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GREEN SYNTHESIS OF COPPER, SILVER NANOPARTICLES USING OCIMUM TENUIFLORUM LEAF EXTRACT

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ABSTRACT

Development of green nanotechnology is generating interest of researchers toward ecofriendly biosynthesis of nanoparticles. In this study, biosynthesis of stable copper nanoparticles were done using Ocimum tenuiflorum leaf extract. First we prepared leaf extract of Ocimum tenuiflorum in deionised water. This extract added to 1mMole of copper sulfate,silver nitrate solution and we observed the change in color of the solution from colorless to colored solution, this indicates that there is a formation of Cu nanoparticles. These biosynthesized Cu,siver nanoparticles were characterized with the help of Fourier transform infrared spectroscopy (FTIR).ultraviolet spectroscopy (UV) It was observed that the Ocimum sanctum leaf extract can reduce copper ions,and siver ions into copper,andsiver nanoparticles within 8 to 10 min of reaction time. Thus, this method can be used for rapid and ecofriendly biosynthesis of stable copper.siver nanoparticles.

KEYWORD: *Cu nanoparticles, silvernanoparticle, Ocimum tenuiflorum , Copper sulfate, silvernitrate biosynthesis.*

INTRODUCTION

In recent years, Nanotechnology has attracted many researchers from various fields like biotechnology, physics, chemistry, material sciences, engineering, medicine. Nanoparticles are synthesized by physical and chemical Methods, these are suffering from drawbacks like expensive reagent, hazardous reaction condition, longer time, tedious process to isolate nanoparticles. Hence, there is scope to develop new methods for the synthesis of nanoparticles which should be required inexpensive reagent, less drastic reaction condition and eco-friendly. In recent years, Cu,silver nano particles have attracted much attention of

researchers due to its application in wound dressings and biocidal properties.potential industrial use such as gas sensors, catalytic process, high temperature superconductors and solar cells In literature, the Cu nanoparticles are synthesized from (a) vapor deposition ,(b) electrochemical reduction, (c) radiolysis reduction, (d) thermal decomposition, (e) chemical reduction of copper metal salt and (f) room temperature synthesis using hydrazine hydrate and starch. In recent, green synthesis of Cu,silver nanoparticles was achieved by using microorganisms, plant extract . Ocimum tenuiflorum (local name Tulasi family) is a traditional medicinal plant of India has a source of bio-reduction and stabilizers. The constituent of Tulsi are alkaloids, glycosides, tannins, saponins and aromatic compounds. It is used in the treatment of headaches, coughs, diarrhea, constipation, worts, worms and kidney malfunctions. Recent interest on Ocimum has resulted from its inhibitory activity against HIV-1 reverse transcriptase and platelet aggregation induced by collagen and ADP22 (adenosine 5- diphosphate). Recently Ocimum tentueflorem leaf extracts have been used in the synthesis of silver nanoparticles and gold nanoparticles.

To the best of our knowledge, the use of Ocimum tenuiflorum leaf extract at room temperature for greener synthesis of Cu, silver nanoparticles has not been reported. Hence the present study was carried out to synthesize and characterize the copper nanoparticles,silver nanoparticle using Ocimum tenuiflorum leaf extract.

2. Experimental

2.1 MATERIAL

All the chemical reagents used in this experiment were of analytical grade purchased from Loba chemicals. The Ocimum tenieuflorem leaves were collected from in and around area.periyakulam.Thoroughly washed leaves (100 g) were cut and boiled with 100 ml of de-ionized water for 15 min in heating mental at temperature 80ºC. The resulting product was filtered and stored in refrigerator for further experiments.

2.2 METHODS

Synthesis of Cu,silver Nanoparticles Using Ocimum tenuiflorum leaf extracts For the Cu,silver nanoparticles synthesis, 1 ml of Ocimum tenuiflorum leaf extract was added to 100 ml of 1mM aqueous CuSO4.5H2O solution in a 250 ml Erlenmeyer flask. The flask was then kept overnight at room temperature in 2 days. The Cu,silver nanoparticles solution thus obtained was purified by repeated centrifugation at 12,000 RPM for 20 min followed by re-

dispersion of the pellet in de- ionized water. Then the Cu nanoparticles were dried in oven at 80ºC.

