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Research Article

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Biogenic synthesis of copper nanoparticles using *Delonix elata* flower extract

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ABSTRACT

Biogenic synthesis of Copper nanoparticles using the Delonix elata flower extract was carried out as various literature resources revealed the importance of Delonix elata flower and Copper nanoparticles. Copper nanoparticles were prepared by adopting standard procedure. The formations of Copper nanoparticles from the Delonix elata flower extracts were identified first by observing the colour changes. The Delonix elata flower extract colour gets changed during the formation of Copper nanoparticles from dark brown to light green colour. Copper nanoparticles formed were characterized by UV, FT-IR, XRD and SEM. UV absorbance at 328nm for Copper nanoparticles. The IR spectrum of copper nanoparticles showed Cu –O stretching at 403cm-1 and proved by the diminished intensity of bonded OH(3200-3400cm-1) of the IR spectra of Delonix elata flower extract. XRD & SEM analysis of copper nanoparticles indicated that they exist in amorphous in nature and with size range 20µm.

Keywords: *Delonix elata* flower, Copper nanoparticles, FT-IR, XRD &SEM.

INTRODUCTION

Delonix elata commonly known as white gold mohur and family Leguminosae [1]; subfamily Caesalpiniaceae. Commonly known as ‘‘Sandesaro” in Gujarati[2]. Large red-orange in color having five petals, one petal contains also white color streaks and little bit big as compare to other petals, four spreading scarlet or orange-red petals up to 8 cm long having same size and colour, a fifth upright petal called the standard, which is slightly larger and spotted with yellow and white. Sepals 5, thick, green outside and reddish with yellow border within, reflexed when the flowers are open, pointed, finely hairy, about 2.5 cm long. Stamens 5 with 10 red filaments. Pistil has a hairy 1celled ovary about 1.3cm long. Style about 3 cm long [3-5]. The members of the genus are flowering trees, native to the East Africa, has been used in traditional Indian medicine for the treatment of rheumatism, stomach disorders [6]. The Delonix plant was reported to have antioxidant, anti-arthritic and anti-inflamatory activities[7]. Flavonoids, tannins, alkaloids, saponins, steroids, carotenoids(lycopene, phytoene, phtofluene, β-carotene, prolycopene, neolycopene, δ-lycopene and γ-lycopene)**,** phenolic acid (gallic acid, protocatehuic acid, salicylic acid, trans-cinnamic acid andchlorogenic acid)**,** anthocyanins (cyanidin-3-glucoside and cyanidin-3-gentiobioside and β-sitosterol were found to be present in the plant[7, 8-10].

EXPERIMENTAL SECTION

a)Materials

Delonix elata flower collected from theni district, Tamilnadu and distilled ethanol were used.

b) Methods Used

i) Preparation of the *Delonix elata* flower Extract

The *Delonix elata* flowers were washed several time with water to remove dust particles and then dried to remove the residual moisture. The ethanol extract of *Delonix elata* flower was prepared by placing 5g of washed dried fine grinded flowers powder in 250ml round bottom flask along with 200ml of ethanol. The mixture was then boiled for

4 hours. Then the extract was cooled to room temperature and filtered with Whatmann No.1 filter paper. The ethanol extract was used as a reducing agent for nanoparticle synthesis .The color of the extract was found to be dark brown (**Figure-1a**).

ii) Synthesis of copper nanoparticles using *Delonix elata* flower extract

10ml of *Delonix elata* flower extract was added to 90 ml of aqueous solution of 1mM copper sulphate for reduction to copper ions and kept at room temperature for one day. As a result a light green solution (**Figure-1b**) was formed indicating the formation of copper nanoparticles and it was further confirmed by UV-Visible and other spectral studies.

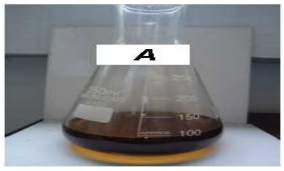

Figure -1a

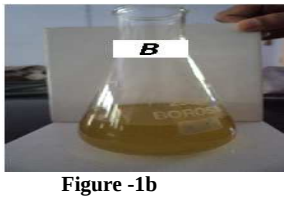

Figure -1b

Photographs showing a) Pure *Delonix elata* flower extract. b) Formation of copper nanoparticles.

iii)Separation of copper nanoparticles:

The synthesized copper nanoparticles were separated by means of centrifugation (Spectrofuge 7M) at 3000 rpm for 15 minutes. The pellets was redispersed and again centrifuged for 15 minutes.

