Scientific Journal of Impact Factor (SJIF): 5.71
e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406
International Journal of Advance Engineering and Research Development
Volume 5, Issue 03, March -2018

Green Synthesis and Characterization of CuO nanoparticles from *Centella Asiatica (*Indian penny wort) LeafExtract

K.Ramya[a], S.Ravi.[b]

[A] *Department of Physics, Annamalai University, Annamalai Nagar 608002, India*
[B] *Department ofEngineering Physics (FEAT), Annamalai University, Annamalai Nagar 608 002, India*

Abstract:- *This paper gives an account of the combination of CuO nanoparticles (NPs) by the leaves concentrate of centellaasiatica plant in fluid medium through green blend and their portrayals regarding morphology, structure, and crystallinity and reactant properties. The use of plant leaves extract in the synthesis of nanostructured materials can be eco-friendly, non-toxic and cost effective approach. The leaf extract acts as both reducing and capping agent. The synthesized copper oxide nanoparticles are characterized byUV (Ultra Violet), FT-IR (Fourier Transform Infrared), XRD (X-ray Diffraction), and FE-SEM –EDX (Field Emission Scanning Electron Microscopy- Energy Dispersive X-ray), TEM (Transmission Electron Microscopy), and antibacterial activity studies. The formation of CuO nanoparticles will be confirmed by their XRD Spectrum. The FESEM images will give shape and size of nanoparticles.*

Keywords: *Nanoparticles, Green Synthesis, Centellaasiatica, TEM(Transmission Electron Microscopy) and X-Ray Diffraction technique (XRD).*

1. INTRODUCTION

Nanotechnology is developing as a quickly developing field with its application in science and innovation with the end goal of assembling new materials at the Nanoscalelevel [1-2].copper oxide nanostructures have pulled in huge consideration as a result of their extensive variety of utilizations, for example, high-Superconductors [3].The size and morphology of the nanoparticles impact their physical and synthetic properties to an expansive degree. Along these lines, incredible endeavors were committed for the creation of CuO nanostructures with various size and morphology. An assortment of techniques was intended for the blend of various measurements of CuO nanostructures with controlled size [4].The harmfulness and moderately high material cost of these strategies confined their utilization bitterly. So a basic, direct, and green course has been required for the planning of metal oxide nanoparticles. The electrochemical technique, a financially savvy and ingenious process has been accounted for the combination of metal oxide in Nano domains[5].The field of Nano science has been built up as of late as another interdisciplinary science which can be characterized overall learning on key properties of Nano-size items[6].Size and state of nanoparticles give an effective control over a large number of their physical and chemical properties [7].and their potential application in optoelectronics[8],recording media[9], detecting gadgets[10], medication[11] and catalysis[12].These properties are and will be used in a wide range of regions as in medicinal applications, data advances, vitality generation and capacity, materials, producing, instrumentation, ecological applications and security. There are couples of businesses that will get away from the impact of nanotechnology and therefore will it additionally influence our day by day life later on [13].Copper oxide nanoparticles, due to their incredible physical frequently do with anti-toxins [14]. Copper oxide nanoparticles have presents open doors for investigating the bactericidal impact wide applications as warmth exchange frameworks, antimicrobial of metal nanoparticles. The bactericidal impact of metal materials, super solid materials, sensors and impetuses. nanoparticles has been ascribed to their little size and Copper oxide nanoparticles are exceptionally receptive in view of high surface to volume proportion, and can without much of a stretch collaborate intimately with microbial layers.[15].Copper oxide nanoparticles have uncovered a solid antibacterial action and could diminish the microorganism focus by 99.9%. Because of the steadiness of copper nanoparticles can be utilized as a bactericide operator to coat healing center hardware[16].Copper oxide NPs have antibacterial movement, synergist properties, biocide properties and use in wound dressings, gas sensors, super conductors, sun based cells and warm conductivity and so on. In this paper CuO NPs is finished by utilizing*Centellaasiatica* (*C.asiatica*) dried leaves separate[17].This green amalgamation strategy have a few points of interest over different strategies to be specific cost viability, effortlessness, utilization of less temperature, the use of less poisonous materials, additionally it is perfect for restorative and nourishment applications[18-19]. In Green synthesis, the plant remove has been utilized as topping and diminishing specialist for the union of copper nanoparticles due to their decreasing properties exhibit in the leaf extract[20].The nanoparticles incorporated from plant concentrate were observed to be secured by the therapeutic properties of plant concentrate which could be utilized as a part of medication, directed medication conveyance and corrective applications[21][22].*Centellaasiatica*to Apiaceous family, Simple leaves with green leaf throughout in India. It is known in English as Indian Pennywort Leaf. The plant is traditionally used for treatment of Brain Benefits, Cancer Prevention, Liver Health [23].This methods, significant returns, enhanced selectivity, and cleaner responses of numerous microwave-induced natural changes offer extra points of interest [24]. Our progressing research program is pointed at growing ecologically benevolent manufactured techniques reasonable for natural aggravates that are generally utilized [25].

