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Ni doped WO_3 nanoplates: an excellent photocatalyst and novel nanomaterial for enhanced anticancer activities

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Abstract

We report on the effects of Ni doping on the structural, optical, photocatalytic and anticancer activities of WO_3. The chemical co-precipitation method was used to synthesize the undoped and Ni doped WO_3 nanoplates. The Ni ions doping into WO_3 was verified by XRD, EDX, FTIR and Raman spectroscopy. The substitution of Ni^{2+} ions on the sites of W^{6+} ions was confirmed through X-ray photoelectron spectroscopy (XPS) analysis. The diffusion reflectance spectroscopy revealed the narrow optical band gap in the visible region for undoped sample, this further reduced upon Ni doping. Photoluminescence spectroscopy was used to depict the defect in undoped and doped WO_3 nanoplates. Most importantly, the mineralization degree of organic dye using Ni doped WO_3 photocatalyst was determined by total organic carbon analysis (TOC), reaching percentages of mineralization up to 96 % of methyl red in just 2 hour under illumination of visible light. Interestingly, it was also observed that the percent cells viability of human breast (MCF-7) and liver (Hep-2) cancers cells were decreased remarkably up to 30% and 35% respectively with 5% Ni ions doping.

Keywords: Nanoplates; Raman; PL; XPS; Methyl red; Cancer

1. Introduction

Environmental pollution is emerging as a serious health care problem in the developed and under developed nations. The large amounts of industrial waste including organic textile dyes and acids