3. RESULTS AND DISCUSSIONS

3.1X-ray Diffract meter (XRD) Silver nanoparticles

X-ray Diffract meter XRD pattern of synthesized Silver nanoparticles using a leaf extract of Ocimum teneiue florem The XRD pattern shows a high crystallinity of silver sample level with diffraction angles of 23.4°, 27.9°, 32.3° and 44.3°, which correspond to the characteristic face centered cubic (FCC) of copper lines indexed in fig 3.1a at (111), (220), and (220),(311). respectively. The diffraction angle observed at 21.1° is related to the tulsi leaf extract medium. The size of the NPs obtained were estimated to be 68 nm using Debye-Scherrer Equation, which may indicate a high surface area, and surface area to volume ratio of the nano-crystals. The equation is written below.

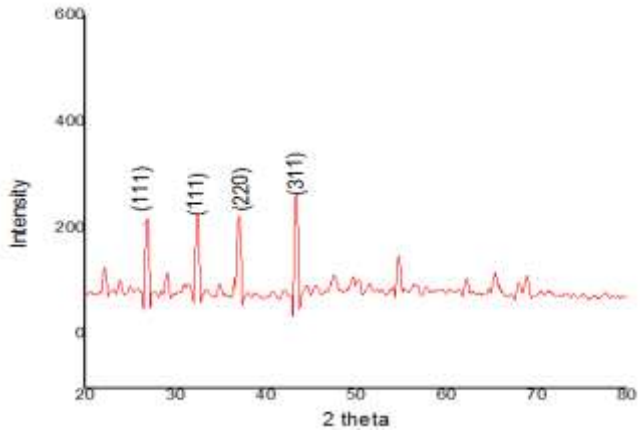
Wher

K, known as Scherer's constant (shape factor), ranges from 0.9 to 1.0

λis 1.5418 Å, which is the wavelength of the X-Ray radiation source,

β1/2 is the width of the XRD peak at half height and

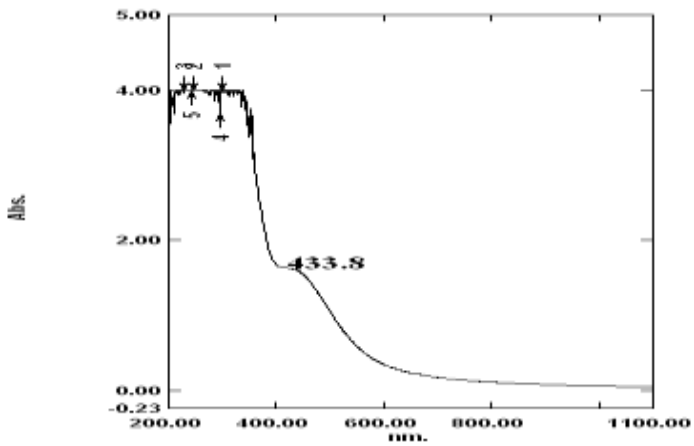
θ is the Bragg angle. **D=Kλ/βCOSθ**



3.1(a)

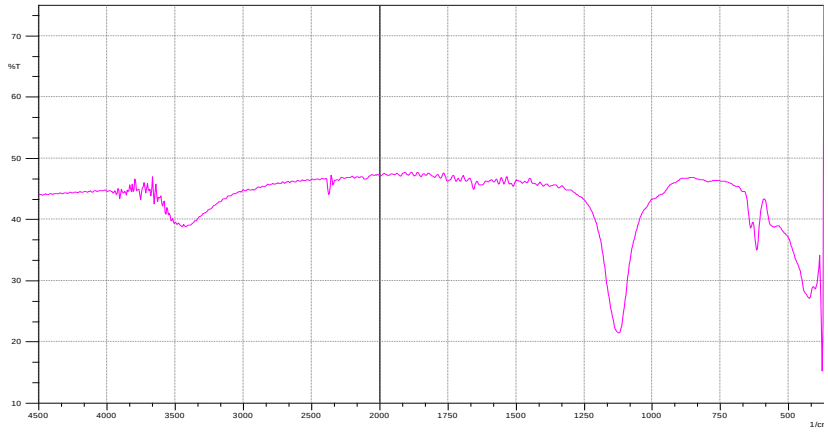
3.2 UV (ultra violet spectroscopy) silver

