



CODEN (USA): IAJPB

ISSN: 2349-7750

**INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES**Available online at: <http://www.iajps.com>

Review Article

**GREEN SYNTHESIS OF COPPER NANO PARTICLES FROM
MEDICINAL PLANTS****Seeram. Hariprasad^{1*}, G. Susheela Bhai¹, B. Kishore Babu¹, CH.Madhu¹, G. Ravi Kumar¹,
A. Hymavathi¹, J.Santhosh kumar¹, S. Nageswara rao²**¹ Department of Engineering Chemistry, Andhra University, Visakhapatnam, India.² Department of Botany, Andhra University, Visakhapatnam, India.**Abstract:**

Green method is simple, cost effective and eco- friendly method. In last decades, Nanotechnology is developed very rapidly. Nano particles are solid particles with size range between 1-100 nm. Copper nano particles are prepared from variety of medicinal plant leaves extract followed by characterized by using characterization techniques like SEM, TEM, XRD, UV-VISIBLE, FT-IR. In this manuscript we report general synthesis, Characterization and antimicrobial activities of copper nano particles.

Key words: *Copper nano particles, Nano science and Nanotechnology.*

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Please cite this article in press as S.Hariprasad et al, **Green Synthesis of Copper Nano Particles from Medicinal Plants**, *Indo Am. J. P. Sci*, 2016; 3(8).

INTRODUCTION:

Nanotechnology plays an important role in modern research [1,2], In recent years Nanotechnology attract many researches for various field like Biotechnology, Physics, Chemistry, Material science, Engineering, Medicine. Nano particles are synthesized by physical and chemical methods. In this methods major drawbacks is Expensive reagents, hazardous reaction conditions and longer time to isolate nano particles.[3,4]. The emergence of Nano science and Nanotechnology in the last decade presents opportunities for exploring the bactericidal effect of metal nanoparticles. The bactericidal effect of metal nanoparticles has been attributed to their small size and high surface to volume ratio, which allows them to interact *closely with microbial membranes and is not merely due to the release of metal ions in solution* [5,6]. Copper nano particles are synthesized by following methods. (a) vapour deposition,[7] (b) Electro chemical reduction[8],(c) Thermal decomposition [9],(d) Radiolysis reduction [10], (e) heat evaporation [11], (f) colloidal synthesis with reduction and extraction steps [12]. Copper nanoparticles were prepared from various plant extracts such as *Hibiscus Rosasinensis* [13], *ocimum santanum* leaf extract [14] , *Syzygium aromaticum* (Cloves) [15], *citrus media* Linn(IDILIMBU) juice [16] , *vitis vinifira* extract [17] , *Eucalyptus* [18] , *guava* leaves extract[19], *Datura innoxia* leaf extract [20], *Nerium oleander*[21], *Capparis zeylanica* [22], *Cassia fistula* flower[23] , *Gymnema sylvestre* [24], *Delonixelata* flower[25], *Aloe vera* [26], *Caesalpinia pulcherrima*[27], *Anthemis xylopoda* flowers[28], *ginkgo biloba* Linn .leaf extract[29], *Cassia Auriculata* leaves[30], *Pseudomonas fluorescens*[31], *Curcumin* leaf extract[32].

MATERIALS AND METHODS:

1. Collection of Leaves:

A major source of plant materials is forest and also occurs from rural areas, agriculture lands. First collect the plant and separate the good and healthy leaves. They are washed with several times with tap water and washed several times with distilled water, after they dried at room temperature for removal of moisture.

2. Preparation of Leaf Extract:

10-15gm of leaves were weighed and sliced in to a small pieces, then 100-200ml of double distilled water was added and then boiled. After boiling the solution it is cooled. After cooling the extract was filtered with whattman no.1 filter paper. The extract was stored at 4°C for further usage.

3. Preparation of CuSO_4 Solution:

Required molar solution CuSO_4 was prepared by accurate amount of copper sulphate was dissolved in required volume of water .generally for the preparation of copper nano particles we use 1mM copper sulphate solution. The solution was stored at clean and dry beaker.

4. Green Synthesis of Leaf Silver Nanoparticles:

Generally 80 or 90 ml of CuSO_4 was added to 20 or 10 ml of leaf extract and follow some physical techniques like heat, stirring.. the solution was incubated some time. The color change was observed, it is indicated by formation of copper nano particles, which was confirmed by UV-Visible Spectrophotometry. The formed silver nano particles was centrifuged, separated and dried.

CHARACTERIZATION:

1. UV-Visual Spectral Study:

Formation and stability of copper nano particles in sterile distilled water is confirmed using UV- vis spectrophotometer in a range of wavelength from 200 to 800 nm. The production of copper nanoparticles by reduction of copper ions due to the addition of leaves extract. The band observed in spectrum, confirmed by copper nano particles. Various plants leaves extracts were giving peaks at different wavelengths.

