

Accepted Manuscript

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PII: S0021-9797(16)30184-9

DOI: <http://dx.doi.org/10.1016/j.jcis.2016.03.042>

Reference: YJCIS 21166

To appear in: *Journal of Colloid and Interface Science*

Received Date: 30 January 2016

Revised Date: 17 March 2016

Accepted Date: 18 March 2016

Please cite this article as: S.S. Momeni, M. Nasrollahzadeh, A. Rustaiyan, Green synthesis of the Cu/ZnO nanoparticles mediated by *Euphorbia prolifera* leaf extract and investigation of their catalytic activity, *Journal of Colloid and Interface Science* (2016), doi: <http://dx.doi.org/10.1016/j.jcis.2016.03.042>

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Green synthesis of the Cu/ZnO nanoparticles mediated by *Euphorbia proliifera* leaf extract and investigation of their catalytic activity

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ABSTRACT

A green synthesis process was developed for the preparation of the Cu/ZnO nanoparticles (NPs) using *Euphorbia proliifera* leaf extract as a mild, renewable and non-toxic reducing agent and efficient stabilizer without using dangerous, hazardous and toxic materials. The approach of biosynthesis appears to be cost efficient eco-friendly and easy alternative to conventional methods of Cu/ZnO NPs synthesis. The Cu/ZnO NPs were characterized by FESEM, EDS, elemental mapping, TEM and XRD. TEM micrograph has shown the formation of Cu NPs with the size in the range of 5-17 nm. In addition, the synthesized Cu/ZnO NPs presented excellent catalytic activity for the degradation of Methylene blue (MB) and Congo red (CR) in the presence of NaBH₄ in water at room temperature.

Keywords: Cu/ZnO NPs, NaBH₄; *Euphorbia proliifera*; Methylene blue; Congo red

1. Introduction

The degradation of toxic, dangerous and hazardous organic dyes in waste waters has always been a center attention of chemists during the past few years. Due to their chemically and biologically stable, it is difficult to remove dyes by natural degradation processes [1,2]. Therefore, the degradation of organic dyes acquires great importance both environmentally and industrially.

Usually degradation of organic dyes is carried out using metal nanoparticles (MNPs) [3,4]. However, their agglomeration is inevitable [6-8]. In recent years, various supports such as Fe₃O₄ [9], TiO₂ [10,11],

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