Development & Its characterization of Copper Nanoparticles Using Natural source.

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ABSTRACT

Nanotechnology is mainly concerned with synthesis of nanoparticles of variable sizes, shapes, chemical compositions and controlled dispersity with their potential use for human benefits. The subject nanotechnology deals with manufacturing, study and manipulation of matter at nano scale in the size range of 1-100 nm which may be called as nanoparticles. Development of green nanotechnology is creating interest of researchers towards eco- friendly biosynthesis of nanoparticles. Biomolecules present in plant extracts can be used to reduce metal ions into nanoparticles in a single-step green synthesis process. Tulasi (Ocimum sanctum L.) is an aromatic plant belongs to family Lamiaceae. Tulasi is a traditional medicinal plant of India, having good source of bio-reduction and stabilizers. The constituent of tulasi are alkaloids, glycosides, tannins, saponins and aromatic compounds and also it contains minerals like Ca, Mn, Cu, Zn, P, K, Na, and Mg where the concentration of Cu is more in tulasi leaves than other leaves. It constitutes 12.31 mg/kg of Cu. Recently Ocimum sanctum L. leaf extracts have been used in the synthesis of silver nanoparticles and gold nanoparticles. Tulasi is a source of bio-reduction and stabilizers. The copper is highly toxic to microorganisms such as bacteria, copper nanoparticles were synthesized from various plant extracts such as Hibiscus rosasinensi. Various instrumental techniques were adopted to characterize the synthesized Cu NPs UV-Vis spectroscopy, FTIR.

KEY WORDS*: Nanotechnology, Nanoparticles, Biosynthesis, Copper, Tulasi leaves, Characterization*

INTRODUCTION

The subject nanotechnology deals with manufacturing, study and manipulation of matter at nano scale in the size range of 1-100 nm which may be called as nanoparticles [3]. Nanotechnology plays a very important role in modern research and it is the most capable technology that can be applied almost all fields. It's growing interest in therapeutic filed for the ailments such as infection, cancer, allergy, diabetes and inflammation [1]. Among heavy metals, copper is most often leads to human poisoning and it is required by the body in small amounts, but toxic in larger doses [2]. The copper nanoparticles are potentially applied in the food package, water treatment, pharmaceutical, electronics, health care, food and feed, drug and gene delivery, energy science, cosmetics and environmental health [4]. Chemical synthesis is costly, toxic and potentially dangerous to the environment [5]. But the biological approach of synthesis of nanoparticles is safe, cheap, low energy and time efficient [6]. Copper nanoparticles have been successfully synthesized by radiolysis, laser irradiation, thermal decomposition, vapour deposition, flame spray and chemical reduction. However, these methods suffer from drawbacks such as unsafe reaction condition, use of expensive chemicals, instruments and longer reaction time. To overcome these, green synthesis of copper nanoparticles are reported using plant leaf extracts [7]. The study related to the green synthesis and characterization of copper nanoparticles using Tulsi Ocimum sanctum is totally wanting. Hence the present study was carried out.

Synonyms: Sacred Basil, Holy Basil, Ocimum sanctum.

Biological source: Tulsi consists of Fresh & dried leaves of plant Ocimum sanctum Linn. (Syn.Ocimum tenuiflorum), belonging to family Lamiaceae.

Chemical constituents: Alkaloid, glycoside, saponin, tannins, vitamin C and tartaric acid. It should contain not less than 0.40% of eugenol calculated on dry basis.

Organoleptic/Morphological characters:

Colour: Fresh & dried leaves are green in colour.

Odour: Aromatic

Taste: Pungent

Height: Herb grows up to the height of 30-75 cm

Uses: Expectorant, Bronchitis, Stomachic Carminative, Stimulant, Flavouring agent, Refrigerant and febrifuge. Antifertility agent. Diaphoretic property Spasmolytic, property, Antibacterial Insecticide, Antiprotozoal.

MATERIAL AND METHODS

Collection and Preparation of Tulsi (Ocimum sanctum) leaf extract:

All the chemical reagents used in this experiment were of analytical grade purchased from Loba chemicals. The Ocimum sanctum leaves were collected from in and around Junnar, Pune Maharashtra, India. Thoroughly washed leaves were cut and boiled with 100 ml of de-ionized water for 15 min in heating mental at temperature 80°C & filtered in Whatman filter paper no.1 and stored in refrigerator at 4°C experiments.