2. FT-IR Spectral Study:

To investigate the functional groups of variety leaves extract, a FT-IR study was carried out and the spectrum is complex nature due to leaves extract giving a number of peaks. The peaks arising from -NH stretching of amino group, and bonded -OH group , -CH stretching vibrations of -CH₃ and -CH₂ functional groups, C=O stretching frequencies of carboxylic acid functional groups, and finger print region peaks of C-O, O-H ,C-N are observed clearly FTIR study indicates that the carboxyl (-C=O), hydroxyl (-OH) and amine (N-H) groups of leaves extract are involved in the reduction of silver ions in to copper nanoparticles.

3. SEM Analysis:

SEM analysis shows uniformly distributed copper nanoparticles on the surfaces of the cells . The suspended silver nanoparticles in sterile distilled water were used for scan electron microscope analysis by fabricating a drop of suspension onto a clean electric stubs and allowing water to completely evaporate. Sem analysis give size of copper nano particles. Majority cases a large size copper nano particles was observed due to agglomeration of smaller ones.

4. TEM Analysis:

TEM analysis give the information about the morphology of the copper nanoparticles .generally silver nano particles are spherical or crystal structures. Tem also give average mean size of copper nano particles.

5. XRD Analysis:

Analysis through X-ray diffraction was carried out to confirm the crystalline nature of the particles, and the XRD pattern showed numbers of Braggs reflections that confirmed the crystalline structure of copper nano particles. The xrd coming from leaf ,was compare with standard spectrum with JCPDS card no-45-0937.The X-ray diffraction results clearly show that the copper nanoparticles formed by the reduction of Ag⁺ ions by the leaves extract are crystalline in nature. The average particle size of copper nanoparticles synthesized by the variety of leaves extracts by using green method can be calculated by using Debye-Scherrer equation.

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

Where D= the crystallite size of CUNPs.

λ = the wavelength of the X-ray source used in XRD.

β = the full width at half maximum of the diffraction peak.

K = the Scherer constant with a value from 0.9 to 1.

θ = the Bragg angle.

6. EDX Analysis:

EDX analysis of synthesized copper nano particles gives the information about elemental analysis. The percent of copper nano particles formed in synthesis process is also give by EDX.

ABOUT MEDICINAL PLANTS:

Nature is the best source of medicinal agentsfor thousands of years and an impressive number of modern drug have been Isolated from natural resources, many based on their use in traditional medicine The wide spread use of herbal remedies and health care preparations, such as those described in ancient texts like Vedas and bibles, have been traced to the occurrence of natural products with medicinal properties, Infact, plants produce a diverse range of molecules, making them a rich source of different type of medicine.

Higher plants as source of medicinal compounds have continued to play a dominant role in the

maintains of human health science ancient times. Over 50% of all modern clinical drugs are of natural product origin and natural products play an important role in drug development programs in the pharmaceutical Industry.

Drugs obtained from plants consist of entire plant or their parts like leaves, roots, fruits, seeds, etc. dried plants or plants parts and Phytochemical have been widely used for the preparation of phytomedicines in ayurvedic, Allopathic, Unani, Siddha, Homeopathic and folk medicines. The disease curing properties of plants are associated with their chemical constituents. It is Estimated that there are about 5, 00,000 species of plants on earth. A relatively small percentage (1 to 10%) of these is used as food by both human and other animal species. It is possible that ever more are used for medicinal purpose. Hippocrates mentioned 300 to 400 medicinal plants. In the first century A.D, Dicorides wrote De material medica, A medicinal plants catalogue, which became the prototype modern pharmacopeias.

It has been estimated that about 30% of pharmaceuticals are derived from green plants; this percentage has been raised considerably in recent years. Most of the plants used in medicines are collected from their wild habitates and only some species used in large quantities are cultivated systematically. Many medicinal plants, which were ignored in the past years, have been over exploited in recent years.

Medicinal plants constitute a vast undocumented and over exploited economic resource and they are the principal health care for the majority of the people of the country. It is well known that infectious diseases account for hi8gh proportion of health problems, especially in the developing countries and the major problem today we are facing was that several microorganisms have developed resistance to mant synthetic drugs and antibiotics; this has created clinical problems in the treatment of infectious disease. This resistance of microbes towards drugs has increased due to indiscriminate use of commercial antimicrobial drugs commonly used in the treatment of infectious diseases. This situation forced scientists to search for new antimicrobial substances from various sources, Such as medicinal plants. Secondary metabolites are produced by plants constitute a source of bio active substances and interest has increased to the search for new drugs foe plant origin.

Now the major problem in front of the scientific community in treating microbial diseases is to find out bio active compounds, which successfully control the micro organisms with developing antibacterial resistance towards the bio active agents. But today the situation is different; Isolation of microbial agents

less susceptible to regular antibiotics and recovery of increasing resistance isolates during antibacterial therapy is raising throughout the world. One of the measures to minimize the increasing rate of resistance in the long run is to have continuous in depth investigation for new, safe and effective antimicrobials as non effective ones. Natural resources especially plants and micro organisms are potent candidates for this aim.

