

عنوان مقاله:

Copper Nanoparticles on Graphitic Carbon Nitride as an Efficient Catalyst for Reduction of Nitroaromatics

محل انتشار:

نهمین سمینار ملی شیمی و محیط زیست ایران (سال: 1398)

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خلاصه مقاله:

Nitroaromatic compounds are subject of many industries in the fields of pharmaceuticals, pigments, dyes, plastics and pesticides. However, these compounds have the harmful effects such as toxicity, mutagenesis and carcinogenesis [1]. Catalytic reduction of nitroaromatic compounds is an effective and ecofriendly method for the treatment of these organic pollutants. On the other hand, the reduction products (their related amines) are important intermediates in the synthesis of pharmaceuticals, agrochemicals and dyes [2]. In the present study, graphitic carbon nitride sheets containing copper nanoparticles (C3N4/Cu) was prepared as an efficient nanocatalyst for reduction of the nitroaromatics via a simple method by using inexpensive precursors. The catalyst was characterized by scanning electron microscopy (SEM), EDX-mapping analysis, X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FT-IR). The catalytic activity of C3N4/Cu catalyst was investigated for reducing of some nitroaromatic compounds in excess NaBH₄ as the reducing agent in aqueous media at room temperature. The process of this reaction was monitored by using the UV-Vis spectroscopy and high performance liquid chromatography. The catalytic efficiency of C3N4/Cu on the reduction of 2-nitrophenol, 4-nitrophenol, 2-nitroaniline and 4-nitroaniline by using NaBH₄ was investigated. NaBH₄ and C3N4 have very little effects on the reduction of the nitroaromatics even after 30 min. When NaBH₄ was used in the presence of C3N4/Cu, a tremendous reaction rates for the reductions were observed. The reduction of nitroaromatic compounds by C3N4/Cu followed the pseudo-first-order kinetics. The rate constants were found to be 1.09×10^{-2} , 1.30×10^{-3} , 4.60×10^{-3} and 1.04×10^{-3} s⁻¹ for the catalytic reduction of 4-nitrophenol, 2-nitrophenol, 4-nitroaniline and 2-nitroaniline, respectively. As well, reduction of 1, 2-dinitrobenzene and 1, 4-dinitrobenzene were followed by the system. The results showed that reduction of the compounds to their diamine derivatives is performed in a fast manner.

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