Special Issue Published in International Journal of Trend in Research and Development (IJTRD), ISSN: 2394-9333, www.ijtrd.com

Green Synthesis of Copper Oxide Nano Particles Using Moringa Oleifera Leaf Extract

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Abstract- Synthesis and characterization of copper oxide nanoparticles (CuO) are under exploration due to its wide medical applications and various research interests in nano technology. The present investigation was made to synthesis copper oxide nanoparticles by using a medicinal plant moringa oleifera and copper sulphate ($cuso_4$). The structural charecterization of nano particles was carried out using XRD diffraction technique. The synthesized nano particles can be used for various applications due to its eco-friendly, nontoxic and compatibility for pharmacentical and other applications.

Keywords- *CuO nanoparticles; moringa oleifera; dislocation density;XRD;*

I.INTRODUCTION

Nanotechnology and nanoparticles based product and application are increased now a days in various fields like biotechnology, physics, chemistry, material sciences, engineering, and medicine. Copper oxide nanoparticles have been of great interest due to their excellent physical and chemical properties and low cost of preparation. CuO nanoparticles have wide applications viz. heat transfer systems, antimicrobial materials, super strong materials, sensors and catalysts and they are very reactive because of their high surface, volume ratio and can easily interact with other particles and better antimicrobial activities [1]. CuO nanoparticles have attracted much attention of researchers due to its application in wound dressings and biocidal properties [2] and potential industrial use such as gas sensors, catalytic process, high temperature superconductors and solar cells [3-4]. In previous reports, the CuO nanoparticles were synthesized from vapor deposition,electrochemicalreduction,thermal ecomposition, chemical reduction of copper metal salt at room temperature using hydrazine hydrate and starch [5-7]. In recent, green synthesis of CuO nanoparticles was achieved by using microorganisms and plant extracts [8-10]. CuO nanoparticles show potential antimicrobial effects against infectious organisms such as escherichia coli, bacillus subtilis, vibriocholerae, pseudomonas aeruginosa, syphilis typhus, and Staphylococcus aureus [14-15]. Moreover, these nanoparticles have drawn the attention of researchers because of their extensive applications in areas such as mechanics, optics, biomedical sciences, electronics, drug-gene delivery, catalysis, and photo-electrochemical applications [16-18]. A structural properties of CuO by leaf extract of moringa olefera is observed by XRD diffraction analysis for the first time.

II MATERIALS AND METHODS

A.Materials

The following analytical grade materials were used without further purification: copper sulphate($CuSO_4$). A.C.S. reagent (sigma-Aldrich, 99% Purity by wt) and the leafs of Moringa oleifera plant were collected from the Tirunelveli area, Tamilnadu during January 2017.

B Synthesis of copper nanoparticles

An amount of 0.03 M $CuSO_4$ solution was added to 70 ml of aqueous Moringa Oleifera leaf extract and mixed and then the solution was stirred in a magnetic stirrer for an hour. The gradual colour change of the reaction in solution from green to dark brownish green was observed with precipitate and which was filtered. Filtered precipitate was dried at100 c/hour. And then the as prepared sample was grinded (fig.1).

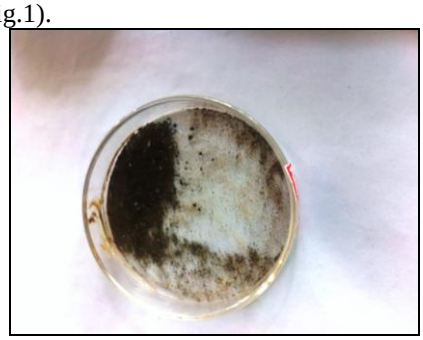

Figure : 1 As prepared sample of CuO nanoparticles

III. CHARACTERIZATION

The synthesized sample was characterized by the powder X-ray diffractometer With a CuKα radiation. CuO nanostructure was confirmed by the characteristic peaks observed in the XRD pattern (fig.2). The analysis was carried out 2θ value ranging from 10® to 80®, with step size 0.020. XRD analysis shows a series of diffraction peaks at 2θ of 16.12, 18.74, 22.25, 23.95, 27.18, 29.25, 31.59, 32.58, 44.71, 47.72, which are assigned to the (020), (103), (004), (111), (222), (311), (133), (110), (008), and (301) planes of orthorhombic CuO (JCPDS- 771898)respectively. All diffraction peaks can be indexed as typical orthorhombic structure. Tthe average crystalline size of CuO nanoparticles was calculated using Scherrer formula and indicating nano crystalline natures. The results of the present study indicated the successful preparation of CuO nanoparticles from moringa olefera leaf extract.

