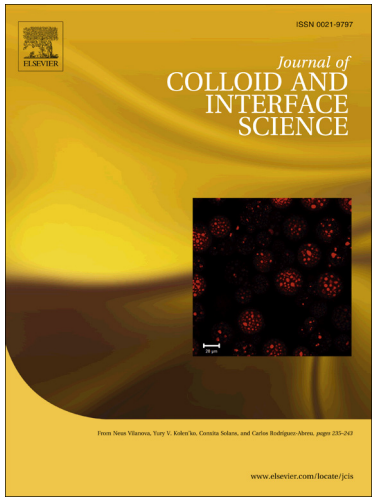

Regular Article

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Bahar Khodadadi, Maryam Bordbar, Mahmoud Nasrollahzadeh

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Achillea millefolium L. extract mediated green synthesis of waste peach kernel shell supported silver nanoparticles: Application of the nanoparticles for catalytic reduction of a variety of dyes in water

Bahar Khodadadi[a,b]*, Maryam Bordbar[a,b] and Mahmoud Nasrollahzadeh[a,b]

[a]*Department of Chemistry, Faculty of Science, University of Qom, PO Box 37185-359, Qom, Iran. E-mail: bkhodadadi98@yahoo.com; Fax: +98 25 32103595; Tel: +98 25 32850953*

[b]*Center of Environmental Researches, University of Qom, Qom, Iran*

ABSTRACT

In this paper, silver nanoparticles (Ag NPs) are synthesized using *Achillea millefolium* L. extract as reducing and stabilizing agents and peach kernel shell as an environmentally benign support. FT-IR spectroscopy, UV-Vis spectroscopy, X-ray Diffraction (XRD), Field emission scanning electron microscopy (FESEM), Energy Dispersive X-ray Spectroscopy (EDS), Thermo gravimetric-differential thermal analysis (TG-DTA) and Transmission Electron Microscopy (TEM) were used to characterize peach kernel shell, Ag NPs, and Ag NPs/peach kernel shell. The catalytic activity of the Ag NPs/peach kernel shell was investigated for the reduction of 4-nitrophenol (4-NP), Methyl Orange (MO), and Methylene Blue (MB) at room temperature. Ag NPs/peach kernel shell was found to be a highly active catalyst. In addition, Ag NPs/peach kernel shell can be recovered and reused several times with no significant loss of its catalytic activity.

Keywords: Peach kernel shell; Ag NPs; *Achillea millefolium* L.; $NaBH_4$; Organic dyes

1. Introduction

Over the past few years, the field of nanotechnology has been an important area of research in modern material science [1,2]. It is well known that, metal nanoparticles (MNPs) have received a great deal of attention owing to their unique physical, chemical, optical and thermodynamic properties [3-7].

Since organic dyes and 4-nitrophenol (4-NP) are widely used in various industries, the release of these toxic, bio-refractory, chemically stable and carcinogenic pollutants into the waste water has become one of the major sources of water pollution in the environment [7-10]. Traditional methods such as adsorption and chemical coagulation, which are two common techniques of treatment of waste water, merely transfer pollutants from the liquid to the solid phase. This may cause secondary pollution and require further treatment [11]. Therefore, researchers have mainly focused on reduction, decolorization or detoxification of these compounds. Recently,