International Journal of ChemTech Research
CODEN (USA): IJCRGG ISSN: 0974-4290
Vol.9, No.02 pp 98-105, 2016

Greensynthesis of Copper Nanoparticles by *Arevalanata* Leaves Extract and their Anti Microbial Activites

Seeram. Hariprasad*, G. Susheela Bai, J. Santhoshkumar, CH. Madhu, D. Sravani

Department of Engineering chemistry, AUCE(A), College of Engineering, Andhra University, Visakhapatnam, India

Abstract: The copper nanoparticles was prepared by using simple method of green chemical reduction. This is eco-friendly and cost-effective method. It is an effective method for the preparation of copper nanoparticles at room temperature. In this present study we report synthesized copper nanoparticles from *Arevalanata* leaf extract. The formation of copper nanoparticles was confirmed by UV-VISIBLE spectro photometer and characterization was done by UV-VISIBLE, FTIR, SEM and TEM. The Antimicrobial activies of copper nanoparticles was tested aganist *E.coli, Staphylococus aureus, Bascillus cereus, Pseudomonas aeruginosa.*
Keywords: copper nanoparticle, leaves extract, SEM, TEM, FTIR, UV-VISIBLE.

Introduction:

In recent years, Synthesis of metal Nanoparticles using plant leaf extracthas attracted attention of many researchers because of availability of materials, inexpensive and process is easy to carry out in any laboratory, use of non-toxic reagent [1]. Nanotechnology plays an Important role in modern research. Nanotechnology that can be applied almost all fields such as pharmaceutical, electronics, health care, food and feed, biomedical science, drug and gene delivery, chemical industry, energy science, cosmetics, environmental health, mechanics and space industries [2].

The copper nanoparticles are synthesized from (a) vapor deposition[3],(b) electrochemical reduction [4], (c) thermal decomposition [5],(d) chemical reduction of copper metal salt [6] and e) room temperature synthesis using hydrazine hydrate and starch [7].In recent years copper nanoparticles were prepared from micro organism [8] Copper nanoparticles act as antimicrobial agent in various fields.

The copper is highly toxic to microorganism such as bacteria. copper nanoparticles were preaped from various plant extracts such as *Hibicus Rosasinensis[9], ocimum santanum* leaf extract [10], *Syzygium aromaticum* (Cloves)[11],*lemon fruit* extract [12] ,*vitis vinifira* extract [13] ,*Eucalyptus [14]* ,*Cassia alata [15]* ,*Centellaasiatica [16]* ,*Malva sylvestris*[17].

In present study we prepare copper nanoparticles from *Arevalanata* leaf extract, which is belongs to a family of *Amearamthus*, the anti microbial activities of synthesized copper nanoparticles was tested and characterization also done.

Experimental Work:

Materials and Methods

The chemical regents used in this experiment analytical grade were purchased from sri sai chemicals, Visakhapatnam, Andhrapradesh, India.

1. Collection of Leaves:

Arevalanata leaves were collected from agricultural lands of rural viallages of Visakhapatnam district in Andhra pradesh. the leaves were washed with tap water several times and then washed with distilled water 2-3 times to remove dust particles and then dried at room temperature for removal of residual moisture.

2. Preparation of Leaves Extract:

The dried leaves were cut into small pieces and take 10gm of small pieces in to 250ml Erlenmeyerconical flask and add 100ml of double deionized water was added and boiled for 20 min at 60^0C. After cooling, the extract was filtered using whatmann No. 1 filter paper and stored at 4^0C for further usuage. The colour of the extract was light brown.