IV RESULT AND DISCUSSION

The average crystalline size (D) has been calculated from the line broadening using the following Debye-Scherrer's relation.

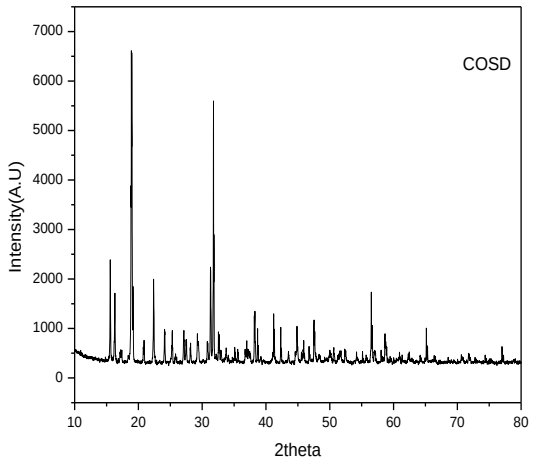

Figure :2 XRD pattern of $CuSO_4$ sample

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

Where k is the scherrer constant, accounts for the factor.

K is 0.9λ is the wavelength of X-ray,

β is the " full width at half maximum(FWHM) in radians of the X-ray diffraction peak

θ is the Bragg's angle.

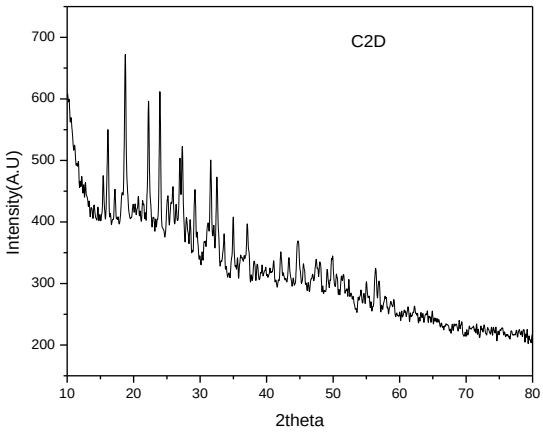

Fig .3 XRD pattern of CuO NPs

By using Williamson- Hall analysis (W-H), crystal sizes along with strain associated due to lattice dislocation can be determined from XRD data.The proposal efficient method for separation of strain and size effects on broadening is looking at the peak width as a function of diffracting angle 2θ. The modified W-H is expressed as follows

$\beta\cos\theta=(k\lambda/D)+(4\varepsilon \sin\theta)$

where, D is the average crystallinesize size and ε is the strain and assumed to be uniform in all crystallographic directions.The average size of synthesized nanoparticles is found to be (D)=13.93nm

The above equation is in the form of straight line equation where the term $\beta\cos\theta$ was plotted against $4\sin\theta$ for the preferred orientation peaks of the prepared samples. From uniform and Stress deformation model the strain and slope are extracted. Accordingly, the slope and y-intercept of the fitted line represent strain and particle size, respectively.

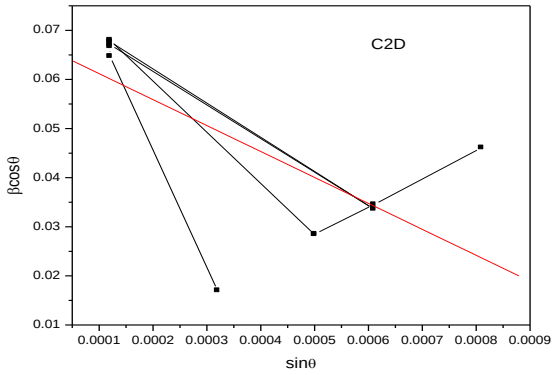

Figure: 4 Hall Williamson plot for CuO NPs

CONCLUSION

For the first time we report green synthesis of CuO nanoparticles using moringa oleifera leaf extract. From XRD analysis we have calculated the average crystallite size 13.74nm with orthorhombic phase of CuO. Missing of some peaks in XRD pattern of CuO compare to XRD pattern of $CuSo_2$ may be due to reduction of sulphur by the agent of leaf extract of moringa oleifera plant.

Acknowledgment

The authors are thankful to the management of Sadakathullah Appa College Tirunelveli for the providing facilities to do the present research. Manonmanium Sundaranar University, Tirunelveli is acknowledged with gratitude for their research supports.

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