GREEN SYNTHESIS OF COPPER NANOPARTICLES USING CASSIA FISTULA FLOWER EXTRACT

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(Received on Date: 5th May 2015 Date of Acceptance : 1st July 2015)

ABSTRACT

Knowing the importance of Cassia fistula flower and Copper nanoparticles as revealed by various literature resources, we planned to carry out green synthesis of Copper nanoparticles using the above extract. Copper nanoparticles were prepared by adopting standard procedure. The formations of Copper nanoparticles from the extracts was identified first by observing the colour changes. The colour of Cassia fistula flower extract changed during the formation of Copper nanoparticles from dark brown to light brown colour . Copper nanoparticle formed were characterized by UV, FT-IR, XRD and SEM. UV absorbance at 239nm for Copper nanoparticles derived from the above flower extract. The IR stretching frequency for copper nanoparticles (Cu –O) at 403cm-1 and also proved by the diminished intensity of bonded OH strecting frequency (3200-3500cm-1) of the Cassia fistula flower extract compared to its assisted copper nanoparticles. XRD & SEM analysis of copper nanoparticles indicated that they exist in amorphous nature and the size of the particle lies in the range of 20µm.

Keywords: Cassia fistula flower, Copper nanoparticles, FT-IR, XRD &SEM.

No. of figures: *5* **No. of References: 19**

INTRODUCTION

Cassia fistula is medium-sized, deciduous tree which is now widely cultivated worldwide as an ornamental tree for its beautiful showy yellow flowers. Cassia fistula known as golden shower belongs to the family Leguminosae [1]. The extract of the flower inhibits the ovarian function and stimulate the uterine function in albino rats. Fruits are used in the treatment of diabetes, antipyretic, abortifacient, demulcent, lessens inflammation, chest complaints, throat troubles, liver complaints, diseases of eye [2,3].Cassia fistula plants contain a wide variety of natural antioxidants compounds such as phenolic acids, flavonoids, saponins, alkaloids, proteins aminoacids, anthraquinones, reducing sugars, carbohydrates and tannins, which possess more potent antioxidant activity [4].The Cassia fistula plant is widely used by tribal people to treat various ailments including ringworm and other fungal skin infections. It is used by Malaialis tribe in India to treat nasal infection [5]. In the Indian literature, Cassia fistula plant has been used against skin diseases, liver troubles, hypercholesterolaemia, tuberculous glands and for the treatment of haematemesis, leucoderm, diabetes and can also used as anti-inflammatory, hypoglycemic, antipyretic, analgesic, anti-ulcer and laxative agent [6-19].

EXPERIMENTAL METHODS

a) MATERIALS

Cassia fistula flower (collected from the College campus Sivakasi,virudhunagar district) and distilled ethanol were used for the preparation of ethanol extract.

b)METHODS

i) Preparation of the Cassia fistula flower Extract

The Cassia fistula flowers were washed several time with water to remove dust particles and then dried to remove the residual moisture. The Cassia fistula flower extract was used for reduction of copper sulphate and copper nanoparticles was prepared by placing 5g of dried fine powder of the Cassia fistula flowers in 250ml round bottom flask along with 200ml of ethanol. The mixture was then boiled for 4 hours and then cooled to room temperature and filtered with Whatmann No.1 filter paper to get an ethanol extract of Cassia fistula flowers. This was used as a reducing agent for copper nanoparticle synthesis by green method .This extract can be stored at room temperature for one week.

ii) Synthesis of copper nanoparticles from Cassia fistula flower extract

1mM aqueous solution of copper sulphate was prepared and used for synthesis copper nanoparticles.10ml of ethanol extract of Cassia fistula 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 1 week. The formation of copper nanoparticles were first identified by dimishedcolour of the extract(**Figure1a-dark brown)** to light brown(**Figure1b)**and it was further confirmed by analytical technique.

iii) Separation of copper nanoparticles

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

iv)Characterization of Copper Nano-particles

a) UV-Visible.

