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GREEN SYNTHESIS OF COPPER NANOPARTICLES USING *Gloriosa superba*L LEAF EXTRACT

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ABSTRACT

The advancement of nanotechnology is increasing the interest of researchers towards synthesis of nanoparticles because nanoparticles have a rising application towards the medical field. Copper metal ions and their derivatives has been used for different Medical purposes like to prevent infection, ulcers etc. An adaptable technique was implemented for the synthesis of Copper Nanoparticle using leaves extract of *Gloriosa superbaL.* The synthesized copper nanoparticles were confirmed by the change of colour after addition of leaf extract into the Copper Sulfate solution. The bio reduction of copper sulphate to copper nanoparticle was characterized by UV-Vis Spectrophotometer and Fourier Transform Infrared analysis (FTIR).

Keywords: Bio reduction, Nanoparticles, *Gloriosa superba L*, Characterization.

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INTRODUCTION

Nanotechnology is rapidly increasing field that making an impact on human life such as pharmaceutical, health, food, electronics, chemical industry, energy science, cosmetics, environmental science and space industries etc. There are many ways to synthesize nanoparticles such as sol gel method, chemical reaction, solid state reaction and co-precipitation. Compared to those methods green synthesis method is one of the best method for the synthesis of nanoparticles in recent years. This method have several advantages namely low cost, simple, use of less toxic materials, most important is eco-friendly. In this method, the plant extract has been used as reducing agent for the synthesis of copper nanoparticles.

Copper is most widely used material in the world due to their electrical, optical, catalytic, biomedical and antifungal, antibacterial applications among various metal particles such as gold, silver, iron, palladium, zinc etc. Copper nanoparticles act as antimicrobial agent in various fields. The copper is highly toxic to microorganism such as bacteria (*E-Coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*) and non-toxic to animal cells, due to these phenomena it is considered to be an effective bactericidal metal.Various plants were used for the synthesis of nanoparticles using green synthesis method. Nanoparticles were synthesized from all the parts of the plant separately like seed, stem, flower, and leaf. In this present investigation, *Gloriosa superba L*family-Liliaceaecommonly known as Glory lily or Flaming lily, is an herbaceous tendril climber found tropical India and has been used as a traditional medicine. This plant extract was used as reducing agent for the synthesis of CuNPs. The plant extract mainly consists of fatty acids, alkaloids and flavonoids. The current investigation focused on the aqueous leaves extract of *Gloriosa superba L* used to synthesize CuNPs and improving the importance of plant source and involving green chemistry for the synthesis of other nanoparticles as future research.

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MATERIALS AND METHODS

Collection of Plant Leaf

The leaves of the healthy plant *Gloriosa superba* was collected from Mordara, Pemgiri, Sangamner (Maharashtra). Then it was washed with distilled water. The cleaned leaves were subsequently dried under sunshade to remove moisture completely and powdered by using mechanical grinder and then stored.

Preparation of *plant* leaf extract

The powder of *Gloriosa superba* leaf was weighed 5g and dissolved in 100ml of distilled water and allowed to boil at 50^0C for 30 min then it was cooled down to room temperature. The extract is filtered by whatmann No1 filter Paper to get clear solution. The filtrate was stored at 4^0 C for future works.

Synthesis of Copper Nanoparticles

For a reaction mixture 80 ml of 1mM $CuSO_4$ and 20 ml of Plant leaf extract was mixed and this reaction mixture was kept for 24 hrs. Within a particular time the colour of solution was changed, which indicates the formation of copper nanoparticles. Then the solution was centrifuged for 15 min at 10,000 rpm and dispersed in double distilled water to remove any unwanted biological materials

Characterization of Copper Nanoparticles

UV-Spectrophotometer analysis

The formation of copper nanoparticles was confirmed by UV- Visible spectroscopy. The copper nano particles were analyzed with UVSpectrometer in the range between 400-700 nm.For this Blank is prepared by addition of 80 ml of distilled water to 20 ml of plant leaf extract.

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FT-IR analysis

To determine the biomolecules present in the leaf extract, FTIR analysis was carried out which is responsible for the reduction of Copper ions with the spectral range of 400-4000 cm^{-1}. Here the sample was centrifuged at 1000 rpm for 20 min, dried using hot air oven and ground with KBr to form a pellet. Then the pellet was analyzed using FTIR instrument.

RESULTS AND DISCUSSION

Synthesis of Copper Nanoparticle

The formation of Cu nanoparticles was initially confirmed visually, the change in color of the reaction mixture indicates formation of copper nanoparticles (fig.1)

***Gloriosa superba*leaves extract** ***Gloriosa superba*leaves extract after addition of CuSO4 solution**

Figure1.Synthesis of copper Nanoparticles exhibits light colour to dark colour.

UV-Vis spectroscopy analysis

The result obtained from UV-Visible spectroscopy analysis of the sample is presented in Fig 2. It is the most important method of analysis to detect the Surface Plasmon Resonance property of copper nanoparticles. The copper nanoparticles formation was confirmed from the peak at 530.