.

Plate: The leaf samples of *centellaasiatica*

2. Materials and Experiment

2.1 chemicals

All reagents used in the study were of analytical grade. Copper nitrate Cu (NO3)2 usedwas purchased from Sigma Aldrich, Pondicherry, India.

2.2 collections of plant samples

Leaves of *centellaasiatica* were purchased from local market, Chidambaram-Tamilnadu, India. The leaves were identified and authenticated by Dept. of Botany, AnnamalaiUniversity, and Annamalai Nagar.

2.3 preparation of leaf extract

The fresh leaves were washed with running tap water and also distilled water. 18g of leaves added in 100 ml distilled water, 800c boiled in water both for 15 min and after that cooling at room temperature. Finally, this extract was filtered through what Mann filter paper and stored at 4^0c for further synthesis.

2.4Synthesis of copper oxide nanoparticles

1mM of copper nitrate solution was treated with 30 ml of aqueous leaf extract and stirred magnetically at room temperature for 30 mints until the light blue color changes to light green color, which demonstrates the preparatory development of copper oxide nanoparticles. The mixture was placed in a pre-heated furnace at 400 ◦C for 3 hours. The black fine product was obtained and stored in an airtight glass container for further use.

3. Result and Discussion

3.1 FTIRanalysis

FTIR peaks showed spectra namely CuO NPs control synthesized CuO and*centellaasiatica* leaf aqueous extract fig (3.1).The phonon bonds at 529cm^{-1} and 868cm^{-1} relate to the extending vibration of cu-o bond in monoclinic cuo[26].The peak in the scope of 868 cm^{-1}-1000 cm^{-1} is credited to extending of cuo (M=cu)[27].The ingestion crest showing up at 1591 cm^{-1} and 3432 cm^{-1} of cuo could be connected to the vibrations of retained water and surface hydroxyl gatherings. The presence of noticeable IR groups almost 2500cm^{-1}-2000cm^{-1} is acclimated the arrangement of $CuONp_s$ from the green synthesis of leaves concentrate of *centellaasiatica* [28].