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 showed an absorbance peak at 239 nm (Figure-2).

b)FT-IR

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

c)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 Ka radiation at 2θ angle ranging from 10^0 to 80^0 . A thin film of the copper nanoparticle was made by dipping a glass plate in asolution and carried out for X-ray diffraction studies. The crystalline copper nanoparticle was calculated from the width of the XRD peaks and the average size of the nanoparticles can be estimated using the Debye Scherrer

$$D = k\lambda/\beta\cos\theta$$

XRD spectrum of copper nanoparticles indicated that they exist in amorphous nature (Figure 4).

d)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 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 Cassia fistula stabilized copper nanoparticles (**Figure-5)**revealed that nanoparticles were in cluster and the average particle sizes were found to be around 20µm

RESULT AND DISSCUSSION

The formation of copper nanoparticles(CuNps) using Cassia fistula flower extract can be observed first by the

color changes of Cassia fistula flower extract fromdark brown to light brown. The diminished intensity of dark brown color of the extract was due to the excitation of surface plasmon vibrations of copper nanoparticles during its formation.

UV-Visible Spectral analysis

UV-Visible Absorption spectra of copper nanoparticles formed in the reaction media have showed an absorbance peak at 239 nm indicated the formation of CuNps.

FTIR Specctral analysis

The IR spectrum of copper nanoparticles assisted by Cassia fistula flower showed Cu –O stretching and at 403cm^{-1} proved by the diminished intensity of bonded OH(3000-3500cm^{-1}) and carbonyl stretching frequencies at 1780cm^{-1}of the IR spectra of Cassia fistula flower extract.

X-Ray Diffraction

XRD studies revealed that CuNps exist in amorphous nature.

SEM Analysis

The SEM image of Cassia fistula stabilized copper nanoparticles indicated that the nanoparticles were clustered and theaggregateswere roughly around 20µm particle size.

CONCLUSION

Green synthesis of copper nanoparticles(CuNps) using cassia fistula flowers were performed by adopting standard procedure.. The formation of copper nanoparticles were first identified by the colour changes ofCassia fistula flower extract from dark brown to light brown.CuNps formed were characterized by UV–Visible, FT-IR ,XRD and SEM studies. UV absorption studies of copper nanoparticles showed that the absorbance peak at 239nm and the IR spectrum of copper nanoparticles showed the Cu –O stretching at 403cm^{-1}. this can also proved by the diminished intensity of bonded OH(3000-3500cm-1) and carbonyl stretching frequencies at 1780cm^{-1} of the IR spectra of Cassia fistula flower extract on comparing the IR spectra of flower extract and its assisted copper nano particles.The XRD and SEM analysis of these copper nano particles indicated that they exist in amorphous state and their sizes were in the range of 20µm.

Figures:

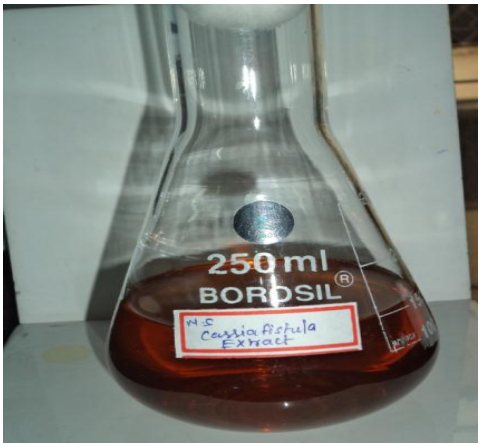

Figure-1a

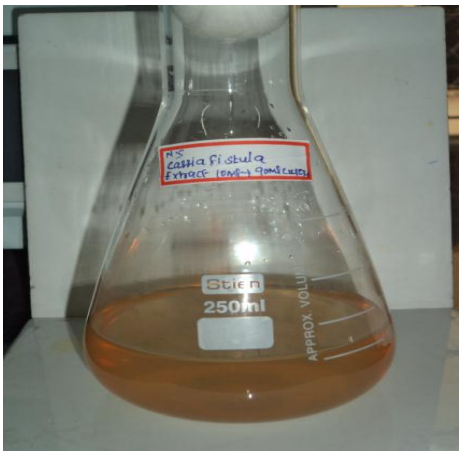

Figure-1b

Figure 1: Photographs showing
a) Pure Cassia fistula flower Extract
b) Formation of copper nano particles.

