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Eco Friendly Approach to the Synthesis of Copper Nanoparticle, Characterization and Its Application

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Abstract:
The word bio reduction of cu nanoparticles has attracted the minds of young researchers because of the need in developing an economical and efficient synthesizing technique. We put forward the green, a biogenic approach for the synthesis of Copper nanoparticles using the leaf extract of leucas aspera. Leucas acts as a potential reducing and stabilizing agent for the synthesis of copper nanoparticles. The biomolecule present in the leaf extract induce the reduction of copper ions from Copper Sulphate as a result of which leucas conjugated nanoparticles are formed. The first confirmation for the formation of copper nanoparticles was the physical colour change (yellow to green). Which was then confirmed by UV visible spectroscopy demonstrated a peak at 579nm corresponding to plasmon resonance of copper nanoparticles Furthermore extending towards the implementation of the synthesized nanoparticle to the ease of mankind. The biomolecules present in leucas enhances the biological property of the leucas conjugated copper nanoparticles .Antioxidant stands as an important application of nanoparticle in the medical world the percentage of radical scavenging exhibited by leucas mediated copper nanoparticle proves that it can act as a efficient antioxidant (DPPH assay proved it) .Dye happens to be a hazardous substances to the environment, Methylene blue was reduced biotically by the action of leucas capped copper nanoparticles, the decreasing value of absorbance at 660nm confirms it

Keywords: *Bio reduction, UV visible spectroscopy, DPPH, leucas aspera*

1. Introduction

Nanotechnology deals the manipulation of matter on atomic, molecular and supramolecular scale. The advent of Nano biotechnology begins with the scientific interest of developing the efficient technique for synthesizing the nanoparticle that can act as a combat source in the biomedical world. The green synthesis of nanoparticle has can just be termed as the combination of ancient wisdom with the modern technology. Medicinal plants are known for millennia and are considered as a rich source of pharmaceutical agents for the prevention and treatment of diseases and aliments. As per the analysis conducted by WHO 80% of India's herbal population possess a unique bio molecule that are of medicinal importance. *Leucas aspera commonly known as Thumbai* belongs to *kingdom: Plante, Order: Lamiales, Family: Lamiaceae, Genus: Leucas, Species.* Even though it is a weed been widely in India it is off vital importance with its medicinal value in its ancient foremost medicinal system. The biomolecules present in it enables it to act as an efficient reducing agent in the synthesis of *leucas* conjugated copper Nano particles. The Plant extract of *leucas* have reported to demonstrate anti-oxidant activity. Plant extract was screened for its antioxidant activity through DPPH assay. The hazardous dye stuffs from various sources contain compounds that are hazardous to fauna and flora as well as aquatic entity. The elimination of such a hazardous compounds is necessary to ensure clean and safe environment since from decades many methods like AOP(Advanced oxidation Processes) are used to degrade dyes Copper and its oxides are also used as the catalyst for the elimination of hazardous effluents studies shows the reaction is structure sensitive process The synthesis of nanostructures with the desired architectural properties have gained the attention of research minds due to their unique action We report the study demonstrating the dye degradation property as a result of the action of our nanoparticles

Figure 1: Leucas Aspera

2. Materials and Methods

2.1. Extract Preparation

2.1.1. Fresh Leaf Stripping

30g of washed, dried rose leaves were taken in a pestle and mortar and grinded into a fine paste using de-ionized water, later the paste was taken in a 250ml beaker with 100ml de-ionized water and was continuously stirred for 6 hours using magnetic stirrer with 30 rpm. This was followed by the filtering process which was first carried out using normal filter paper and the filtrate so obtained was re filtered using whatmann filter paper number 1. Thus obtained extract is freshly used or can be stored in 4^{o}c.