The uv spectroscopy was the prillimery technique for the charecterzation of the silver nanoparticle the uv absorbtion analyzed after centerfuging and redispensing the particle in de ionized water the maximum smooth and broad absorption peak was absorbed at 400 to 450 nm



3.3 (Fourier transform infrared spectroscopy) FTIR

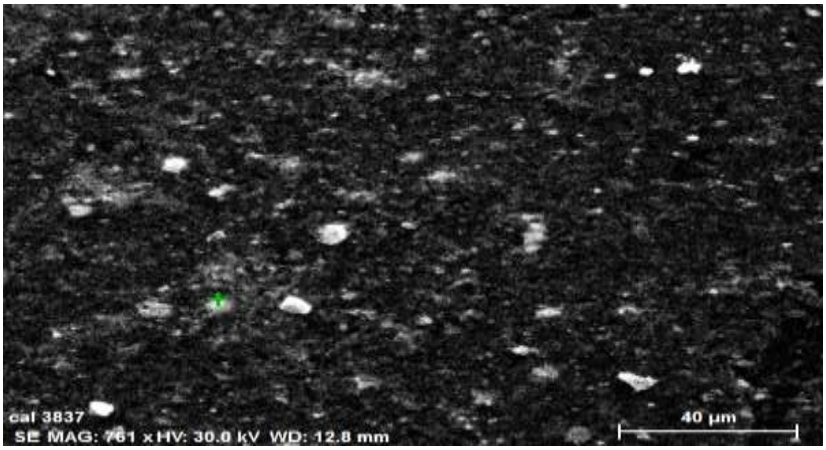
The FTIR spectrum of Ag nanoparticles The IR spectrum of Ag nanoparticles shows band at 3500 cm-1, , 2516 cm-1, 600 cm-1 , 1198 cm-1,486cm-1 C-I stretch correspond, N-H stretch (1per N-H bond),acytylenic C-H bend FTIR spectrum of Ag nanoparticles suggested that Ag nanoparticles were surrounded by different organic molecules such as alkyl halaides,amines,alkynes.



3.3(c)

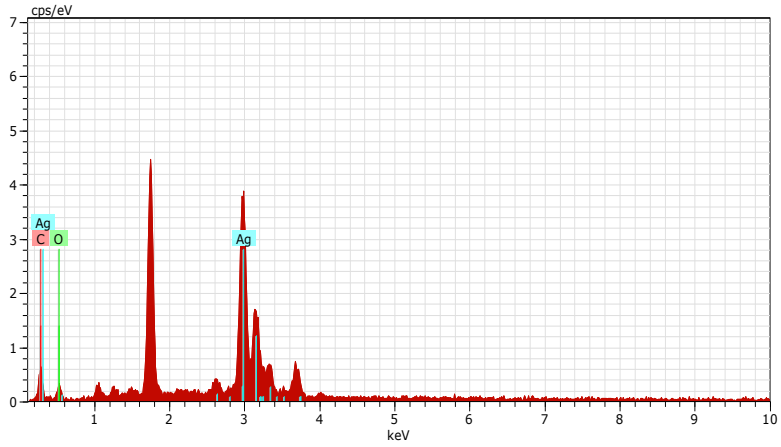
3.4 SEM (scanning electron microscope) silver

The surface morphology of the synthesized silver nanoparticles was examined by SEM micrographs. It is evident that the SEM micrographs show nano spherical structure of the synthesized silver nanoparticles.The prominent well-structured growth observed from the SEM micrographs of the fine particles confirms the development of the crystal structure of the silver nanoparticles. It may be noted that the grain size of silver nanoparticles fine powders esteemed from SEM is in good agreement with the particle size calculated from the XRD analysis.



3.5 EDAX (energy dispersive x-ray spectra) silver

Energy dispersive x-ray spectra displayed in diagram furnish the composition of various elements in the prepared sample.