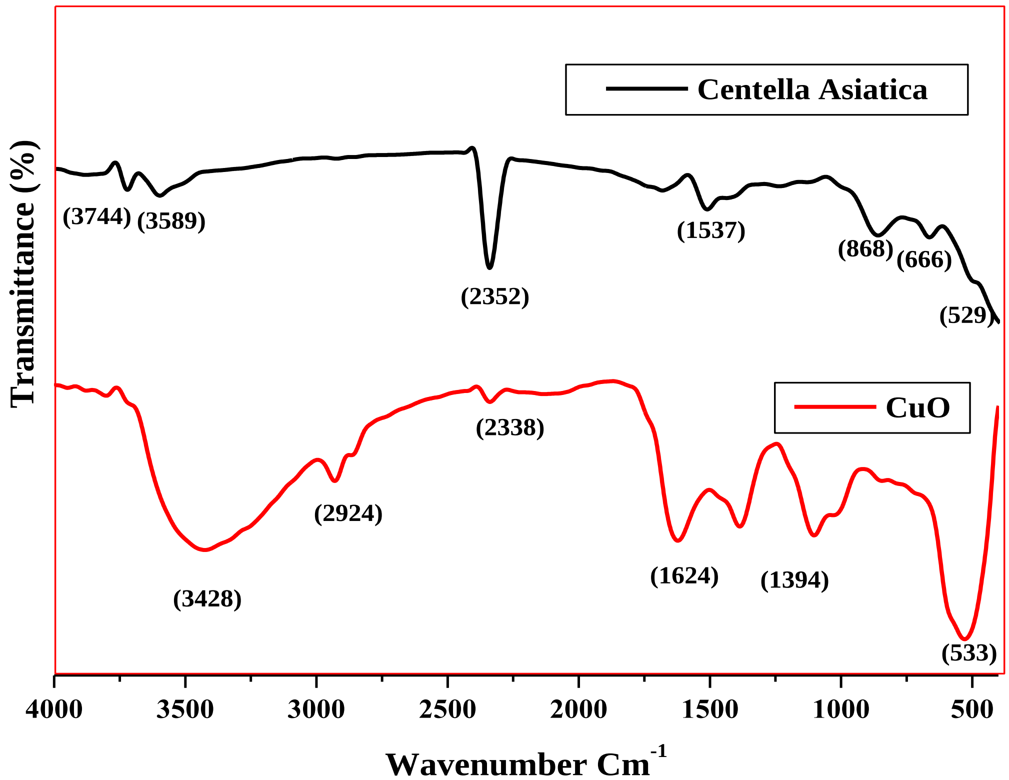

Fig 3.1: FTIR spectra of (a)*centella asiatica* leaf extract (b) biosynthesized CuO-NPs.

3.2 FESEM analysis and EDX study

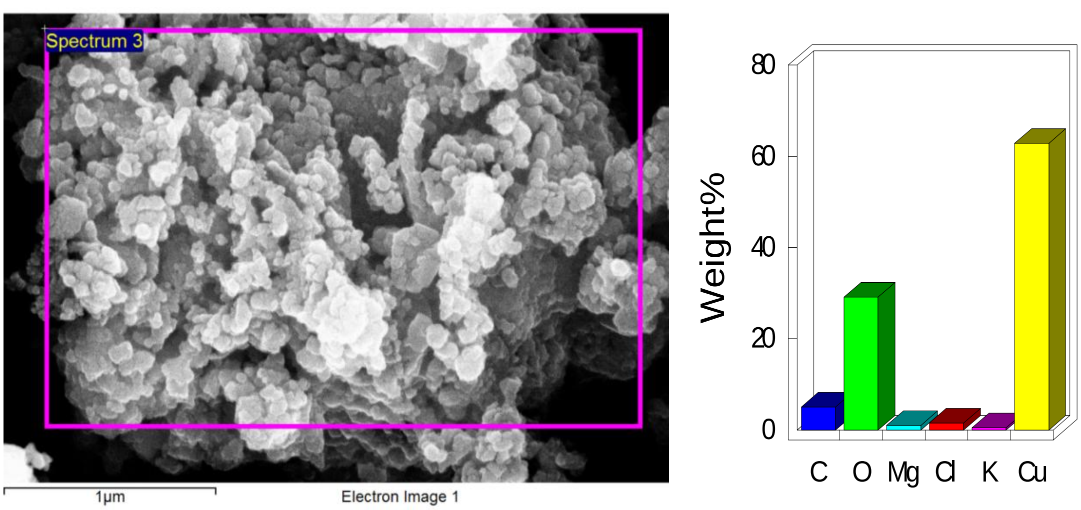

Fig 3.2: FESEM –EDXMorphological structure and elemental status of *Centellaasiatica*

From the FESEM image as appeared in fig 3.2(a), theCuONPsintroduce uniform and characterize of circular morphology [29].It is seen that green combination of cuoNPs creates the little and circular size of particles. The synthesis of combined CuONPs has been analyzed by exploring the Energy Dispersive X-ray spectroscopy (EDX),as shown in fig.3.2(b) [30].EDX range shows the main cu and o tops with no pollution peak, revealing that the integrated nanomaterial are made out of cu and o components. The quantitative information of the development of CuO rather than other copper oxide in the combined materials by green agglomeration of *centellaasiatica*leaf [31].

