2015). It is mainly due to the surface plasmonic effect of noble metal nanoparticles. As opposed to simple metallic nanoparticles, different metals nanoparticles in today's society possess special electrical, photonic, as well as catalytic capabilities.

Despite the fact that there has a substantial amount of research performed on the construction of precious metallic combinations, there seem to be relatively few investigations on bimetallic copper particles, notably when combined to silver (Rodrigues et al., 2019; Khan et al., 2017). Bimetallic nanoparticles are composed of two different metal elements. Their major advantage over monometallic nanoparticles is the improvement in catalytic properties since bi-metallization improves the original single-metal catalyst's properties and creates a new property.

Ag and Cu have crystalline phase of 0.409 and 0.361 nm,

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