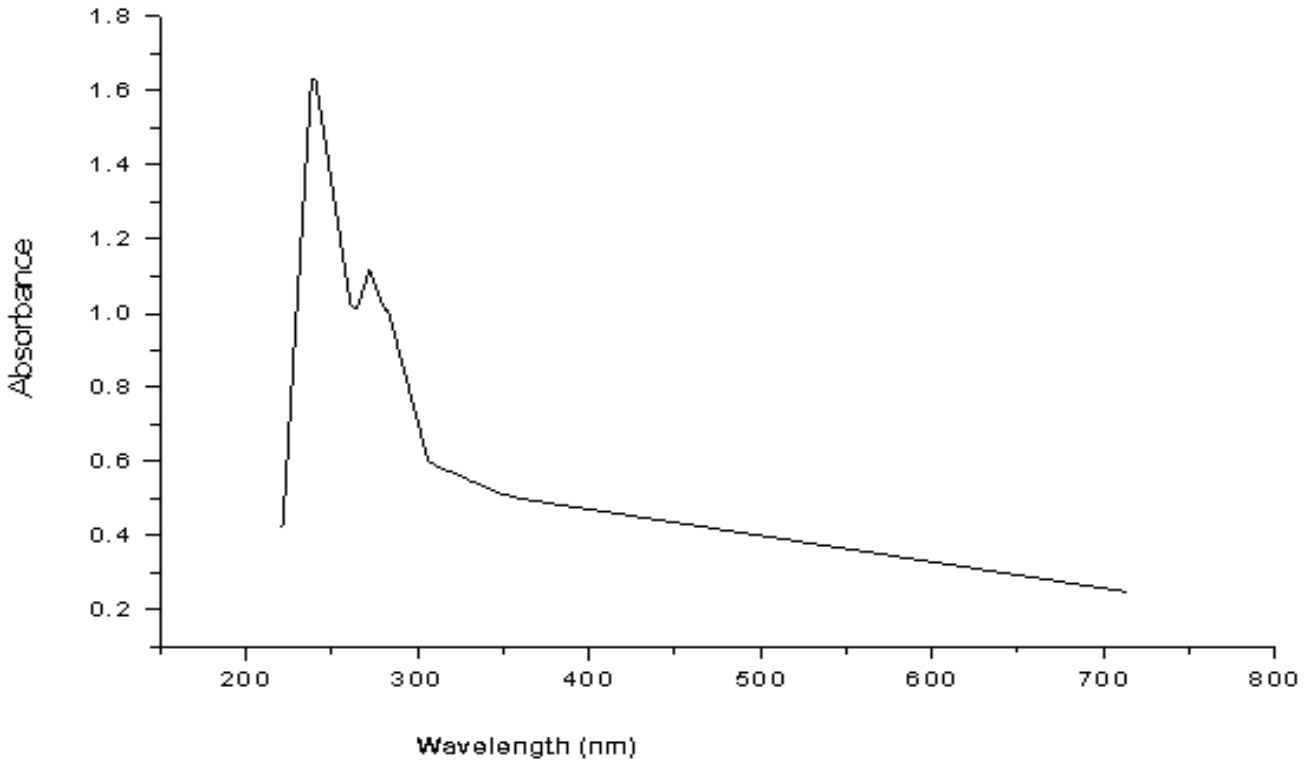

Figure 2:UV- Visible Spectra of copper nanoparticles

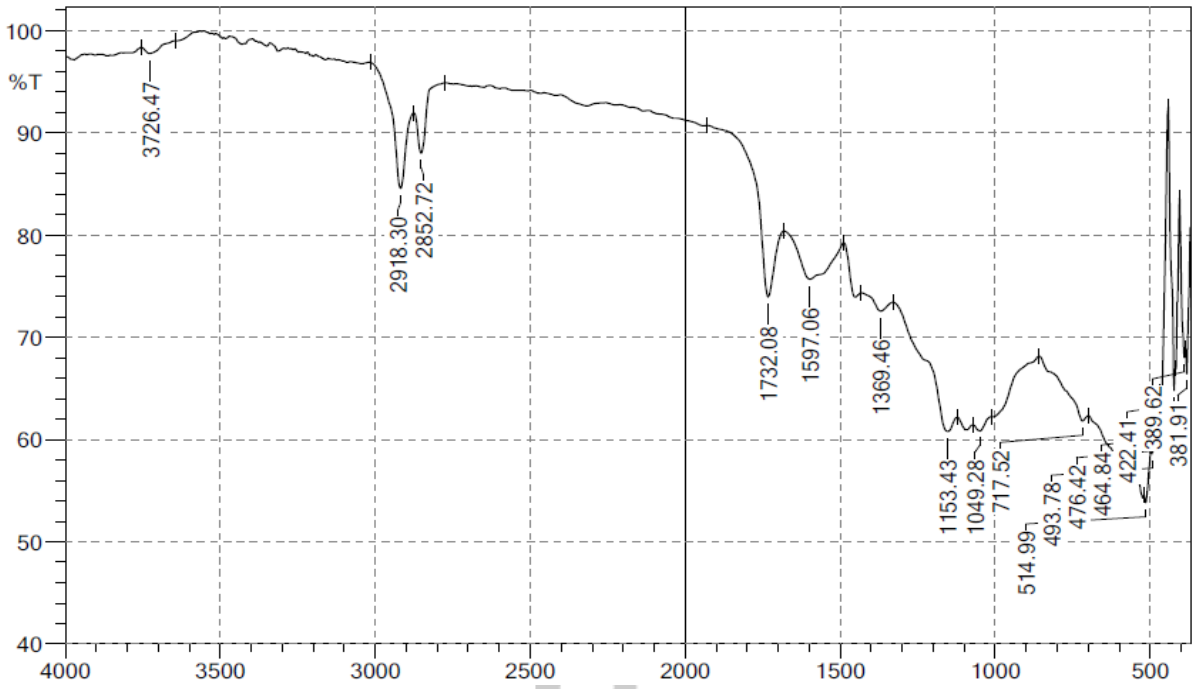