3.3 TEM analysis of CuONPs

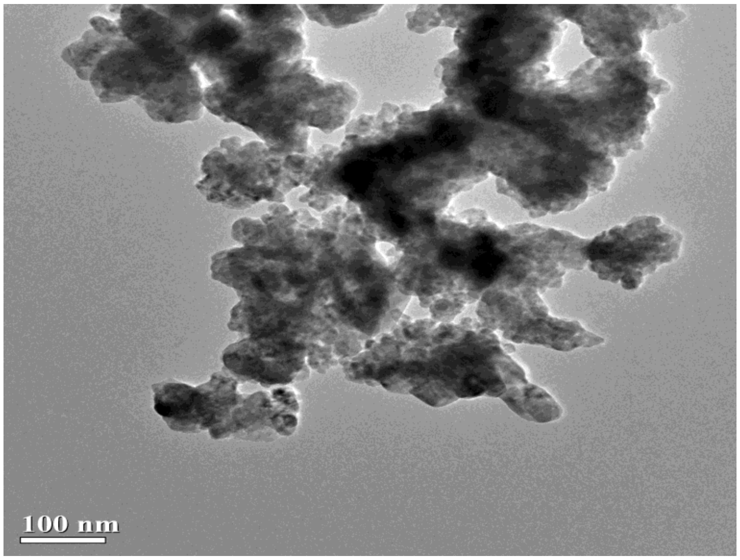

Fig 3.3:TEMimage of synthesized CuO nanoparticles

The morphology and microstructure of arranged items were additionally analyzed with TEM. [32].Fig 3.3 demonstrates a normal TEM picture of the integrated CuO nanoparticles. From the TEM picture it can be seen that the particles are almost round with moderately uniform. [33]

3.4 XRD studies

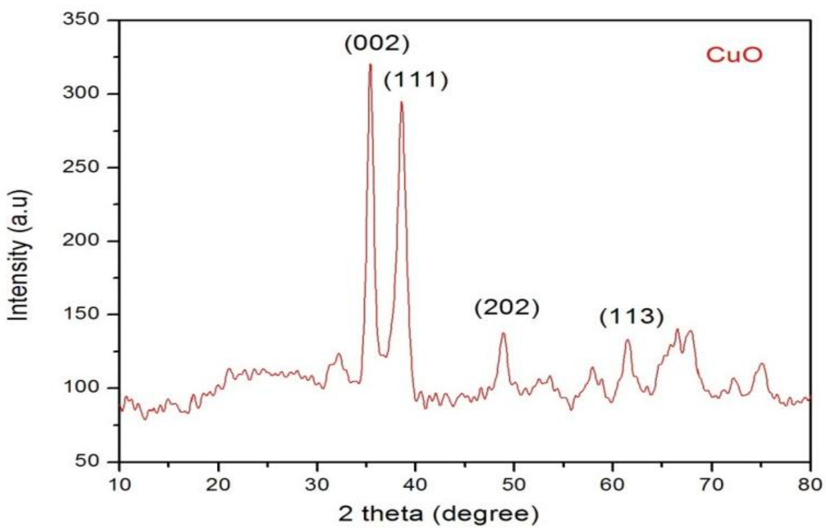

Fig 3.4:XRD analysis of copper oxidenanoparticles

The X-Ray Diffraction pattern of the CuO NPs synthesized using *centella asiatica* leaf extract is shown in fig 3.4.The XRD peak positions were dependable with the copper oxide and sharp peaks of XRD exhibit the crystalline structure. These are good agreement with those in the JCPDS card (Joint Committee on Powder Diffraction Standards, Card No, 05-667).The presence of (002), (111), (202) and (113) plans in XRD indicates the formation of pure monoclinic structure of CuO NPs [34].The strong intensity and thin width of CuO diffraction peaks show that the subsequent items were of very crystalline in nature. To decide the normal molecule size of the CuONPs, the

Debye-Scherer equation is utilized.