Characterization of Copper Nanoparticles

Characterization of copper nanoparticles was first carried out using UV-Visible absorption spectrometer 2400PC with a resolution of 1nm between 200 and 800nm possessing a scanning speed of 200nm/min. Absorption spectra of copper nanoparticles formed in the reaction media was found have absorbance in the range 320-340nm as given in **Figure-2.**

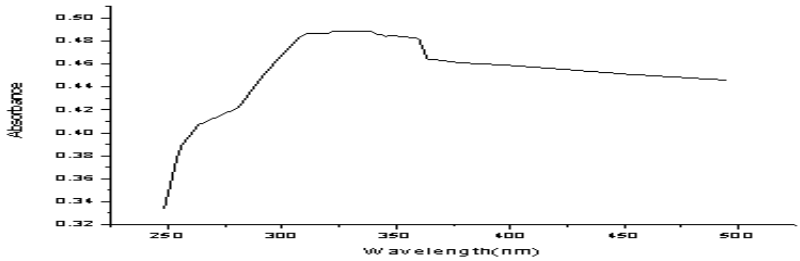

Figure -2 UV- Visible Spectra of copper nanoparticles

FTIR

The characterization of functional groups on the surface of copper nanoprticles by flower extracts were investigated by FT-IR measurements on a IRTRACER-100 Model Instrument and the spectra was scanned in the range of 370-4000 $cm^{-1.}$ FTIR spectrum of Cu nanoparticles (**Figure-3)** suggested that Cu nanoparticles binds with oxygen present in the phytoconstituent and were surrounded by different organic molecules such as alcohols, ketones, aldehydes and carboxylic acid.

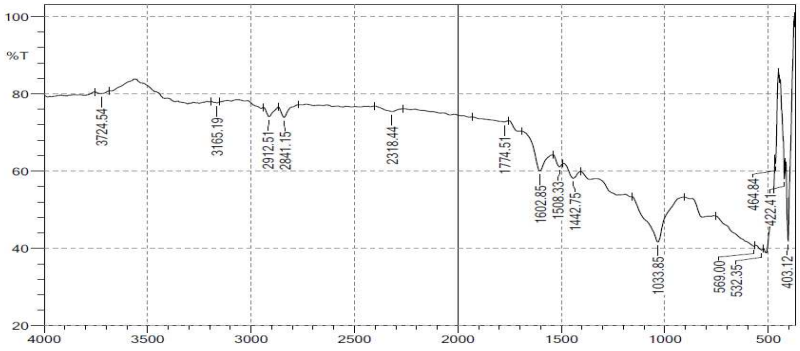

Figure -3 FT-IR Spectrum of copper nanoparticles

X-Ray Diffraction

The particle size and nature of the copper nanoparticles were determined using Bruker Eco D8 Advance X-pert PRO operating at a voltage of 40kV, a current of 20mA with copper Kα radiation at 2θ angle ranging from 10^0 to 80^0 .The XRD of copper nanoparticle was given in **Figure-4.**

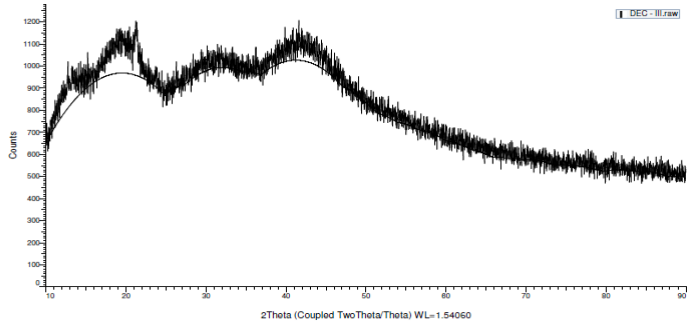

Figure -4 XRD spectrum of copper nanoparticles

SEM

Each sample for SEM examination was initially deposited onto a thin mica strip using a glass pipette; the mica strip was attached to a SEM using carbon tape. The samples were then dried under vacuum overnight. The following day, all the samples were sputter coated with a 2nm layer. The pellet was subjected for SEM analysis. Thin films of the sample were prepared on a carbon coated copper grid by just dropping a very small amount of the sample on the grid, extra solution was removed using a blotting paper and then the film on the SEM grid were allowed to dry for analysis. The SEM image of *Delonix elata* flower stabilized copper nanoparticles was given in **Figure-5.** From the image, it was revealed that nanoparticles were of in cluster.