Figure 3:*FT – IR spectroscopy of copper nanoparticles*

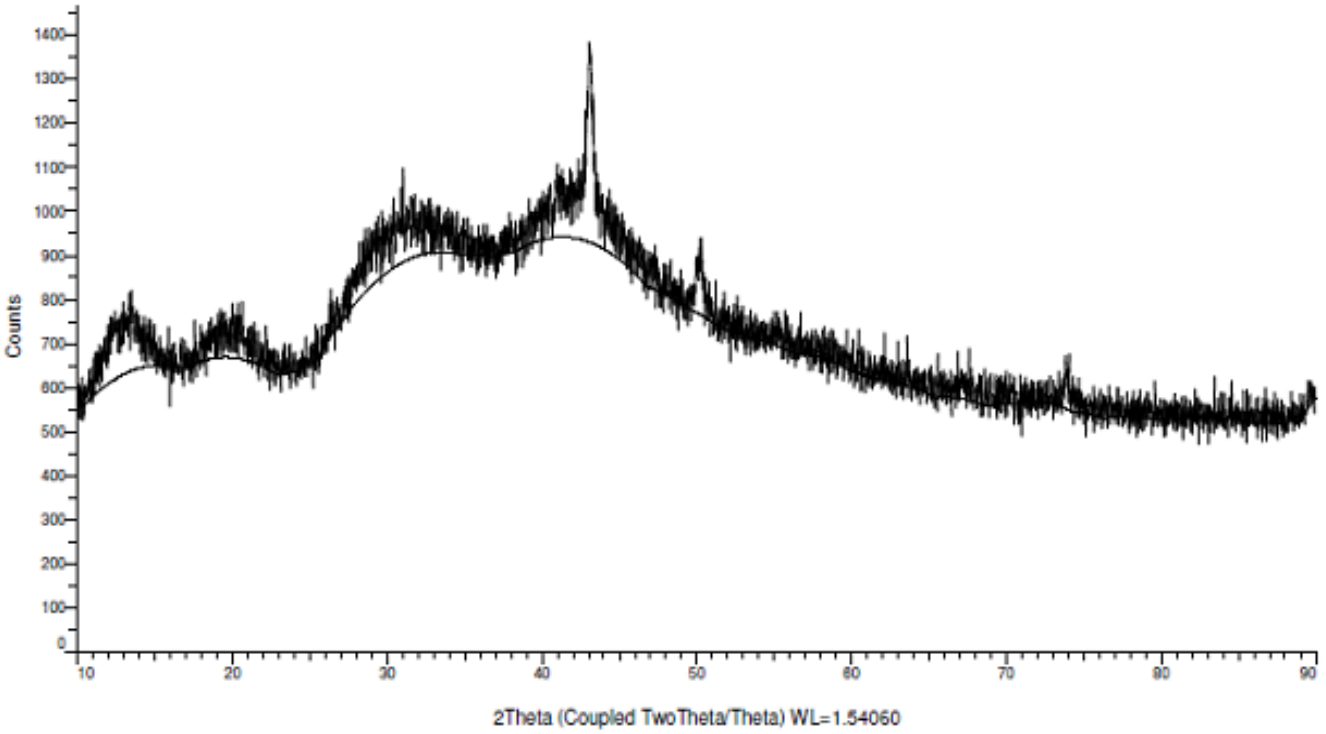

Figure 4:*XRD spectrum of copper nanoparticles*