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

Where, D is the crystalline size of NPs, (FWHM) K is the Scherer constant with a value from 0.9 to 1.λ is the wavelength of the X-ray source (0.1541 nm) used in XRD, β is the full width at halfmaximum of thediffraction peak and θ is the Bragg's angle. According to Debye Scherer equation the average particle size [35].

3.5 UV-Vis spectral analysis

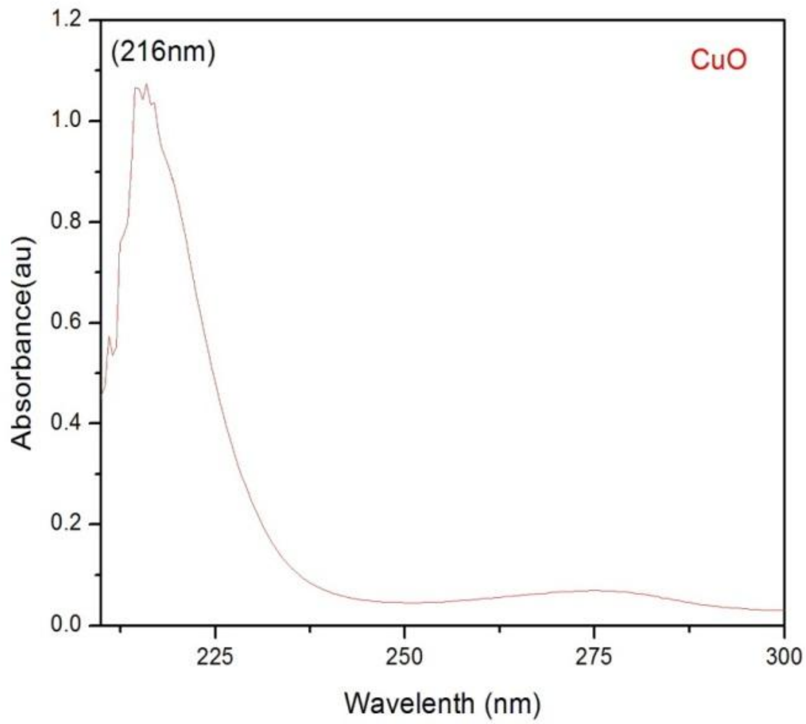

Fig 3.5:UV-VISspectra of CuO nanoparticles

The result obtained from UV-Visible spectroscopy analysis of the sample is presented in Fig 3.5. It is the most important method of analysis to detect the Surface Plasmon Resonance property of CuONPs [36].The CuNPs formation was confirmed from the peak at 216 nm, the peak value was found to be gradually decreased with increase in particle size. Copper SPR effects decrease with the time because of the oxidation of the synthesized copper nanoparticles [37]. UV Visible spectroscopy is an important technique to affirm the arrangement and soundness of metal nanoparticles in fluid arrangement [38].

3.6 Anti- Bacterial Studies

The presence of antibacterial activity on the synthesized CuO NPs was detected by the Disc Diffusion Method. The antibacterial studies of CuO showed reduced activity towards Gram positive and Gram negative bacteria [39]. Temperature affects the antibacterial activity of Copper oxide nanoparticles. At high temperatures, the antibacterial activity of both gram positive and gram negative bacteria as well as the zone of inhibition of the bacteria was found to be reduced [40].

