# Green Synthesis of Copper and Lead Nanoparticles using ZingiberOfficinale stemextract

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***Abstract-*** The green synthesis of Copper and Lead nanoparticles were synthesized using ZingiberOfficinale stem extract. The stem extract acts as both reducing and capping agent. The synthesized Copper and Lead nanoparticles were confirmed by the change of colour after addition of stem extract into the Copper Sulphate and Lead Sulphate solution. The biosynthesized Copper and Lead nanoparticles were characterized by using UV-Visible analysis, X-ray diffraction analysis (XRD), Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray analysis (EDX). From UV-Visible analysis, Copper and Lead nanoparticles shows the characteristic absorption peak at 208nm and 239nm. From the XRD, it was found that the average particle sizes of both nanoparticles were found to be 3nm.

***Index Terms***- Bio-reduction, ZingiberOfficinale,XRD,SEM

## I. Introduction

Nanotechnology plays a very important role in modern research [1], it is the most capable technology that can be applied almost all fields such as pharmaceutical, electronics, health care, food and feed, biomedical science, drug and gene delivery [2], chemical industry, energy science, cosmetics, environmental health [3], mechanics and space industries. It has also been utilized for the treatments of infection [4], cancer, allergy, diabetes and inflammation [5].Green chemistry is an implementation, development, design of chemical Products and processes to minimize the use of hazardous to environment.

Green synthesis method was found to be the best method when compared to the other method such as chemical reduction, photochemical reduction, electrochemical reduction, heat evaporation etc., [6].This green synthesis method have several advantages over other methods namely cost effectiveness, simplicity, use of less temperature, the usage of less toxic materials, moreover it is compatible for medical and food applications [7]. Many researchers used green synthesis methods for different metal nanoparticles due to their growing need of eco-friendly properties [8].

The metal nanoparticles are focused mainly for the research work due to their potential applications in different fields such as magnetic recording media or micro electronics [9], catalysis, nanosensors, nanoelectronics, optoelectronics and information storage devices [10]. Copper is most widely used material in the world due to their electrical, optical, catalytic, biomedical and antifungal/antibacterial applications among various metal particles such as gold, silver, iron, palladium, zinc and quantum dots [11]. It can give more yields and reaction rate in mild reaction conditions when compared to other traditional catalysts .PbS nanoparticles possess unique electrical and optical properties [12]. They exhibit quantum confinement below a certain size threshold called, quantum size effect that allows their optical and electrical properties to be precisely tuned with size [13].

Various plants were used for the synthesis of nanoparticles using green synthesis method. In this present investigation, ZingiberOfficinaleto the family of Zingiberaceaecommonly known as Ginger. Ginger is a tropical plant that has green-purple flowers and an aromatic underground stem (called a rhizome). It is commonly used for cooking and medicinal purposes. Ginger contain potentially active chemical constituents such as Phenolic compounds (shogaols and gingerols),Sesquiterpenes,6-dehydrogingerdione, galanolactone, gingesulfonic acid, zingerone, geraniol,monoacyldigalactosylglycerols and ginger glycolipids[14]. ZingiberOfficinalewas reported to hold antioxidant, antimicrobial, anti inflammatory and immunostimulantactivity [15].Ginger is used as a folk or traditional remedy for post surgerynausea, joint and muscle pain.

**Plant Description:**
Bionomial Name - GingiberOfficinale
Common Name – Zinger
Plant part taken - Stem
Family Name – Zingiberacea

## II. Materials and Methods

All reagents are in AR standards, deionised water was utilized for this process. Filtration was established by using Whatmann No.1 filter paper.

**Preparation of GingiberOfficinale extract**

The extracts were prepared by taking 50gms of GingiberOfficinale stem. These were thoroughly washed with distilled water and cut down into fine pieces and grinded in a mortar and pestle. Theaqueous extract was filtered through the Whatmann No.1 filter paper and the filtrate was stored at $4^0$c for further experiments.

