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Symplocos Racemosa Bark Functionalized Copper Nanoparticles and Its Characterisation

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ABSTRACT

INTRODUCTION: Symplocos racemosa used in the treatment of eye disease, skin diseases, ear diseases, liver and bowel complaints, tumors, uterine disorders, spongy and snake-bite, bleeding gums, fever, asthma, gonorrhea and arthritis. The characteristic features of Cu nanoparticle were studied and were obtained.

MATERIALS AND METHODS: Fresh lodgers bark powder was collected from the market, Chennai.1g of freshly collected Lodhra bark extract is mixed with 0.1 liters of distilled water thoroughly and boiled for 3-5 mins in heating mantle then filtered by using filter paper.0.861 g of CuSo4 powder is added in 0.5 liters of distilled water and to this lodhra bark extract was been added. The solution is kept in a shaker and the reading was taken for every 2 hrs to examine the synthesis of Cu nanoparticles. The characterization Of Cu nanoparticles is done by using Transmission electron microscopy(TEM)

RESULTS: The size of the symplocos racemosa bark functionalized copper nanoparticles is 40-80 nm.while the shape appeared to be spherical, rectangular. The process is known as Solution reduction Process in which Cu nanoparticles were synthesized.

CONCLUSION: Reduction method is best for synthesizing Cu(0) nanoparticles than the Convention method because that method is greener and environmentally suitable, cheap, and best. The surface area to volume ratio of solid-supported metal nanoparticles (1–100) nm in size is mainly responsible for their catalytic properties. In a further study, we will see the catalytic and biological properties of these nanoparticles.

ARTICLE HISTORY

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Copper, Nanoparticles, symplocos racemosa, characterization. Lodhra bark, UV-vis spectrophotometer.

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INTRODUCTION

Symplocos racemosa Roxb. belongs to a monogeneric family Symplocaceae, known as lodhra in Sanskrit; is a small evergreen tree, found throughout the tropical and subtropical countries. Its is an important medicinal tree in India.[1,2]It is used in Ayurveda,[3]for the therapy of various disorders like bleeding disorders, persistent dysentery, menstrual and urinary disorders, skin diseases, constipation, piles, gastric inflammation, intestinal paralysis, etc.,.There are many pastes, ointments which are come from The plant extract are often used for wounds, scars, and cuts.in laboratory it is also used in the synthesis of many nanoparticles in that we used to it for the synthesis of the copper nanoparticle.[4,5]Wide range of bioactive compounds was synthesized from the plant. These include the flavonoids, linolenic acids, salireprosides, benzoylsalireproside, ethanolic extract, benzoic acid, etc.[4,6] There are magnificent characteristics of Symplocos racemosa that make it distinguishable from other herbal species.[7,2,8]

These include the anti-acne effect as it inhibits the growth of propionibacterium acnes, antioxidant activity as it contains salireproside and benzoylsalireproside that have a potent antioxidant effect, antipyretic effect which is done by ethanolic extract present in it.[910]Apart from these benefits, that plant has the potential to cure many ailments. This includes Alzheimer's diseases by the presence of three new benzyl derivatives extracted from the bark which in vitro inhibitory activity against α-chymotrypsin, female reproductive diseases by treating the uterine disorders.[1112] Not only this, but the plant is also known for its significant anticancer and antibacterial effect. They help to treat leukemia and cervical cell lines. The butanol extract present in the plant has the highest cytotoxicity activity. The plant shows a better antimicrobial property against both gram-positive and gram-negative bacteria.[11,13,12,14,15]

Nanoparticles are materials in which its property and characteristics differ and are widely used in the various areas includes electronic, magnetic, pharmaceutical, cosmetic energy, catalytic, and materials applications.[16] Copper nanoparticles and many others like silver, gold, palladium, platinum, etc are widely used these days. Copper nanoparticles show its excellency in electrical conductivity. These play a major role in modern electrical circuits because of their low costs.[177] Because of its extraordinary properties like electrical conductivity, catalytic behavior, good compatibility, and surface-enhanced Raman scattering activity, Cu nanoparticles have used as essential components in future nano-devices.[18,19] These nanowires are used in nanoelectronics, magnetic devices, nanosensors, electron emitters, and other electronic applications.[120] Cu nanoparticles have been used as nanoprobes in medicines.[7] From these CuO compounds, many High-temperature superconductivity materials and antiferromagnetic material are synthesized .[7,21,22]. High-speed homogenization or ultrasonication is employed in order to synthesize a small particle size.[23] Conventional methods such as solvent extraction–evaporation, solvent diffusion, and organic phase separation methods are hazardous to the environment as well as physiological systems. Reduction systems include NaBH4, Cu, Ni, Co complexes, and macrocyclic ligands are used to carry out the reduction process to characterize the different nanoparticles and their characteristics.[2418,21]These reduction methods help in the control of hazardous environments. The most popular Cu(I) and Cu(0) nanoparticles emerged as useful and unique green catalysts whose efficiency is attributed to their characteristic high surface to volume ratio that translates into more number of active sites per unit area compared to dominate the properties of matter as the size is reduced to the nanoscale.[25,2]