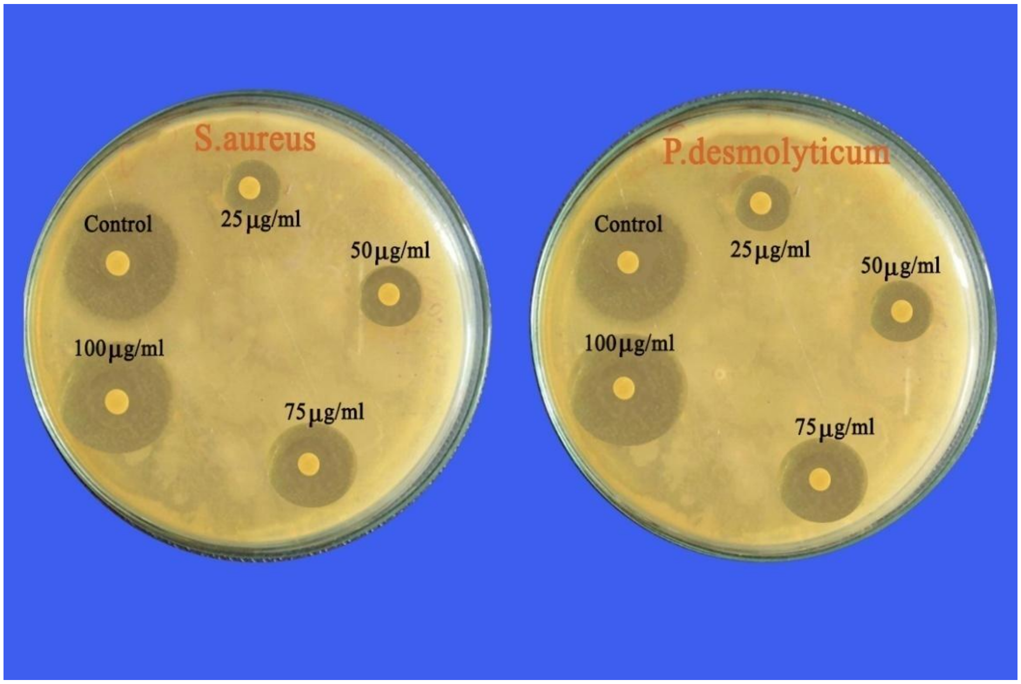

Fig 3.6:(a) S.aureus (b) P.desmolyticum

Conclusion

Synthesis of nanoparticles can be performed using a number of routinely used chemicals and physical methods. In this study, synthesis of copper oxide nanoparticles was conducted using an environmentally friendly mechanism in which aqueous leaf extract of *centellaasiatica*. We have developed an efficient, facile and economical method for the green synthesis of CuONPs using *centella asiatica* leaf extract as a reducing and stabilizing agent. A cost effective and an eco-friendly method were used to synthesize copper oxide nanoparticles with environmentally plant leaves extract of *centellaasiatica*. UV, FT-IR, FESEM and XRD studies confirmed the formation of copper oxide nanoparticles. The UV-Vis spectra analysis shows that the absorption values for $CuONp_s$was at 216 nm. Hence, they can find applications in textile industry and water treatment plants. Thus, the green synthesis provides advancement over chemical method as it is cost-effective, environment friendly, easily scaled up for large scale synthesis and there is no need to use high pressure, energy, temperature and toxic chemicals.

REFERENCES

1. Abdel Rahim SI, Almagboul AZ, Omer ME, Elegami A. Antimicrobial activity of *Psidium guajava L.* Fitoterapia 2002; 73: 713-715
2. Abdel Rahim SI, Almagboul AZ, Omer ME, Elegami A. Antimicrobial activity of *Psidium guajava* L. Fitoterapia 2002; 73: 713-715
3. T. Walker, P. Fang, D. Hoffmann, and R. S. Williamson,"Spin-polarized spontaneous-force atom trap".Physical Review Letters - Volume 69 Issue 15,
4. Chen H., Yang Z., Hu Y., Tan J., Jia J., Xu H., et al. (2016). Reference genes selection for quantitative gene expression studies in *Pinus massoniana* L. *Trees* 30 685–696. 10.1007/s00468-015-1311-3,
5. RishuKatwala, Harriet Kaur b, Gaurav Sharma a, Mu. Naushad c, *, Deepak Pathania a, * ''Electrochemical synthesized copper oxide nanoparticles for enhanced photo catalytic and antimicrobial activity" .Journal of Industrial and Engineering Chemistry 31 (2015) 173–184
6. G. B. Sergeev and T. I. Sabatini, "Cry chemistry of nonmetals," Colloids and Surfaces A:Physicochemical and Engineering Aspects, vol. 313, pp. 18-22, 2008.
7. A.P. Alivisatos, "Perspectives on the physical chemistry of semiconductor Nano crystals." The journal of physical chemistry. vol. 100 no. 31 pp. 13226-13239, 1996.
8. R. Jin, Y.W. Cao, C.A. Marking, K. Keechi, G.C. Schatz and J. Zhen, "Photo induced conversion of silver Nano spheres to Nano prisms, "Science, vole 294, no 5548, pp. 1901, 2501.