**Synthesis of Nanoparticles**

5ml of GingiberOfficinale extract was treated to 10ml of 0.1M aqueous solution of Copper sulphate and Lead sulphatethen stirring continued for 1minute at room temperature. The solution was changed from yellow to greenish blueand yellow to dark fellow which indicates the formation of Copper and Lead nanoparticles.

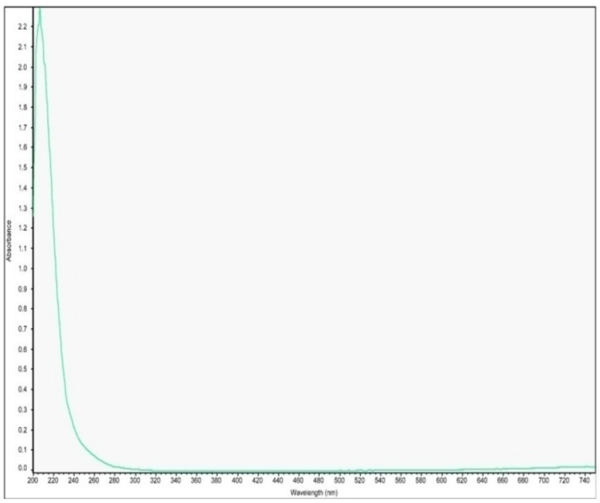
**Characterization**

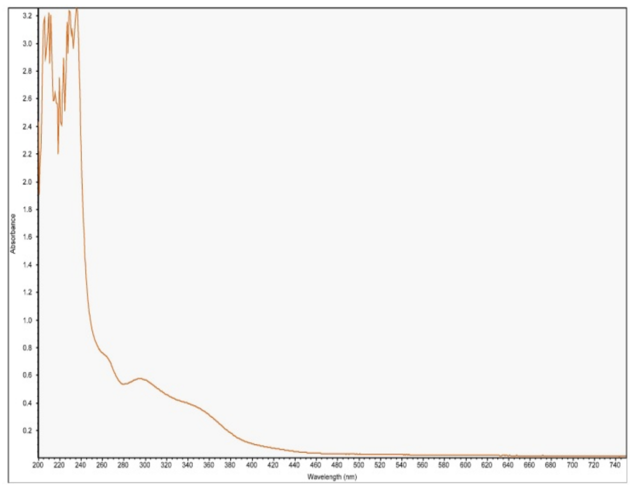
The formation of nanoparticles was confirmed by UV-Visible spectroscopy using Jasco V-550 spectrophotometer instrument. Size of the Copper and Lead nanoparticles was analysed with UV-Spectrometerin the range of 208nm and 239nm. The crystalline structure of the nanoparticles were determined by X-Ray diffraction analysis using Rigaku X-Ray diffractometer (Miniflex, UK) instrument operating at 40 kV with 2sec time interval at room temperature 27ºC. Morphology and mean particle size of the Copper and Lead were determined by SEM analysis. The elemental composition in the reaction mixture was determined by EDX analysis.

## III. Results and Discussion

**UV-Vis spectroscopy analysis**

The result obtained from UV-Visible spectroscopy analysis of the sample is presented in **Fig.1.**It is the most important method of analysis to detect the Surface Plasmon Resonance property of nanoparticles. The Copper and Lead nanoparticles formation was confirmed from the peak at 208nm and 239nm.





(a) (b)

**Fig. 1: UV- Visible spectrum of (a) Copperand (b) Leadnanoparticles**

**XRD analysis**

Using XRD spectrum analysis, diffraction peaks obtained at 2θ values of $32.14^0$, $22.25^0$ and $18.84^0$ corresponds to (111) (101) and (011) for Copper nanoparticles. For Lead nanoparticles, 2θ values of $38.14^0$, $19.72^0$ and $32.38^0$ corresponds to (111) (100) and(211).To determine the average particle size of the nanoparticles, the Debye-Scherrer equation is used.

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

Where,

D is the crystalline size of NPs

K is the Scherrer constant

λ is the wavelength of the X-ray

β is the full width at half maximum of the diffraction peak

θ is the Bragg's angle.

According to Debye Scherrer equation the average particle size of Copper and Lead nanoparticles was found to be 3nm.