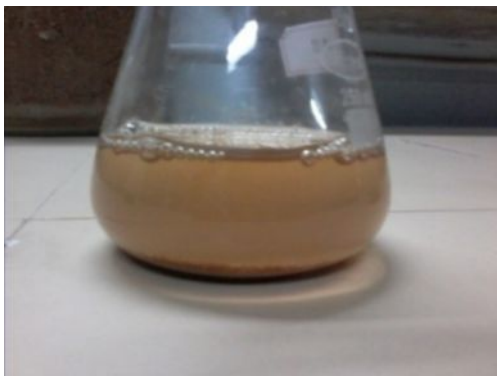


Figure1: Arevalanata leaves extract.

3. Preparation of Coppersulphate Solution:

Accurate amount of 1mm copper sulphate solution can be prepared by dissolving 0.0622gm of $CuSO_4$ in 250 ml of double distilled water and stored in clean, dried reagent bottle (chemicals used were of sigma grade, USA).

Figure2: copper sulphate solution.

4. Preparation of Copper Nanoparticles:

10ml of leaves extract was added to 90ml of 1mm copper sulphate solution solution, the colour of the solution changes from light brown to light green colour. Due to formation of copper nanoparticles the colour changes arises from the excitation of surface Plasmon vibrations with the copper nanoparticles. The resulting

solution was incubated 24 hours at room temperature. Then the mixture was centrifuged for 20 minutes at 10,000 rpm. The residue was dispersed in double distilled water to remove any unwanted material. The solution was filtered , dried at 60^0, stored for further characterization.

Figure3: Preparation of copper nanoparticles.

Characterization Techniques:

UV-VISIBLE absorption spectra were measured suing shima dzu uv-2203 doublem beam spectrophotometer. FTIR spectra were obtained withIR-prestige-21 shimaduz, FTIR spectrophotometer, using Kbr pellet method. SEM analysis of copper nanoparticles was one by using JSM-6610LV Machine.

Results and Discussions:

1.UV-Visible Spectral Study:

UV-Visible spectral study was carried out by using Shimadzu uv-2203 double beam spectrophotometer. The surface Plasmon vibrations of copper nanoparticles produced a peak at near 562nm.The wave length range which used in UV-Visible spectrophotometer is 450-650nm.

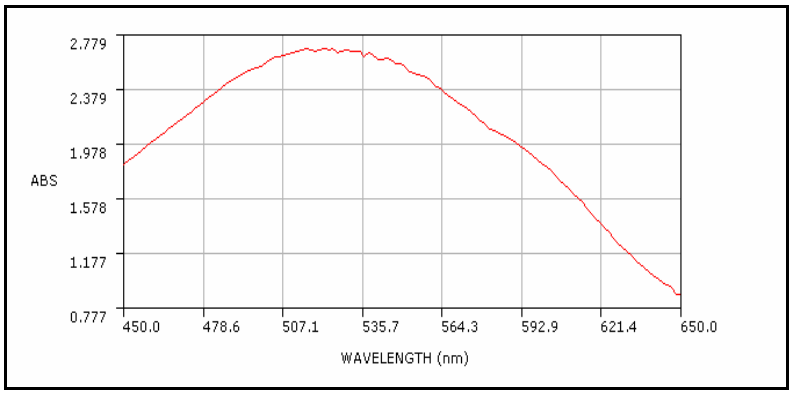


Figure4: UV-VISIBLE spectrum of copper nanaoparticles

2. FTIR Spectral Study:

FTIR spectrum was obtained by IR-prestige-21 Shimaduz, FTIR Spectrophotometer, using Kbr pellet method. The FTIR spectrum of copper nanoparticles, which are formed by leaves extract of *Arevalanata*. The measurements and spectrum was shown in figure5. The band at 3447cm^{-1} correspods to O-H stretching H-bonded alcohols and phenols.The bands at 1527cm^{-1},1546cm^{-1} corresponds toN-H bending of primary amines. the bands at 1054cm^{-1},1032cm^{-1},1016cm^{-1} corresponds to C-N stretching of amines, The peaks at 771cm^{-1},636cm^{-1} corresponds to C-H stretching. Therefore the synthesized nanoparticles were surrounded by proteins

and metabolites such as terpenoids having functional groups of alcohols, ketons, aldehydes, amines and carboxylic acids.