3.6 X-ray Diffract meter (XRD) Copper

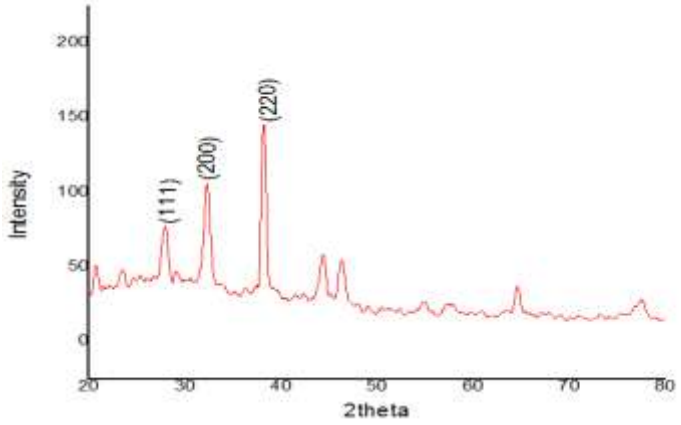
X-ray Diffract meter XRD pattern of synthesized Cu nanoparticles using a leaf extract of Ocimum teneiue florem The XRD pattern shows a high crystallinity of Cu sample level with diffraction angles of 22.4°, 23.9°, 32.3° and 43.3°, which correspond to the characteristic face centered cubic (FCC) of copper lines indexed at (111), (200), and (220), respectively. The diffraction angle observed at 21.1° is related to the tulsi leaf extract medium. The size of the NPs obtained were estimated to be 72 nm using Debye-Scherrer Equation, which may indicate a high surface area, and surface area to volume ratio of the nano-crystals. The equation is written below: in fig 3.4(d) Where

K, known as Scherer's constant (shape factor), ranges from 0.9 to 1.0,

λ is 1.5418 Å, which is the wavelength of the X-Ray radiation source,

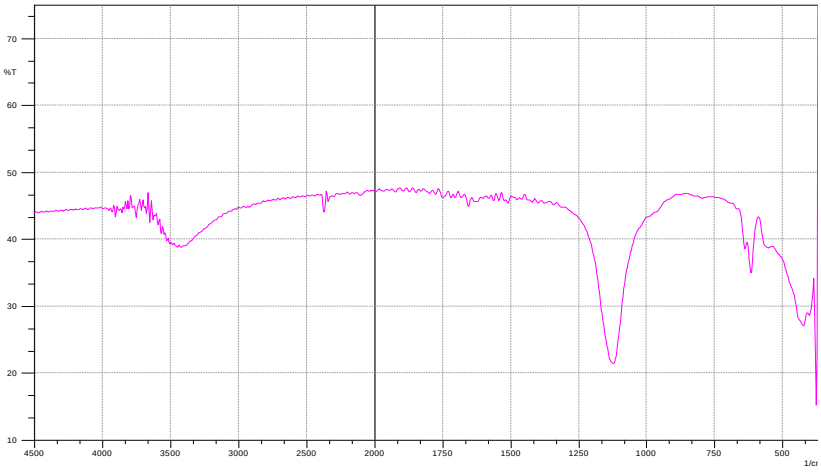
β1/2 is the width of the XRD peak at half height and

θ is the Bragg angle.



3.7 FTIR

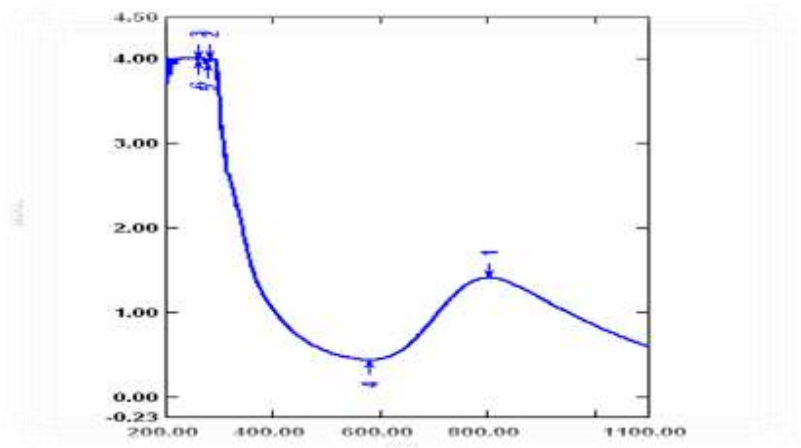
The FTIR spectrum of Cu nanoparticles The IR spectrum of Cu nanoparticles shows band at 4373 cm-1, 1235 cm-1, 2516 cm-1, 1376 cm-1 , 1198 cm-1 corresponds to O-H Stretching H-bonded alcohols and phenols, carbonyl stretching, N-H bend primary amines, corresponds to C-N stretching of the aromatic amino group and C-O stretching alcohols, ethers respectively. FTIR spectrum of Cu nanoparticles suggested that Cu nanoparticles were surrounded by different organic molecules such as terpenoids, alcohols, ketones, aldehydes and carboxylic acid.