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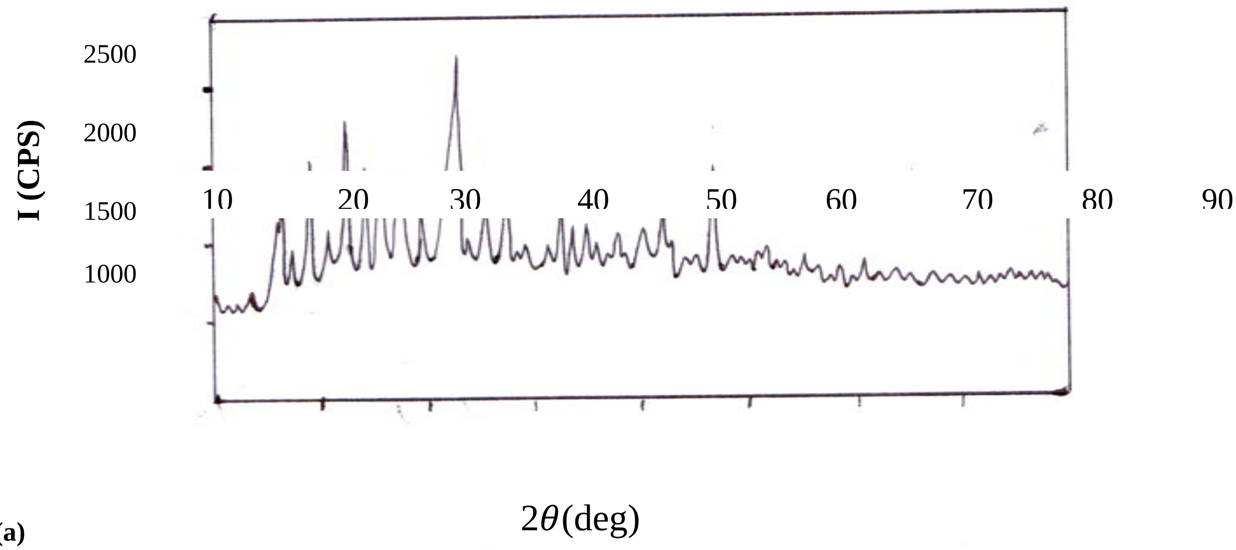
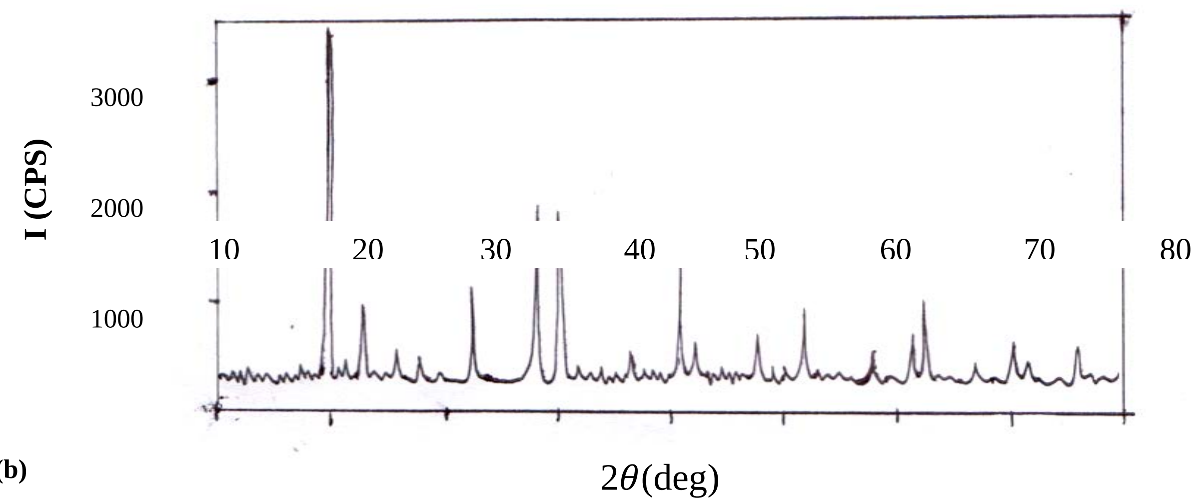