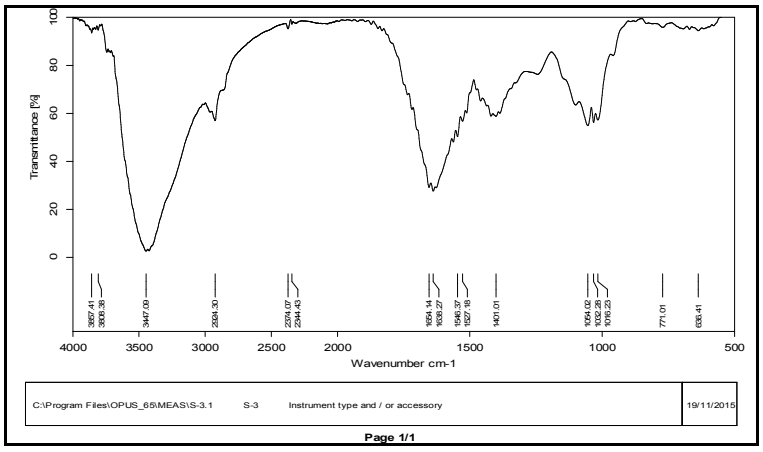
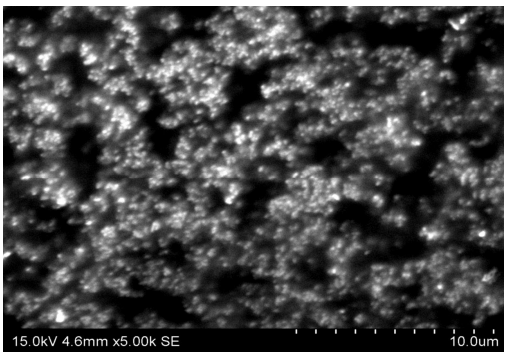


Figure5: FTIR spectrum of copper nano particles.

3. SEM Analysis:

SEM analysis of copper nanoparticles was done by using JSM-6610lv machine the scanning electron microscopic images indicated the spherical nature of copper nanoparticles and also morphology of the synthesized copper nanoparticles were identified. The copper nanoparticles were uniformly distributed on the surface of the film. Thin films of the samples were prepared by dropping a very small amount of the sample on glass plates and then allowed to dry at room temperature. It was shown that spherical and relatively uniform shape of the copper nanoparticles was confirmed in the range of 40-100nm.



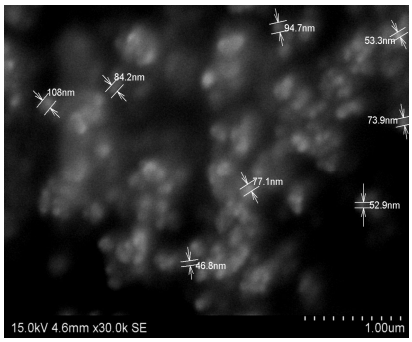


Figure6: SEM images of copper nanoparticles:

4. EDX Analysis:

From EDX spectrum, we confirm the copper nanoparticles formed by arevalanata leaf extract. the weight percentage of copper nanoparticles is more than 90% , remaining is sulphur and calcium impurities.