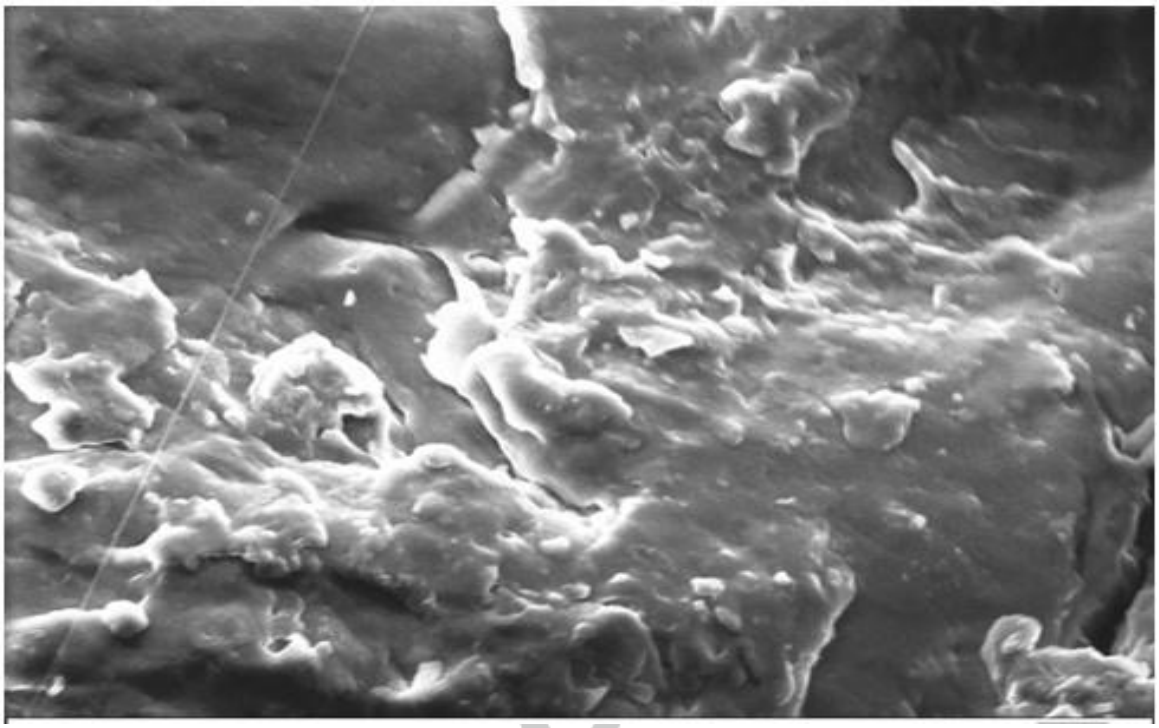

Figure 5:*SEM Spectrum of copper nanoparticles*

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