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ARTICLE

Synthesis of immobilised Ni-doped TiO_2 nanoparticles through hydrothermal route and their efficiency evaluation in photodegradation of formaldehyde

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ABSTRACT

The aim of the present study was to synthesis Ni-doped TiO_2 nanoparticles (NPs) in order to evaluate their effectiveness in photocatalytic degradation of formaldehyde in the aqueous phase. The Ni-doped TiO_2 NPs were synthesised using a mild hydrothermal method. They were then immobilized on glass plates by the calcination method. Characterisation of Ni-doped TiO_2 NPs was also carried out using scanning electron microscopy (SEM) and X-ray diffraction (XRD) analyses. The SEM images showed the uniform distribution of as-synthesised NPs on the surface of glass plates, with multidimensional crystalline structures. The results indicated that increasing the dopant weight ratio to 0.7% enhanced the photocatalytic degradation efficiency of formaldehyde; however, a further increase in the dopant weight ratio reduced the process efficacy. According to the results, increasing the initial pH from acidic and neutral to alkaline conditions decreased the efficacy of the process. Furthermore, the results showed that increasing the amount of nanocatalyst and decreasing the initial concentration of formaldehyde favoured the photocatalytic degradation of formaldehyde.

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Formaldehyde; photocatalytic degradation; nanoparticles; doping; immobilization

1. Introduction

Formaldehyde is a toxic compound, which can be easily discharged into aquatic, aerial, and soil environments through various industrial activities[1]. Therefore, the presence of this pollutant in industrial effluents is inevitable [2]. Various industries, including petrochemicals, synthetic adhesives, weaving, paper, paint, and resin, discharge formaldehyde into water resources [3,4]. In addition, hospital wastewater is one of the main sources of formaldehyde discharge owing to the high concentration of formaldehyde used to maintain biological tissues [2].

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