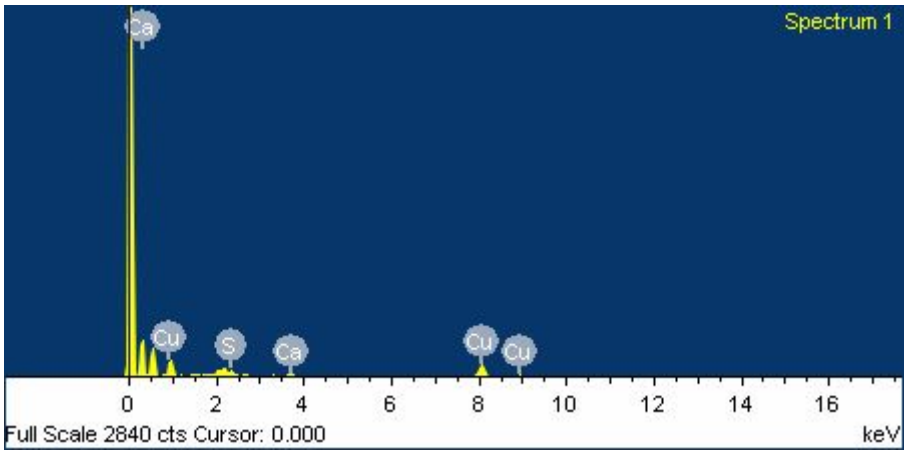


Figure7: EDX spectrum of copper nanoparticles.

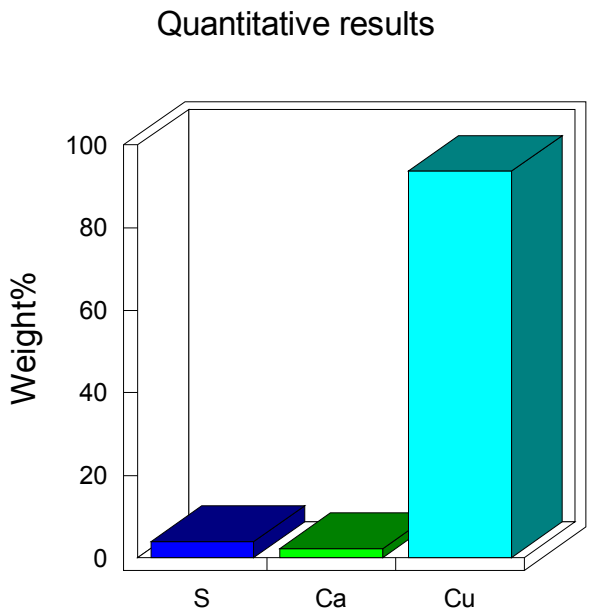


Figure8:Elemental analysis of copper nanoparticles.

4. Tem Spectral Analysis:

The tem images of copper nanoparticles, which are prepared from *areva lanata* leaves extract was shown in figure. These images clearly indicate that spherical morphology and crystalline structure. The average size of copper nanoparticles is 50nm.Which is good agreement with SEM images.