The important necessity and potentiality was well established and cannot be over looked. The Indi-pak subcontinent is very rich in having resources of medicinal plants. A large no of powder, decoction and infusion for the treatment of various diseases including the infection caused by various microbes. Several workers throughout the world have carried out antimicrobial studies with some medicinal plants.

PREVIOUS INFORMATION:

From Hibiscus Rosasinensis leaves extract, UV absorption peak of copper nano particles is 610nm, they show good bacterial properties against *Bacillus subtilis*, *Escherichia coli*, and show anti oxidant properties by using FRAP method and hydrogen peroxide method[13].

Copper nano particles prepared from *ocimum sanctum* leaf extract, size is 77nm confirmed by XRD [14].

From *Syzygium aromaticum* (Cloves) leaves extract, UV-VISIBLE band give at 570 nm, The average size is 40-45nm (SEM) and 14-50nm (TEM), shape is spherical[15].

From *citrus media* Linn (IDILIMBU) juice, UV absorption peak of copper nano particles is 610nm, size is 10-60nm (SEM), and 20nm (TEM), show good anti microbial activities against *Escherichia coli*, *Klebsiella pneumonia*, *Propionibacterium acnes*, *Salmonella typhi*[16].

From *Vitis vinifera* extract, UV absorption peak of copper nano particles is 384nm, they show anti microbial activity against *Escherichia coli*, *Staphylococcus aureus*, *pneumonia*, *Salmonella typhi* and *Bacillus subtilis*[17].

From *Eucalyptus* extract, UV absorption peak of copper nano particles is 572nm and XRD give size 38.62nm, SEM images give morphology is crowded groups[18].

From *guava leaf* extract, preparation of copper nano particles from three different ratios and their characterization by using SEM, XRD, TEM. The stability of formed copper nano particles is up to 15 days. They show anti microbial activity against *Escherichia coli*, *Staphylococcus aureus*[19].

From *Datura innoxia* leaf extract UV absorption peak of copper nano particles is 236-262nm. SEM images give 5-15nm size and uniform cluster

structure and anti microbial activity against rice pathogens [20].

By using *Nerium oleander* leaf extract UV-VISIBLE band observed at 325-370nm. Good bacterial activity of five different organisms like *Salmonella typhi*, *Klebsiella pneumonia*, *Escherichia coli*, *Staphylococcus aureus*, and *Bacillus subtilis*[21].

From *Capparis zeylanica* leaves extract, UV-VISIBLE band give at 531nm, size is 5nm (XRD) and 60-100nm (SEM), spherical shape given by TEM and show bacterial activity *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*[22].

From *Cassia fistula* flower leaves extract, UV-VISIBLE band give at 239nm and size of copper nano particles is 20µm, shape is clustered[23].

From *Gymnema sylvestre* leaves extract, UV-VISIBLE band give at 560nm and SEM images reveal copper nano particles are spherical and size is 65-184nm range[24].

Biogenic synthesis of copper nano particles from *Delonix elata* flower, UV absorption spectra give band at 328nm, SEM image give 20µm. XRD pattern give amorphous nature of copper nano particles [25].

Photo synthesis of copper nano particles using flower extract of *Aloe vera*, UV absorption band at 578nm. FE SEM give spherical shape with 40nm[26]. Synthesis of copper or copper oxide nano particles from floral extract of

Caesalpinia pulcherrima, the size of nano particles obtained from this method is 18-20nm, the Surface Plasmon resonance peak is observed at 380nm. XRD give size is 6nm. EDX give composition of copper and oxygen is 75:25.[27].

Synthesis of *Anthemis xylopo* flowers extract assisted in situ green copper nano particles supported on natural NATROLITE ZEOLITE. In this method developed a novel and highly efficient method for the preparation of the Cu NPs supported on Natrolite zeolite by *A. xylopo* flowers aqueous extract as a reducing and stabilizing agent. The synthesized catalyst exhibited excellent activity for the synthesis of various formamides at room temperature in a high yield[28].

Green synthesis of copper nano particles from *Ginkgo biloba* Linn leaf extract, UV absorption give 560-580nm, TEM give size is 15-20nm. The catalytic activity of these nano particles used in Huisgen [3+2] cyclo addition of Azides and alkynes at room temperature[29].

Green synthesis of copper nano particles using *Cassia Auriculata* leaves extract, FE-SEM suggested that particles are spherical and size is 38.1-43.5, UV absorption give band in the region of 488.5-514.3nm[30].

Biological synthesis of copper nano particles using *Pseudomonas fluorescens*, It was found that the

average particle size was 49 nm with spherical and hexagonal shapes. The influencing parameters such as pH, concentration of copper, volume of cell-free supernatant used and reaction time were studied[31].

From *Curcumin leaf* extract, UV-VISIBLE band give at 585nm and size is 45nm (XRD), shape is cubic and rods. TEM gives size range is 60-100nm. they show bacterial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus Bacillus*[32].

ACKNOWLEDGEMENT:

Authors are thankful to Prof. G. Susheela Bai and B. Kishore babu, Assistant Professor, Department of Engineering chemistry, Andhra University, Visakhapatnam for giving valuable suggestions.

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