2.1.2. Drying

The fresh leaves were dried at 50^{o}c for 8hrs in the hot air oven and powdered using grinder. 10g of the powder was mixed with100ml de-ionized water and continuously for 2 hours in magnetic stirrer This was followed by the filtering process which was first carried out using normal filter paper and the filtrate so obtained was re filtered using whatmann filter paper number 1. Thus obtained extract is freshly used or can be stored in refrigerator for further use.

2.1.3. Homogenization

30g of washed, dried rose leaves were taken in a pestle and mortar and grinded into a fine paste using de-ionized water, later the paste was taken in a 250ml beaker with 100ml de-ionized water and was continuously stirred for 6 hours using magnetic stirrer with 30 rpm. This was followed by the filtering process which was first carried out using normal filter paper and the filtrate so obtained was re filtered using whatmann filter paper number 1. Thus obtained extract is freshly used or can be stored in 4^{o}c.

2.2. Synthesis of Copper Nanoparticles

20ml of the Plant extract was taken in separate 5 conical flasks and was kept in stirring condition. After 15 min of stirring the solution was treated with different amount of copper sulphate salt, treatment with 3g yielded the best result which was added in each conical flasks. Stirring condition was further continued till 60minutes.The completion of the reaction was demonstrated by a physical colour change, then the solution was subjected to ripening overnight. The next confirmation of the synthesis of copper nanoparticle was done by taking absorbance after ripening period. The peak at a range of around 579nm confirmed the presence of copper nanoparticle. The recovery was done by transferring whole solution is to petri plates and dried in hot air oven at 60^{o}c for 24 hours. The Nano particle in the form of dry powder was recovered and used for further analysis[i]

3. Confirmation through UV

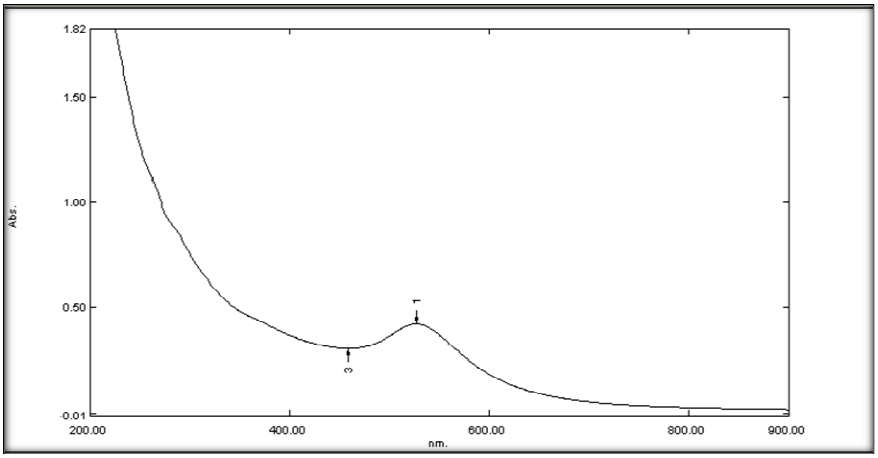

Figure 2: UV Graph

3.1. Anti-Oxidant Activity

24mg of DPPH was weighed and dissolved in 100ml methanol this was the stock solution. To 10ml of the above prepared solution,45 ml of methanol was added this serves as the working solution for the study then in a clean and dry test tube 10,50,100,200 µl of the Copper nanoparticle sample was taken and the final volume was made up to 3ml.This was subjected to incubation in dark for 30 minutes. Then the Absorbance was measured in a UV Spectrophotometer at 517nm [iii]

Leucas posses an antioxidant property as a result of which *leucas* capped copper nano particle acts as a good antioxidant the percentage radical scavenging activity obtained after the experiment by DPPH scavenging confirms it.