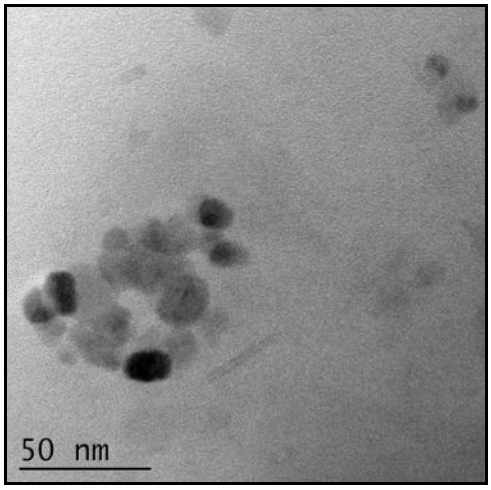
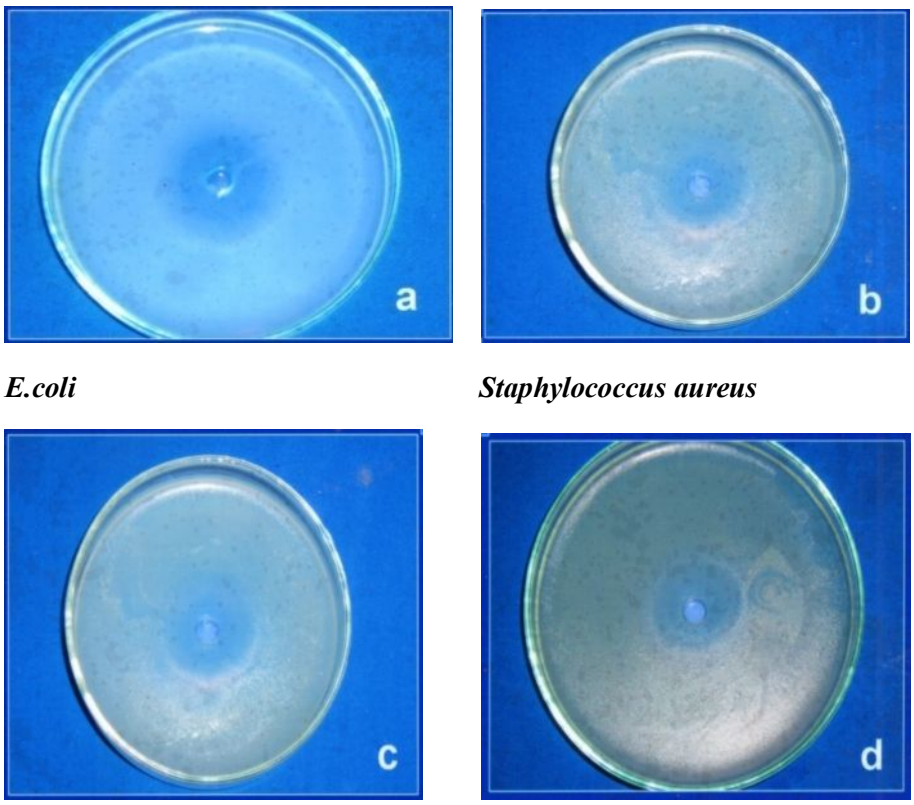


Figure 9: TEM image of copper nanoparticles

5. Antimicrobial Activities:

The anti bacterial activity of synthesized copper nanoparticles was tested against bacteria by zone inhibtion disc diffusion method. The particles showed good bacterial activity against *E.coli, Staphylococcus aureus, Bascillus cereus* and *Pseudomonas aeruginosa*.



E.coli ***Staphylococcus aureus***

Bascillus cereus ***Pseudomonas aeruginosa***

Figure 10: Anti bacterial activities of copper nanoparticles

Conclusion:

In the present investigation we observed that copper nanoparticles synthesized from *Areva lanata* leaves extract exhibited in light green colour in aqueous solution due to excitation of Surface Plasmon Vibrations. The absorption maximum observed at 435nm. The SEM results reveal that average size of copper nanoparticles was found as spherical shape and 40-100nm in size range. The average size of copper nanoparticles was 50nm, which was confirmed by TEM. The anti bacterial activity was tested by zone inhibition disc diffusion method.

Acknowledgement:

Authors are thankful to professor G. SusheelaBai, Department of Engineering Chemistry, College of Engineering(A), Andhra university for providing the facilities and giving her valuable suggestions.

References:

1. V.D.kulakarni, K.K.jare, P.D.patoles, S.B.rode, P.S.kulkarni,biosynyhesis of copper nanoparticles using aegle marmeloes leaf extract, Indian Streams Research Journal, ISSN:-2230-7850.
2. K. Saranyaadevi, V. Subha, R. S. Ernest Ravindran, S. Renganathan, Synthesis and Characterization of Copper Nanoparticle using *Capparis Zeylanica* leaf Extract,vol.6, No.10, pp 4533-4541, International Journal of ChemTech Research 2014, coden (USA): IJCRGG ISSN : 0974-4290.
3. Hyungsoo C., Sung-Ho P., Seedless Growth of Free-Standing Copper Nanowires by Chemical Vapor Deposition J. Am. Chem. Soc. (2004) 126(20), 6248–6249.
4. Huang L., Jiang H., Zhang J., Zhang Z., Zhang P, Synthesis of copper nanoparticles containing diamond like carbon films by electrochemical method Electro.Comm., (2006) 8(2), 262–266.
5. Aruldhas N., Raj C. P., Gedanken A., Synthesis, Characterization, and Properties of Metallic Copper Nanoparticles Chem. Mater., (1998) 10(5), 1446–1452
6. Hashemipour H., Rahimi M. E. Z., Pourakbari R. Rahimi P., Investigation on synthesis and size control of copper nanoparticle via electro chemical and chemical reduction method Int. J. Phys. Sci.,(2011) 6(18), 4331-4336.
7. Surmawar N. V., Thakare S. R., Khaty N. T., One-Pot, Single Step Green Synthesis of Copper Nanoparticles: SPR Nanoparticles International Journal of Green Nanotechnology, (2011) 3(4), 302–308
8. Honary S., Barabadi H., Gharaeifathabad E., NaghibiF., Green synthesis of copper oxide nanoparticles using *penicillium aurantiogriseum*, *penicilliumcitrinum* and *penicillium waksm*anii Digest Journal of Nanomaterials and Biostructures (2012) 7(3), 999 –1005.
9. R Subbaiya, M Masilamani Selvam. Green Synthesis of Copper Nanoparticles from *Hibicus Rosasinensis* and their antimicrobial, antioxidant activities. RJPBCS, (2015), 6(2), Page No. 1183, ISSN: 0975-8585.
10. Vasudev D. Kulkarni, Pramod S.Kulkarni, Green Synthesis of Copper Nanoparticles Using *Ocimum Sanctum* Leaf Extract, International Journal of Chemical Studies ,Volume 1 Issue 3, ISSN: 2321-4902.
11. Ipsa Subhankari and P.L. Nayak, Synthesis of Copper Nanoparticles Using *Syzygium aromaticum* (Cloves) Aqueous Extract by Using Green Chemistry, World Journal of Nano Science & Technology (2013), 2(1): 14-17, , ISSN XXXX-XXXX.
12. M. Jayandran, M. Muhamed Haneefaand V.Balasubramanian, Green synthesis of copper nanoparticles using natural reducer and stabilizer and an evaluation of antimicrobial activity, Journal of Chemical and Pharmaceutical Research, (2015), 7(2):251-259, ISSN : 0975-7384.
13. J.K.V.Mahavinod Angrasan and R. Subbaiya, Biosynthesis of Copper Nanoparticles by *Vitis vinifera* Leaf aqueous extract and its Antibacterial Activity, *Int.J.Curr.Microbiol.App.Sci,* ISSN: *2319-7706* Volume 3 Number 9 (2014) pp. 768-774.
14. R.V. kolekar, S.P.D.bhade, Rajiv kumar, Priyanka reddy, Rajivsingh, P.K.pradeep kumar, Biosynthesis of copper nanoparticles using aqueous extract of *Eucalyptus* sp. plant leaves, Current science, (2015), vol195,No2, 25July.

15. Jayalakshmi, A.Yogamoorthi, Green synthesis of copper oxide nanoparticles using aqueous extract of flowers of *Cassia alata* and particles characterization, International Journal of Nanomaterials and Biostructures (2014); 4(4): 66-71,ISSN 2277-385.
16. Henam Sylvia Devi, Thiyam David Singh, Synthesis of Copper Oxide Nanoparticles by a Novel Method and its Application in the Degradation of Methyl Orange, Advance in Electronic and Electric Engineering. ISSN 2231-1297, Volume 4, Number 1 (2014), pp. 83-88.
17. Awwad, A.M. Albiss, B.A, Salem N.M., Antibacterial Activity of synthesized Copper Oxide
18. Nanoparticles using *Malva sylvestris* Leaf Extract,MU Medical Journal,(2015) Volume – 2, No.1.

*****