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Green Synthesis Of Nanoparticle Of Zinc And Treatment Of Nanobeads For Waste Water Of Alizarin Red Dye

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ABSTRACT:

The present study reports the synthesis of zinc nanoparticles, Zinc nanobeads. The nanoparticles synthesised were characterised by UV visible spectroscopy, colour change, pH change and particle size analysis. The nanoparticles synthesised were spherical and uniform in size with an average diameter of about 56. 8nm which was determined by dynamic light scattering method. The synthesised nanobeads were used efficiently for alizarin red degradation. In the present preliminarily investigatory study the nanobeads were applied for removal of alizarin red dye waste water.

Key words: Alizarin red, zeera powder, nanobeads, dye decolourisation.

INDRODUCTION

Various industries such as paper and pulp, tanneries, cosmetic, coffee pulping, pharmaceutical food processing, electroplating and dye manufacturing units, discharge coloured and toxic effluents to water. (1, 2) The untreated waste water containing coloured compounds which have complex structures are difficult to biodegrade. Some dyes used in the textile industries are toxic and carcinogenic, which present eco toxic hazard and introduce the potential danger of bioaccumulation and also affect humans through the food chain(3). The synthetic dyes cause severe environmental hazards which disturb water quality and causing allergic reactions and various types of poisoning (4). Various treatment methods have been employed for the removal of dyes from waste water such as coagulation, filtration, sedimentation, cation exchange membrane, electrochemical degradation advanced oxidative process and adsorption(5-8). Among these techniques adsorption has been found to be effective for higher adsorption capacity and low-cost. In the present study, Zinc nanobeads are employed for the removal of Alizarin red from aqueous solution.

The aim of the work is to synthesise the zinc nanoparticles from zeera and characterise the zinc nano particles by UV Visible spectroscopy, colour change, PH change and particle size. The synthesised nanoparticles were converted into immobilised nanobeads. These immobilised nanobeads were used for the decolourisation of alizarin red from aqueous solution.

METHODS AND MATERIALS

Green synthesis of nano particles of zinc

Selection of zinc nano particles for synthesis

Synthesis of zinc nanoparticles are considered because of their unique properties such as chemical stability, electrical conductivity, catalytic activity, anti bacterial, antiviral, antifungal in addition to anti inflammatory activities. The low cost, nontoxic, Zinc metal compounds belonging to transition metal series have been selected for the present study. The synthesised nanoparticles will have large surface area to volume ratio.

Selection of plant extract for synthesis of nano particle

Plants have potential to hyper accumulate and biologically reduce metal ions. Due to their environmental friendly nature and detoxification effects plant extracts were selected for synthesis of nanoparticles. Properties of the plants extract such as its concentration, metal salt concentration, reaction time, reaction solution pH, and temperature significantly influence the quality, size, and morphology of the synthesized nanoparticles. (9-12). In the present study the seed extract of cumin seeds belonging to the family of Apiacaer have been selected for the green synthesis of nanoparticle.

Seeds that were used are described as follows:
Bionomial Name: Cuminum Cyminum
Common Name: Jeera
Plantpart taken: Seed
Family Name: Apiacear.

Description:
cumin is extracted from fruit of cuminum cyminum (Jeera) after drying they are used. Cumin seeds have powerful antioxidant properties and they promote several health benefits.

Preparation of seed extract and zinc acetate as precursor:-

For the synthesis of Zinc nano particles 0. 001M zinc acetate was prepared by using Milli pore distilled water. The seed extract was prepared by 25gms of materials. The seeds were finely grinded by a using a grinder. The seed extract was collected and added to 50ml water and kept in micro wave oven to get a concentrated solution of plant extract. It is kept in refrigerator for further use. The plant extract was filtered by using what man filter paper and then it is used for further process.

The synthesis of nanoparticle process begins by mixing a sample of plant extract/seed

extract solution with a metal salt solution. Biochemical reduction of nanoparticle starts immediately and it is enhanced by placing the mixture of plant extract solution and metal ion solution in microwave oven.

Characterisation of nanoparticles

In the case biological synthesis of nanoparticles, the aqueous metal ion precursors from metal salts are reduced and as a result a colour change occurs in the reaction mixture. This is the first qualitative indication that nanoparticles are being formed. The nanoparticles are characterised by colour change, PH change, UV visible spectroscopy, dynamic light scattering technique.

Preparation of zinc Immobilized beads

Zinc Immobilized beads are prepared by using Sodim alginate and Calcium chloride. An aqueous solution of sodium alginate was prepared by adding 1gm of sodium alginate to 100 ml of distilled water and 0. 1M (1. 1gm/100ml) of aqueous calcium chloride was prepared. When the sodium alginate was added drop wise to the calcium chloride solution, spherical, green-colored calcium alginate beads were formed. Beads containing zinc nanoparticles were prepared. (amount of ZnNp is 5 mg/100ml of sodium alginate). Effect of zinc Immobilized beads for the removal of the dye was tested.