3.8 UV (ultra violet spectroscopy) copper

The uv spectroscopy was the prillimery technique for the charecterzation of the cu nanoparticle the uv absorbtion analyzed after centerfuging and redispensing the particle in de

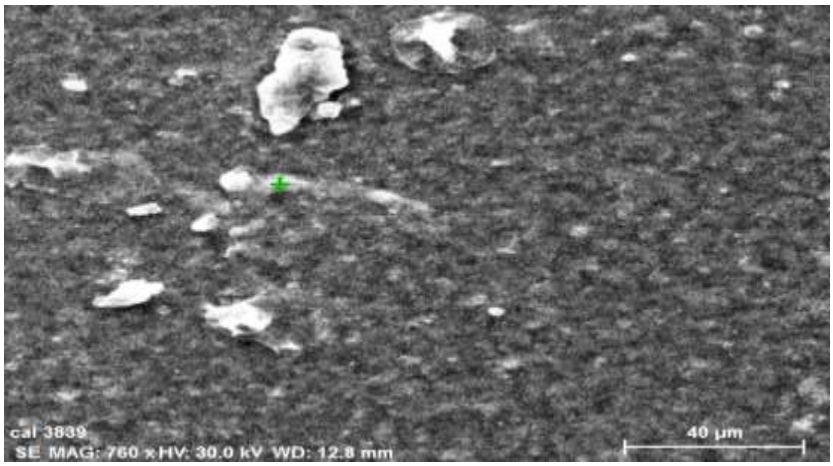
ionized water the maximum smooth and broad absorption peak was absorbed at 200 to 800 nm.



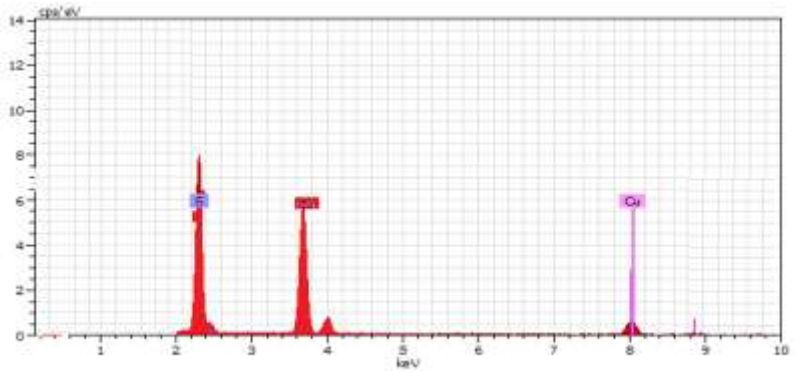
3.6(f)

3.9 SEM (scanning electron microscope) copper

The surface morphology of the synthesized cu nanoparticles was examined by SEM micrographs. It is evident that the SEM micrographs show nano sheet structure of the synthesized cu nanoparticles. The prominent well-structured growth observed from the SEM micrographs of the fine particles in fig 3.9(1c) confirms the development of the hexagonal wurtzite crystal structure of the cu nanoparticles. It may be noted that the grain size of cu nanoparticles fine powders esteemed from SEM is in good agreement with the particle size calculated from the XRD analysis.



4. EDAX (energy dispersive x-ray spectra) copper Energy dispersive x-ray spectra displayed in diagram furnish the composition of various elements in the prepared sample.



4. CONCLUSION

In conclusion, here we report eco-friendly synthesis of Cu,silver nanoparticles using leaf borth extract of Ocimum tenuiflorum . This method has merits over other reported methods are easily available starting materials, inexpensive and procedure is easy to carry out any laboratory, use of toxic reagent is avoided and pollution free.

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