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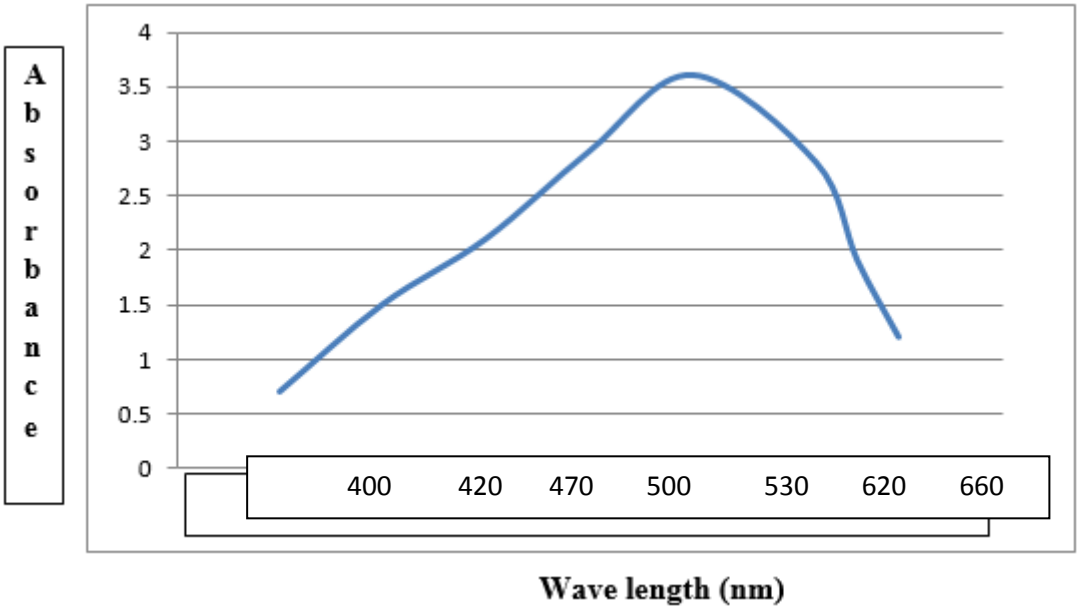

Figure2.UV-Spectrophotometer Results for Synthesized Nanoparticles

FTIR analysis

The FT-IR Characterization is used to find the molecules and their functional group present in the synthesized copper nanoparticles. The below Figure 3 represent the FT-IR spectra which shows peaks at 3750,3778, 3610, 3488, 2980, 2845, 2430, 2129, 1926, 1847, 1740, 1410,1250, 1051, 885 and 765 cm^{-1}. The FTIR spectra revealed the presence of different functional groups like Alcohol (OH stretch H-bonded, free), Alkane (C-H stretch, -C-H bending) Alkene (=C-H bending, C=C stretch) Amine(C-N, stretch) Nitro compounds (N-O stretch) Acid (OH, stretch) Ester(C-O, stretch). These functional groups play a very important role in these copper nanoparticles synthesis.

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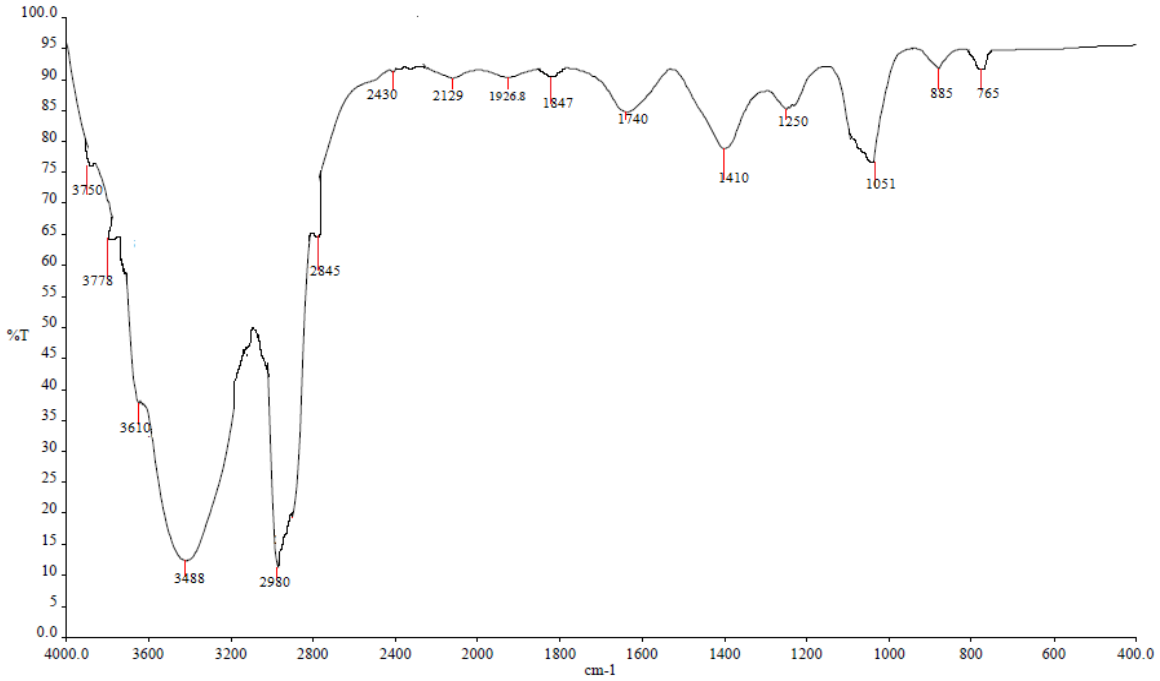

Figure3. IR spectrum for Synthesized Nanoparticles

CONCLUSION

In this paper we report Green synthesis of copper nanoparticles from leaves extract of *Gloriosa superba.* This is ecofriendly, cost effective, easy and proficient way for synthesis of Copper nanoparticles.The functional group present in the leaf extract was confirmed by FTIR analysis. These functional groups were mainly responsible for the reduction of copper metal ions into Copper nanoparticles. The synthesized copper nanoparticles were analyzed using UV-spectrophotometer and FITR. The *Gloriosa superba* plant may be effectively utilized for the production of Copper nanoparticles with economically for many pharmaceutical applications.

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