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Optimization of photocatalytic degradation of β-naphthol using nano TiO_2-activated carbon composite

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ABSTRACT

β-naphthol is a highly toxic compound and up to now, various approaches were proposed to remove it. However, these methods indicate low removal efficiencies since these materials are difficult to degrad. Hence, this research aims to synthesize TiO_2 nanoparticles with maximum photocatalytic properties suitable for application in the *β*-naphthol wastewater treatment. For this purpose, firstly, two types of titanium nanoparticles in the crystalline forms of anatase and rutile were synthesized. Here, anatase crystals indicated superior photocatalytic properties, as compared to the rutile crystals. The hypothesis behind this work is that using a biphasic mixture of the rutile and the anatase may enhance the photocatalytic properties of the anatase. Then these synthesized nanoparticles were stabilized on activated carbon (AC) using the microwave thermal stabilization. Next, characterization of these nanoparticles was performed using the X-ray diffraction and scanning electron microscopy techniques. The results indicated when having the ratio of 4:1 anatase to rutile, this nano-TiO_2 stabilized on AC indicate the maximum catalytic activity in *β*-naphthol degradation. In addition, at pH 11, catalyst content of 8 g/L, and aeration of 0.36 m^3/h, the maximum *β*-naphthol removal was observed. The complete removal of *β*-naphthol from the initial solution occurred in a duration shorter than 90 min using the initial concentration of $C_0 = 3 \times 10^{-4}$ mol/L.

Keywords: Photocatalyst; Nano-TiO_2; Photocatalytic degradation; Beta-naphthol; Activated carbon

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