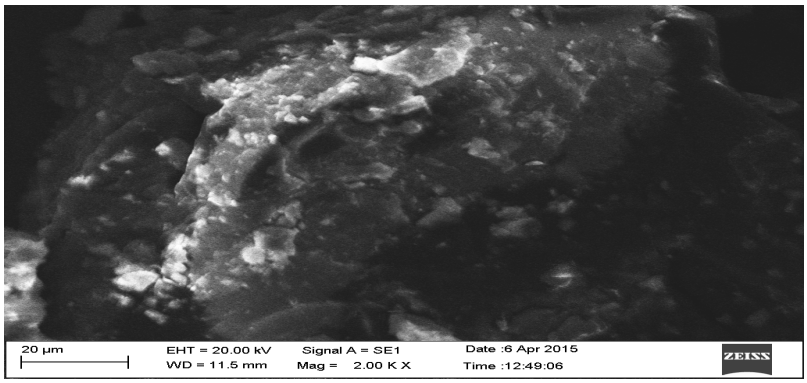

Figure -5 XRD spectrum of copper nanoparticles

RESULTS AND DISSCUSSION

The formation of copper nanoparticles using ethanol extract *Delonix elata* flower can be observed by the change in the color of the extract from dark brown to light green after one day. The diminished in the intensity of brown color to light green was due to the excitation of surface plasmon vibrations of copper nanoparticles.

i)UV-Visible Spectroscopy

The reduction of pure copper ions was monitored by measuring the UV-Visible spectrum Absorption spectra of copper nanoparticles formed in the reaction media have absorbance peak at 328nm.

ii) FTIR Specctral studies

The IR spectrum of copper nanoparticles showed Cu –O stretching at $403cm^{-1}$ and also proved by the diminished intensity of bonded OH(3200-3400cm-1) of the IR spectra of *Delonix elata* flower extract as given in **Figure-6** .

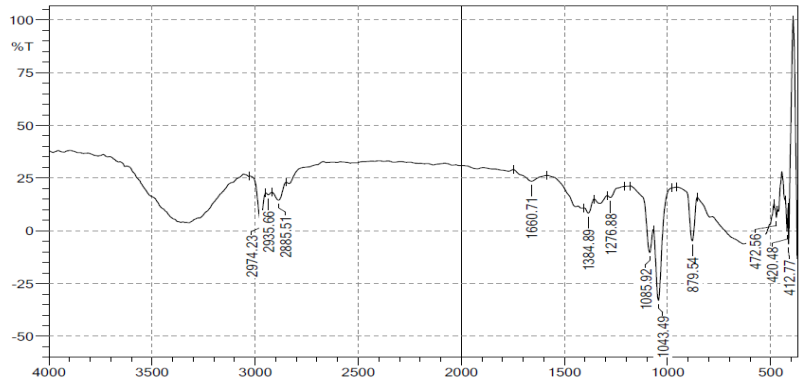

Figure -6 FT-IR Spectrum of *Delonix elata* flower extract

ii) X-Ray Diffraction

The XRD pattern showed that copper naonparticles were found to be amorphous in nature.

iv) SEM

The SEM image of *Delonix elata* flowers extract stabilized copper nanoparticles prepared from copper sulphate as given in **Figure-5** showed that the copper nanoparticles were found to be clustered. The surfaces of the aggregates was found to have a particle size around 20µm.

CONCLUSION

Biogenic synthesis of copper nanoparticles using ethanol extract of *Delonix elata* flowers were performed by adopting standard procedure were characterized by UV–Vis, FT-IR ,XRD and SEM studies. The formation of copper nanoparticles were identified first by the colour changes of the *Delonix elata* flower extract from dark brown to light green colour. UV absorption studies of copper nanoparticles showed the absorbance peak at 328nm. The IR spectrum of copper nanoparticles showed Cu –O stretching at 403cm$^{-1.}$ This may also proved by the diminished intensity of bonded OH(3200-3400cm-1) of the IR spectra of *Delonix elata* flower extract. The SEM analysis of copper nanoparticles indicated that their sizes were in the range of 20µm.

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