Synthesis of nanoparticles

For the synthesis of copper nanoparticles (Cu NPs) 25 ml of Ocimum sanctum leaf extract was added to 100ml of 1mM aqueous CuSO4.5H2O solution under continuous stirring. After complete addition of leaf extract, the mixture was kept for incubation for 24 hrs [1]. At particular time, the colour of the solution changes from light green to dark green. This indicates the formation of copper nanoparticles. Then the solution was centrifuged at 6000 rpm for 30 min followed by re-dispersion of the pel-let in deionized water to remove any unwanted biological materials [8]. Biosynthesis of copper nanoparticles. The biosynthesized copper nanoparticles were characterized by using UV-Visible Spectroscopy (Lambda-35 Spectrophotometer) and Fourier transfer Infra-Red Spectroscopy and Antimicrobial activity.[1]

Table 1: Colour change during biosynthesis of copper nanoparticles.

Sr.No.	**Solution**	**Before reduction**	**After reduction**
1.	Ocimum sanctum leaf extract	Brown colour	Green colour
2.	Copper sulphate (CuSo4, 5H2O)	Blue colour	Green colour

(A) (B) (C)

Biosynthesis of copper nanoparticles. (A) Copper Sulphate, (B) Leaf extract (Ocimum sanctum), (C) Synthesized Copper Nanoparticles.

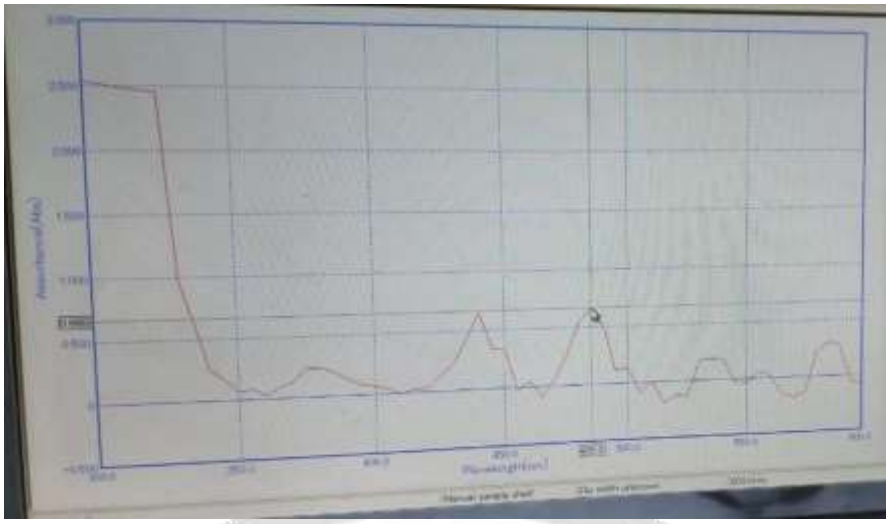
EXTRACTION OF THE SYNTHESIZED NANOPARTICLES

The synthesized nano particles are collected by the Process of the centrifugation. In which the synthesized Particles Are filled in the micro centrifuge tubes and spined at the speed of 6000rpm for 3-5 min duration. After that the copper nano particles get Accumulate at the bottom of the tube that are visible by the naked eye that accumulated particle are dried thoroughly under the IR light or shade dry process. this process can take about the 2-3 days. after this process the collection of the nano particles at one place is done. after that they are converted into nanoparticles.

RESULT:

UV- Visible Spectroscopy analysis:

It is generally recognized that UV- Visible spectroscopy could be used to examine the size and shape-controlled nanoparticles in aqueous suspensions. Absorption spectra of copper nanoparticles formed in the reaction media has absorbance's peak ranges between 300-800 nm. The absorbance peak of copper nanoparticles found to be at **485** nm.

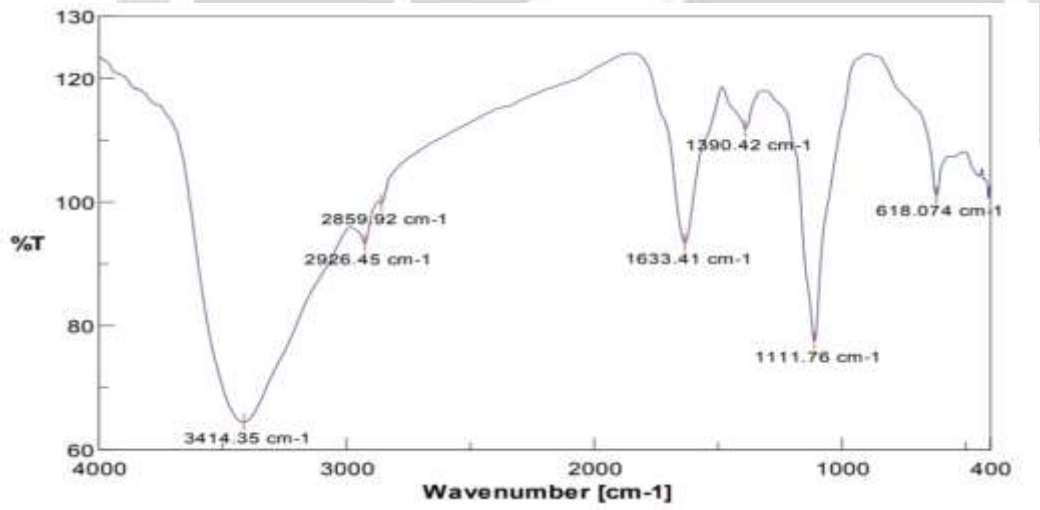


FTIR PROCESS:

In this Process the FTIR Device Is used the Following Are the Steps Of the FTIR.