Figure 3: (a) Before incubation (b) After incubation

Sample concentration(µl)	Absorbance of CuNpsat 517nm	Absorbance of leafextract	Control	% radical scavenging
10	0.214	0.043	0.525	59.23
50	0.216	0.126	0.524	58.85
100	0.236	0.198	0.524	55.04
200	0.515	0.411	0.523	1.98

Table 1: Anti-oxidantabsorbance values

3.2. Dye Reduction (Methyleneblue)

310µlofdye(methyleneblue) was dissolved in 690 microliter of water this was the stock solution for the study then 1ml of synthesized copper nanoparticles was added to 100ml of dye solution which serves as the working solution for the experiment. The working was kept in stirring condition for 30minutes. Then both the sample and the control (without nanoparticle) were kept in sun light and absorbance was recorded for every 30 minutes at 660 nm. The dye reduction activity of *Leucas* conjugated copper nanoparticle was verified using the dyemethyleneblue, the reducing in the value of absorbance value shows the action of copper nanoparticle in the reduction of methyleneblue[iv]

Time (minutes)	Cunps	Control
0	0.395	0.415
30	0.390	0.414
60	0.339	0.412
90	0.337	0.412
120	0.320	0.410
150	0.311	0.409
180	0.301	0.407
210	0.280	0.407
240	0.268	0.405
270	0.243	0.405
300	0.210	0.404
330	0.199	0.404
360	0.180	0.403
390	0.168	0.403
420	0.15	0.402

Table 2: Dye reduction absorbance values

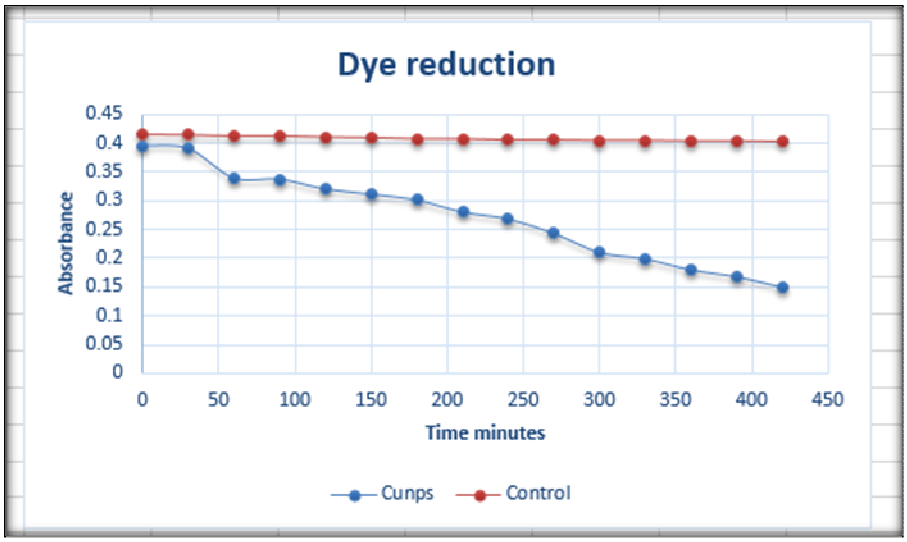

Figure 4: Dye reduction graph

4. Conclusion

Concluding with our experimental result, it can be concluded that choosing *leucas* as a reducing agent can just be stated as combination of ancient wisdom with modern advent technology of the era. *Leucas* happens to have a very good medicinal importance, and acts as an efficient reducing and stabilizing agent for the synthesis of *leucas* conjugated Copper nanoparticle as our reducing agent possess a formidable medico property the leucas capped Copper nanoparticles can be tested for various biological activity. The antioxidant activity was studied through DPPH assay

The percentage radical scavenging activity by DPPH as say reports it to be potent antioxidant agent. As described dyes never die. The dyes are hazardous to environment, the action of our copper nanoparticle reduced it efficiently. In the present scenario there is a need for green and clean technologyourstudycanbereportedasanecofriendlyapproachthatcanbereproducedeasily at room temperature.as a result, *leucas* mediated copper nanoparticles can be incorporated widely in the biomedical world for various sorts of treatments

5. References

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