ISBN : 978-81-961555-9-9

ADVANCED NANORESEARCH AND APPLICATIONS

Dr. Ram H. Kadam

ISBN: 978-81-961555-9-9

National Conference on

Advanced Nano Research and Applications

(An Edited Book)

INDEX

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Advanced Nano Research and Applications
(An Edited Book)
ISBN: 978-81-961555-9-9

Green Synthesis, Characterization of Iron Oxide Nanoparticles Using Azadirachta Indica Aqueous Leaf Extract

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ABSTRACT

Green chemistry has significant role in improving and protecting the global environment and they are even competent over other conventional methods. In the present research work was focused on the synthesis of iron oxide nanoparticles using Azadirachta indica leaf extract as a plant resource. This method has been proven cost effective, simple, economical, eco-friendly and non-hazardous. On treatment of aqueous solutions of ferrous and ferric salts in alkaline medium with Azadirachta indica leaf extract, the rapid formation of stable iron oxide nanoparticles or also known as magnetite nanoparticles is observed to occur. In contrast to previously reported co-precipitation approaches, our synthesis method had utilized a much cheaper and less toxic iron precursor with environmental- ly benign and non-toxic Azadirachta indica leaf extract was used as a reducing and stabilizing agent. It was found that the presence of various biomolecules such as flavonoids and terpenoids of the aqueous leaf extract plays a major role for the formation of Fe_3O_4-NPs through infrared spectra analysis. The formation was further confirmed with strong characteristic peak observed at 249 nm for Fe_3O_4-NPs through UV-Vis spectroscopy. Besides, the shape was mostly spherical and oval. X-Ray Diffraction (XRD) analysis revealed the purity of synthesized Fe3O4-NPs with crystalline cubic structure phase. Transmission Electron Microscopy (TEM) results illustrated that the size and diameter was in the range from 9-14 nm which agrees with calculated Scherrer equation with average diameter of around 11 nm. Vibrating Sample Magnetometer (VSM) analysis indicated that the samples exhibit superparamagnetic with magnetization value was 82 emu/g. Results confirmed this protocol as a simple, rapid, one-step, eco-friendly, non-toxic and hence can be potentially used in various biomedical applications such as magnetic targeting drug delivery system

Keywords: Azadirachta indica, Eco-friendly, Iron oxide nanoparticles, Magnetite, Non-toxic.

INTRODUCTION

"Nano" is derived from the Greek word for dwarf. A environment friendly, easily scaled up for large scale nanometer is one billionth of a meter (109) and might be synthesis and in this method there is no need to use high represented by the length of ten hydrogen atoms lined up pressure, energy, temperature and toxic chemicals [9]. in a row [1] Nanotechnology implies the creation and Green synthesis offer better manipulation, control over utilization of materials, devices and systems through the crystal growth and their stabilization. This has motivated control of matter on the nanometer-length scale i.e. at the an upsurge in research on the synthetic routes that allows level of atoms, molecules and supramolecular structures better control of shape and size for various [2-4] Nanotechnology is mainly concerned with synthesis nanotechnological applications of nanoparticles of variable sizes, shapes, chemical. Here in the present work we have reported for the compositions and controlled dispersity and their potential first time the synthesis of green iron nanoparticles using use for human benefits. Although chemical and physical the leaf extract of the plant – (common name - Azadirachta indica (Neem) methods may successfully produce pure, well-defined Leaves). Aqueous Ferric Chloride solution, after reacting nanoparticles, these are quite expensive and potentially with Azadirachta indica (Neem) Leaves extract, led to rapid formation of highly dangerous to the environment. Use of biological stable, crystalline Iron nanoparticles. The rate of organisms such as microorganisms, plant extractor plant nanoparticle synthesis was very high, which justifies use biomass could be an alternative to chemical and physical of plants over microorganisms in the biosynthesis of methods for the production of nanoparticles in an ecometal nanoparticles through greener and safer methods. friendly manner [5-7]. Nanotechnology is a reliable and In the subsequent sections we have described the enabling