RESULTS AND DISCUSSIONS

UV-Visible spectroscopy refers to the absorption spectroscopy in the ultraviolet visible spectral region. It uses light in the visible region and adjacent near infrared (NIR) ranges. In this region of electromagnetic spectrum, molecules undergo electronic transitions nano particles have certain optical properties such as size, shape, concentration, agglomeration state and refractive index which can be identified by UV-visible spectrometer. Nano particles made from certain metals strongly interact with certain wavelength of light and their unique optical properties leads a phenomena known as surface Plasmon resonance. UV visible spectra of zinc nano particles is represented in the fig 1

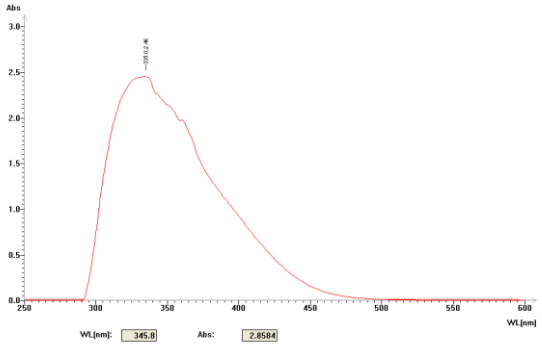


Figure 1

Colour change conformation in biosynthesis of Zinc nanoparticle

Biochemical reduction of the salts starts immediately but the reaction is slow. To enhance the reaction a slightly and to change the morphology of zinc nano particles microwaves are used. During this process of colour change the divalent oxidation states may be getting converted to the zerovalent states and nucleation of reduced metal atoms takes place(13).

pH ANALYSIS

PH Analysis:

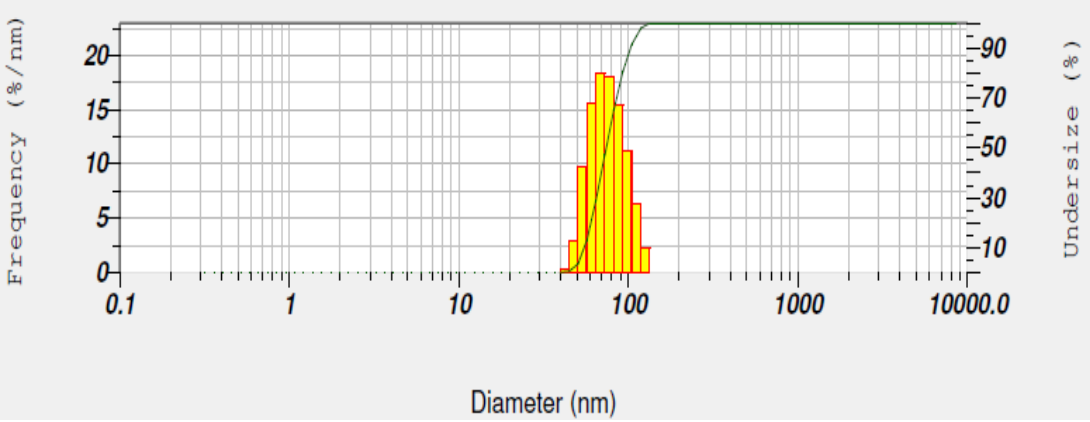
The PH was determined by using Systronics digital PH meter. The PH of the reduced solution was found to be acidic. After the reduction the PH of every sample was found to decrease and move towards the acidic range. The results are given in

Table 1: Variation of PH

S. NO	Molarity	PH (Before)	PH(after)	CHANGE
1.	0. 01	5	4. 6	Reduced
2.	0. 025	5	4. 8	Reduced
3.	0. 05	5	4. 9	Reduced
4.	0. 001	5	4. 4	Reduced

Particle size analysis

Particle size analysis was carried out for the sample which is lyophilised and dispersed by the ultrasonicator for the determination of size. The zinc nano particles were analysed by the dynamic light scattering method and by using the particle size analyser and it is found to be equal to 56. 3nm. In the above PSA analysis graph, X-axis indicates the particle diameter in nanometers left Y-axis indicates the cumulative particle size in percentage.



Application of Nano beads for colour removal of alizarin waste water in the Laboratory

The solution in the beaker A indicates the Alizarin red waste water. The solution in the beaker B indicates the nano beads after treatment with the Alizarin red waste water. The beaker C indicates the successful removal of colour of Alizarin red by nanobeads.

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