MATERIALS AND METHODS

Plant Material

Symplocos racemosa was collected for the research experiment.

Preparation of The Plant Extract

Fresh Lodhra bark was collected in a mixer jar and made into a fine powder so that there is no bark piece left (figure 1). 1g of the powder was being added with 100mL of distilled water and mixed with a stirrer properly (figure 2). Mixing with a stirrer was done to avoid lump formation. The extract was boiled for 3 to 5 minutes with the help of a heating mantle. The extract was being filtered using a filter paper.

Preparation of The Copper Nanoparticles

0.816g of copper sulfate powder was taken to which 500mL of distilled water was being added (figure 3). To this recently prepared solution, the previously prepared Lodhra bark extract was being added and mixed. The mixture was kept in a magnetic shaker for two to three days and the readings were taken for analyzing the synthesis of nanoparticles. The color of the mixture kept in the magnetic shaker was being observed visually after every two hours & proper pictures were taken of the beaker.

After 3 days of observation, there was a lot of difference in the initial and the final color of the Solution. The mixture was taken in the graduated centrifuge pellet. Up to 12mL of six pellets were being filled with the mixture and was kept inside the centrifuge machine for 5 minutes. After this

process, the supernatant was being separated from the filtrate from the centrifuged pellet. The final supernatant from all the six pellets was taken into one graduated pellet and stored in a refrigerator for further characterization activity.

Characterization

The characterization is done by using Transmission electron microscopy

Figure 1: Fine powder of lodhra bark

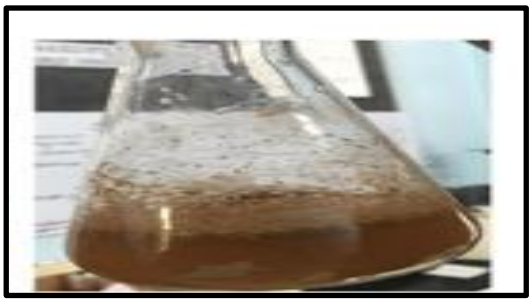

Figure 2: Symplocos racemosa mixed with distilled water

Figure 3: Measured copper sulfate solution used for the preparation of the copper nanoparticles

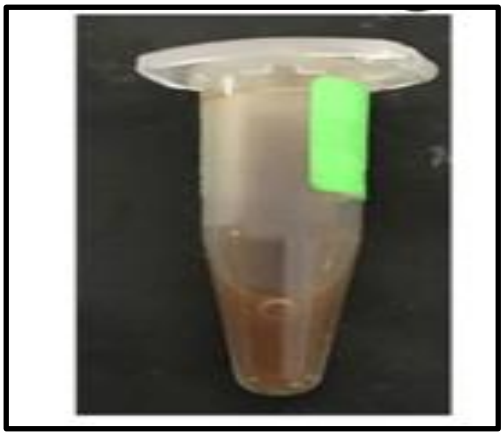

Figure 4: visual observation of copper nanoparticles synthesis using Symplocos racemosa

RESULTS AND DISCUSSION

Visual Observation

In Figure 4 The copper nanoparticles exhibit a light green color in the beginning and at the end of three days, this color has changed to dark brownish-green. The intensity and the size of the nanoparticles and surface plasmon resonance(SPR) are the main characteristics that help in color change being formed in the mixture. With the stimulation by incident light, there is the resonance that leads to the oscillation of conduction of electrons at the interface between negative and positive permittivity material. When lodhra bark was added to the copper sulfate solution, the color of the solution transformed from a turbid light bluish color to light greenish color. Thus, this color change seen for three days was a clear indication for the synthesis of copper nanoparticles in the mixture which was further analyzed and confirmed by the Ultraviolet-visible spectrophotometer. UV- vis spectrophotometer involves the basic principle i.e. Beer-Lambert Law. The theory associated with this concept states that the energy difference between the higher energy state and the ground energy state is actually equal to the absorbed UV- radiation. This is a proper renowned technique which is used nowadays to confirm the synthesis and stability of Cu nanoparticle. The UV- vis spectra graph was recorded for the Lodhra bark mediated copper nanoparticles.