9. M.Han, x.Geo, J.z.ands.nie, Quantum m-dot-tagged micro beads for multiplexed optical coding of biomolecules, Nature biotechnology ,vole 19.no-7.,pp,631-635.,201
10. S. Sun, C. Murray, D. Weller, L. Folks and A. Moser, "MonodispergeFept nanoparticles and Ferromagnetic Feptnanacrystalsuperlattices, Science vol. 287 no. 5460, pp. 1989-1992, 2000.
11. M. J. Wang, "Nanoparticle-based electrochemical DNA detection, "AnalyticachimicaActa, vol. 500, no.1-2 pp. 247-257, 2003.
12. J.A Rojas – Chapala and M. Gorging. "Multi – Walled carbon nanotubes and metallic nanoparticles and their application in biomedicine "Journal of nanotechnology vol. 6. No. 2 pp. 316-321. 2006.
13. E.C.Wang and A.Z.Wang, Nanoparticles and their applications in cell and molecular biology, Integrative biology, vol.6, no.1, 2014.
14. AK / M Awed, Noida M. Green synthesis of silver Nanoparticles by *Mulberry* leaves Extract Nano science and nanotechnology 2012; 2(4): 125-128.
15. R. Narayanan and M.A. El-Saied, "Effect of Nano catalysis in colloidal solution on the tetrahedral and cubic nanoparticle shape electron-transfer reaction catalyzed by platinum nanoparticles. "The Journal of Physical Chemistry B. vol. 108 no. pp. 5726-5733, 2004.
16. Subhankari and P. Nyack, "Synthesis of copper nanoparticles using *syszygiumaromaticum* (cloves) Aqueous Extract by using green chemistry. "World vol 2. No. 1 pp., 14-17. 2013.
17. Dong M, Ma H, Zhang G, Chen Y, Zhang X, Cao X. 2017. A model for determining electromechanical response profile of ultrasonic transducers and ultrasonic transient echo ShengxueXuebao/ActaAcustica, 42:403-410.
18. Dong M, Ma H, Zhang G, Chen Y, Zhang X, Cao X. 2017. A model for determining electromechanical response profile of ultrasonic transducers and ultrasonic transient echo ShengxueXuebao/ActaAcustica, 42:403-410.
19. Chandra Kant Tagged, Sreekantha Reddy Dugasanic, RohiniAiyer, SunghaParkc, AtulKultarni, SushmaSabharwal. Green synthesis of silver nanoparticles and their application for the development of optical fiber based hydrogen peroxide sensor. Sensor and Actuators B 2013; 183: 144-149.
20. Christopher L. Kitchens, Douglas E. Hart, Scott M, Hudson, Alexey A, Vertexes. Synthesis, stabilization, and characterization of metal nanoparticles. The Graduate school of Clemson University 2010.
21. AKAwed, Noida M. Green synthesis of silver nanoparticles by *Mulberry* leaves extract Nano science and nanotechnology 2012; 2(4): 125-628.
22. AKAwed, Noida M. Green synthesis of silver nanoparticles by *Mulberry* leaves extract Nano science and nanotechnology 2012; 2(4): 125-628.
23. William C. Stevens, Robert M. Jones, Goninan Subramanian, Thomas G. Metzger, David M. Ferguson, and Philip S. Portuguese* **"**Potent and Selective Indolomorphinan Antagonists of the Kappa-Opioid Receptor "Journal of Medicinal Chemistry 2000 43 (14), 2759-2769.
24. MBM Reddy, S Ashoka, GT Chandrappa, MA Pasha,Nano-MgO: an efficient catalyst for the synthesis of form amides from amines and formic acid under MWI, Catalysis letters 138 (12),82-87.
25. M R M Bhojegowd, A Siddaramanna, A B Siddappa, C G Thiemann, M A Pasha, "Metal and silicon oxides as efficient catalysts for the preparative organic chemistry "he, 29 :1863,2011.
26. Xia J, Li H, Lou Z, Shi H, Wang K, Shu H, Yan Y , Microwave-assisted synthesis of flower- like and leaf-like CuO nanostructures via room-temperature ionic liquids Phys. Chem Solids 70:1461–1464.
27. P.C.Sharma and M.B. Yale and T.J. Dennis" Database on Medicinal Plants Used in Ayurveda":vol.1, (2008), 141-147.
28. HR Chime, R Chandra, S Kauirik. Evaluation of antipyretic activity of Calotropisgigantea (*Asclepiadaceous)* in experimental animals. Physiotherapy research 19 (5), 454-456, 2005.71, 2005.
29. VVT Pedal, M Carnie,"Green antibacterial", International Journal of Nano medicine 8, 889.
30. Jiao Y, Wang Y, Xue D, Wang J, Yan M, Liu G, Dong G, Zeng D, Lu Z, Zhu X,"Functional Conservation and Divergence among Homologs of *TaSPL20* and *TaSPL21*, Two SBP-Box Genes Governing Yield-Related Traits in HexapodWheat", Planting. 2017 Jun; 174(2): 1177–1191.
31. Kirtikar KR, Basu BD, Evaluation of anticonvulsant activity of hydro alcoholic extract of mussaendaphilippica on animals. Indian Medicinal Plants(2014): 46-50.
32. B. Fahmy, S.A. Cormier," Copper oxide nanoparticles induce oxidative stress and cytotoxicity in airway epithelial cells", In Vitro 23 (7) (2009) 1365–1371.
33. A Esfandiari, F Bakhtiari-Nejad, A Rahai, M Sanayei,Structural model updating using frequency response function and quasi-linear sensitivity equation, Journal of sound and vibration 326 (3-5), 557-573.
34. Mallikarjunaa K, Narasimhab G, Dillipa GR, Praveen B, Shreedharc B. Sreelakshmic C et al. Green synthesis of copper nanoparticles using *centella asiatica* leaf extract and their characterization digest, J. Nanometer. Instruct. 2011; 6(1): 181-186.
35. Tilaki R M, Iridized A and Mahdavi S M Effect of aging on copper nanoparticles synthesized by pulsed laser ablation in water: structural and optical characterizations, Bull. Mater. Sci., Vol. 34 No. 7, December 2011, pp. 1363–1369.