**(a)**

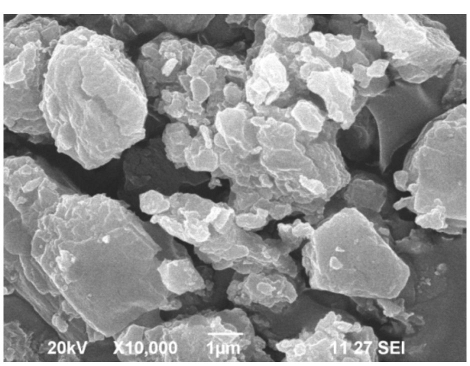


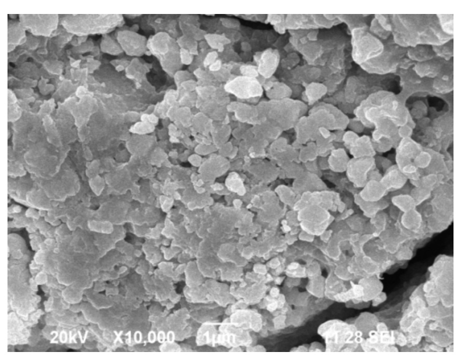

**(b)**

**Fig.2 XRD analysis of (a) copperand (b) Lead nanoparticles**

**SEM analysis**

The surface morphology of the nanoparticles was obtained by Scanning Electron Microscopy (SEM) analysis. The **Fig. 3**shows the nanoparticles synthesized by the stem extract of ZingiberOfficinale. It was shown that spherical and relatively uniform shape of the Copper and Lead nanoparticles.

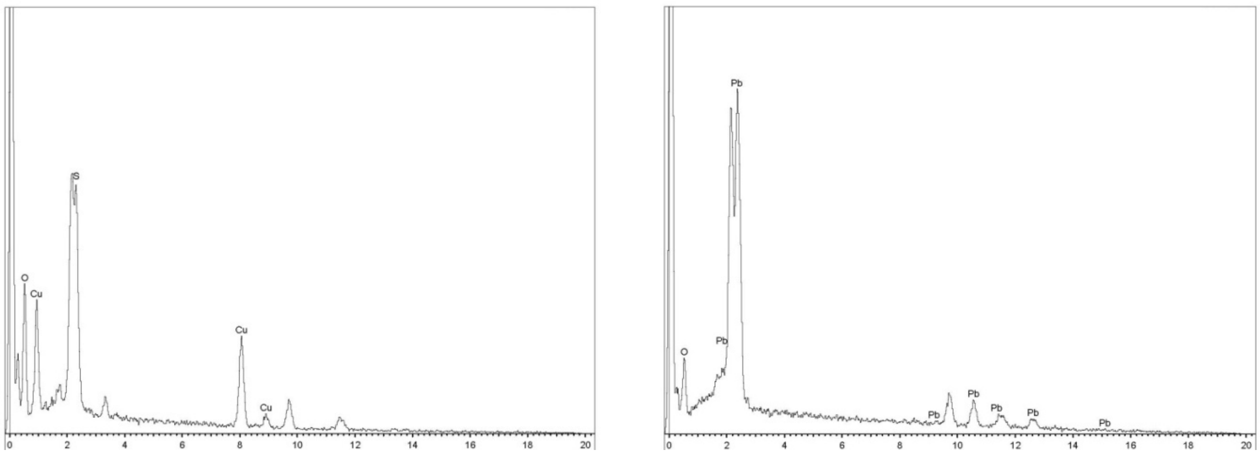



**(a)** **(b)**

**Fig.3: SEM analysis of (a) copperand (b) Lead nanoparticles**

EDX analysis data confirms the main components of the materials. The weight percentage of Copper and Lead nanoparticles are synthesized using Zingiberofficinale extract is 49.28 % and 66.91 % shown in **Fig. 4**