Preparation of the KBr Pellets

These pellets are prepared by the Process of the Hydraulic Press equipment. The Drug is thoroughly crushed and the Poured in the press and set for the 1000psi for the 3min only. This process is very delicate. More pressure and also more time can cause the pellets to break.

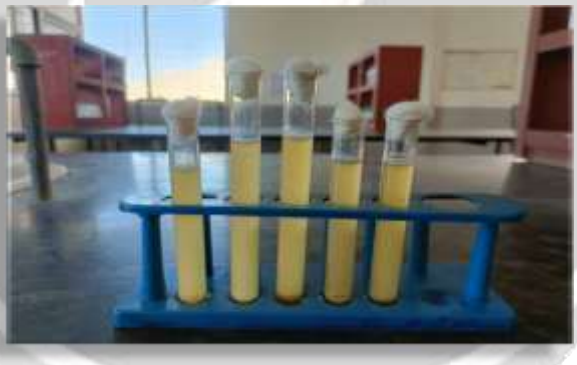


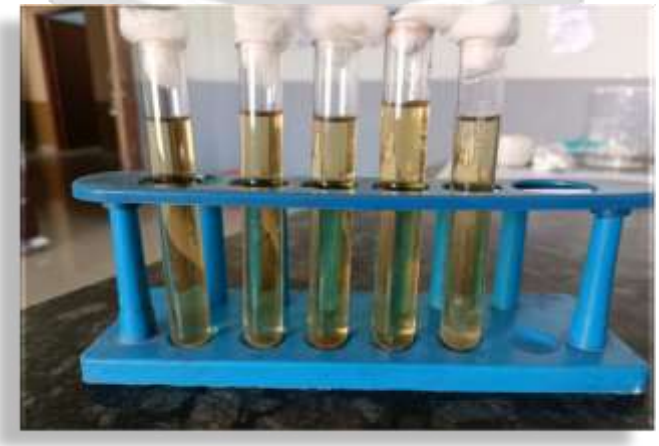
FT-IR analysis of copper nanoparticles

1.	Frequency	Bond	Functional group
2.	3414.35	OH-stretch	Alcohols and Phenols
3.	2926.45	CH stretch	Alkanes
4.	2859.92	CH stretch	Alkanes
5.	1633.41	C = O	β diketones
6.	1390.42	COO^-	Carboxylic acid
7.	1111.76	$C\text{-}NH_2$	Primary aliphatic amines
8.	618.074	- C ≡ C –H :C –H bend	Alkynes

ANTIMICROBIAL ACTIVITY:

CuNPs with larger surface area provide a better contact with microorganisms Thus, these particles are capable to penetrate the cell membrane or attach to the bacterial surface based on their size. In addition, they were reported to be highly toxic to the bacterial strains and their antibacterial efficiency is increased by lowering the particle size. Many arguments have been given to explain the mechanism of growth inhibition of microbes by Cu NPs but most convincing is the formation of free radical which has also been supported by the appearance of a peak at 336.33 in the electron spin resonance (ESR) spectrum of CuNPs. The free radical generation is quite obvious because in a living system they can attack membrane lipids followed by their dissociation, damage and eventually inhibiting the growth of these microbes.





DISCUSSION:

In the present study, synthesis of copper nanoparticles using aqueous leaf extract Ocimum sanctum belonging to family Lamiaceae, without any harmful chemicals. The green synthesis of copper (Cu NPs) is subjected to UV-spectroscopy analysis and obtained a single peak but broad at 485 nm and are inconformity with the eco-friendly biosynthesis of copper nanoparticles using flower extract of Aloe Vera [9]. FTIR spectra revealed that three was thin film of proteins and some secondary metabolites that covered the metal nanoparticles. The studies are in conformity with the biosynthesis of copper nanoparticles using Capparis zeylanica [1]) and Nerioum oleander leaf extract [10]. Synthesized copper nanoparticles are showing antimicrobial activity. The study successfully demonstrates the convenient utilization of Ocimum sanctum leaf extract for the synthesis of copper nanoparticles.

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