36. Rinks Vishnu Kurume, SandeshJaybhaye, AbhijeetSangle Synthesis of Copper / Copper Oxide nanoparticles in eco-friendly and non-toxic manner from floral extract of *Caesalpiniapulcherrima*, Volume: 4 Issue: 4 953 – 955.
37. Gopinath M, Subbaiya R. MasilamaniSelvam M, Suresh, D, Synthesis of copper nanoparticle from *centellaasiatica* leaf extract and its antibacterial activity. Int. J. CurrMicrobiol, App. Sci. 3 (9): 814-818 (2014).
38. Sharma, S.R., Aramid and N.S.Gajbhiuge, Geothermal, geochemical and tritium investigations in Grampian hot spring area, N.C.Hills, Assam,"Geaphys.Res.Bull.V.20 (4), pp.205-212.
39. N. P. S. Acharyulu, R. S. Dubey, V. SwaminadhamGreen Synthesis of CuO Nanoparticles using*PhyllanthusAmarus* Leaf Extract and their Antibacterial Activity against MultidrugResistance Bacteria.Vol. 3 Issue 4, April - 2014.
40. N. P. S. Acharyulu, R. S. Dubey, V. SwaminadhamGreen Synthesis of CuO Nanoparticles using*PhyllanthusAmara's* Leaf Extract and their Antibacterial Activity against MultidrugResistanceBacteria.Vol. 3 Issue 4, April - 2014.