**(a)** **(b)**

**Fig.4: EDX analysis of (a) copperand (b) Lead nanoparticles**

## IV. Conclusion

The Copper and Lead nanoparticles were successfully synthesized by using GingiberOfficinale stem extract, which provides cost effective, easy and proficient way for synthesis of nanoparticles.The synthesized Copper and Lead nanoparticles were analyzed using UV-spectrophotometer, SEM with EDAX and XRD. The GingiberOfficinale may be effectively utilized for the production of Copper and Lead nanoparticles with economically for many pharmaceutical applications. By UV-Visible spectrophotometer, the SPR band observed at 208nm and 239nm for Copper and Lead nanoparticles. XRD analysis shows the particle size of 3nm for both Copper and Lead nanoparticles. The surface morphology and main component of the material examined using SEM-EDX analysis.

## References

[1] Sougata Ghost, SumersingPatil,MehulAhire,RohiniKittture, "Synthesis of gold nanoparticles using DioscoreaBulbifera Tuber extract", *Hindawi Publishing Corporation*,2011,3Article ID354793.

[2] De Jong WH, Borm PJA, "Drug delivery and nanoparticles: application and hazards", *Int. J.Nanosci*.2008, 3,133-149.

[3] Sahoo SK, ParveenS,Panda JJ, "The present and future of Nanotechnology in human health care",*Nanomedicine*., 2007,**3**,20-31.

[4] GebreselemaGebreyohanneand MebrahtuGebreyohannes, "Medicinal values of garlic: A review",*IntJ of Medicine and Medical Science*, 2013, vol.5 (9), 401-408.

[5] AK Khan, R Rashid, G Murtaza and A Zahra,"Gold Nanoparticles: Synthesis and Applications in DrugDelivery**",**Tropical Journal of Pharmaceutical Research July 2014, 13 (7), 1169-1177.

[6] G. Caroling1, M. Nithya Priyadharshini1, E. Vinodhini1, A. Mercy Ranjitham1, P. Shanthi,"Biosynthesis Of Copper Nanoparticles Using Aqueous Guava Extract –Characterisation And Study Of Antibacterial Effects ", *Research Article Biological Sciencesijpbs* ,Volume 5, Issue 2,25-43.

[7] "Sunscreen",U.S.Food and Drug Administration

[8] MonalisaPattanayak and Nayak P L, "Ecofriendly Green Synthesis of Iron nanoparticles from various plants and spices extract, 2012, vol 3, 68-78.

[9] Saranyaadevi K, Subha V, Ernest Ravindran R.S and Renganathan S, "Synthesis and characterization of Copper Nanoparticle using CapparisZeylannica leaf Extract, 2014, vol.6, No.10.

[10] Bo Hu, Shang-Bing Wang and Kan Wang, "Microwave- Assisted Rapid Facile "Green" synthesis of uniform Silver nanoparticles: Self-Assembly into Multilayered Films and their optical properties", *J.Phys.Chem.C*, 2008, 112, 11169-11174.

[11] P.K. Khanna P.K, Gaikwad. S, Adhyapak P.V, Singh N, Marimuthu R. Synthesis and characterization of copper nanoparticles: Materials Letters 61 2007; 4711–4714.

[12] K.V. Pavani, N. Sunil Kumar and B.B. Sangameswaran, "Synthesis of Lead Nanoparticles by Aspergillus species", *Polish Journal of Microbiology*, 2012, **Vol. 61**, No. 1, 61–63.

[13] S. D. Meshram, R. V. Rupnarayan, S. V. Jagtap,V. G. Mete, V. S. Sangawar, " Synthesis and Characterization of Lead Oxide Nanoparticles",*International Journal of Chemical and Physical Sciences*, 2015, ISSN:2319-660 ,**Vol. 4**.

[14] Kathi J. Kemper MD, "Ginger (Zingiberofficinale)", 1999, 1-18.

[15] Shirin Adel PR and JamunaPrakash, "Chemical composition and antioxidant properties of ginger root (Zingiberofficinale)",*Journal of Medicinal Plants Research* ,2010,**Vol. 4**(24), pp. 2674-2679, 18.

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