Characterization

The figure 5 shows the UV-vis spectroscopic peak of copper nanoparticles synthesized using lodhra bark and peak at 300 nm confirms the formation of the nanoparticles. After the observation of the extract under the transmission electron microscopy, the size of the symplocos racemosa bark functionalized copper nanoparticles is 40-80 nm.while the shape appeared to be spherical, rectangular (Figure 6). Nanosized Cu is the most studied metallic nanoparticle as the surface plasmon resonances are clearly featured in the optical spectra, and are located in visible regions. nanoparticles were first indicated by the appearance of a blue color solution. This is due to Plasmon resonance, with a significant contribution from interband transition which produces blue hydrosol having Imax at 100 nm. The blue color the colloidal solution remains stable after one month of synthesis. The position and shape of the plasmon absorption peaks are dependent on the particle morphology, dielectric functions of the metal and the surrounding medium as well as surface-absorbed species.

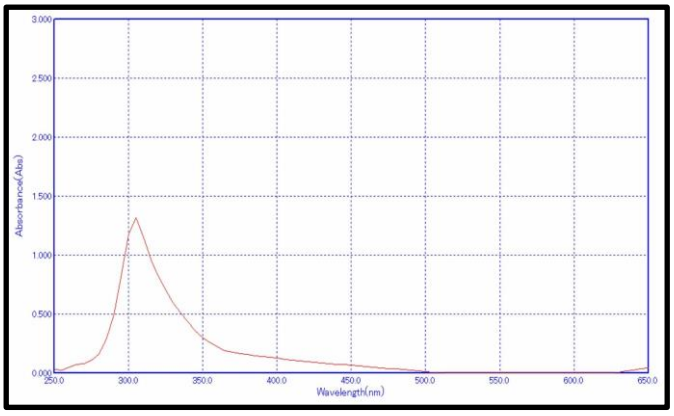

Figure 5: UV-vis spectroscopic analysis of copper nanoparticles

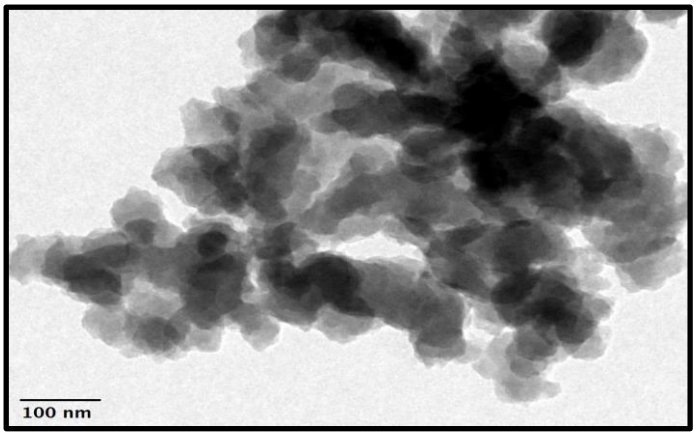

Figure 6: TEM image of copper nanoparticles

CONCLUSION

We have prepared spherical Cu nanoparticles In the nano regime by transmission electron microscopy technique which is simple and environmentally benign. It is an easy, fast, and cost-effective technique and doesn't involve any harmful and environmentally toxic chemicals used previously in conventional chemical reduction Processes.Cu nanoparticles with very good stability have been synthesized as an aqueous solution. It has been also discussed that the biomolecules present in the biomass not only reduce the metal ions but also stabilize the metal nanoparticles by preventing them from being oxidized after the preparation.

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Authors Contribution

The authors have carried out the study by collecting data from search engines and drafted the manuscript by necessary information. They have aided in the conception of the topic, have participated in the review, and have supervised in preparation of the manuscript. The authors have participated in the study design and have coordinated in developing the manuscript. All authors have discussed the study details among themselves and contribute to the final manuscript.

CONFLICT OF INTEREST

Authors declare no potential Conflict of interest.

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