WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Green Synthesis and Characterization of Bioactive Silver Nanoparticles using Curcuma Longa Extract.

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A B S T R A C T

The main objective of this topic is to describe a simple, rapid, eco-friendly and economically feasible green synthesis of nobel nanoparticles such as AgNP's using Curcuma Longa(Turmeric) root extract as reducing agent. In the present study Curcuma Longa root extract which contain flavonoids, phenolic compounds was used as stablising agent and the phytochemicals present in the extracts act as reducing agent . The synthesis of AgNP's was first monitored by using UV-Vis spectrophotometer; the UV spectroscopy shows absorbance at 424 nm. The morphology, size and structure stability was characterized by SEM and TEM.

Keywords: Keyword- Green approach, UV–Vis-Spectrophotometer, SEM and TEM

1.Introduction

Nanopartocles having large surface area to volume ratio due to nanoscale and size of Nanoparticles. This is the main advantage of Nanoparticles[1] nanoparticles shows completely new and enhanced properties based on specific characters such as size, and morphology due to increase in surface area[2,3]. The metal nanoparticles shows excellent antibacterial properties and which are useful in variety of fields such as catalysis [4],bio-molecular detection, diagnostics[5],optical receptors, bio labeling and sensors [6]. The greener synthesis of nanoparticles are superior than any other conventional methods, as they are one step, simple, cost-effective, ecofriendly and often result in more stable materials [7]. Green synthesis of silver nanoparticles using plant extracts and micro- organism have been suggested as more valuable alternative to conventional chemical and physical methods. Use of Plant extracts for the synthesis of silver nanoparticles has more advantages than microorganism due to ease of scale up, less biohazard, easily availability and elaborate process of maintain cell cultures [8]. Curcuma Longa belong to the family Zingiberaceae [9] parts of Turmeric leaves and roots which are safe and nutritious for human consumption[10] both leaves and roots possess high natural antioxidant properties and antibacterial activity against gram positive and gram negative bacteria [11,12]. In the present study we establishes that an aq.extract of Turmeric roots were used for the reduction of Ag^+ into Ag metal and check the antimicrobial activity.

2.Experimental Methods

Silver nitrate (AgNO3) was purchased from Sigma– Aldrich Chemicals. All glassware are sterilized with nitric acid and further with distilled water and dried in oven before use. Turmeric roots were collected from campus of Siddharth College, Jafrabad ,Dist. Jalna, Maharastra, India.

3.Preparation of Plant root extract

Fresh Turmeric roots were collected from campus of Siddharth College, Jafrabad,Dist. Jalna, Maharastra, India. The Turmeric roots were washed with tap water to remove impurities. The plant roots dried under shade for 1 week, the dried roots were grinded in a mixer grinder into the powder form. Same process repeated 4 to 5 times. The aqueous extract of Turmeric roots was prepared by using 15 g of powder of roots which was added to 100 mL of deionized water at 60 °C to 80 °C for 25 min. This extract was filtered through Whattmann filter paper No-1. The filtered extract was stored in refrigerator at 4°C for further studies.

4.Green synthesis of silver nanoparticles (AgNPs)

The silver nitrate (A.R.) used in this study was obtained from Sigma–Aldrich Pvt.Ltd Mumbai, India. Aqueous solution (1 mM) of AgNO3 was prepared in deionized water. For synthesis of silver nanoparticles, the Erlenmeyer flask containing 90 mL of $AgNO_3$ (1 mM) was reacted with 10 mL of

the aqueous root extract of Curcuma Longa and stirred on magnetic stirrer heated at 80^0C for 1 hour, for the reduction of Ag^+ ion from AgNO3 to synthesize AgNPs. The solution turns yellowish to dark brown indicating the formation of silver nanoparticles. The bioreduction of silver ion was also monitored by the UV-spectrophotometer.

5.Characterization of silver nanoparticle

5.1 UV-Vis. spectroscopy

The reduction of silver ions by root extract were performed instrumentally investigated by using UV- Visible spectrophotometer (Model EQ-826, Equip- tronics Pvt. Ltd.). The UV-visible absorption spectrophotometer with optical absorbance between 200 to 600 nm was used. Scanning electron microscope (Hitachi S-4500) was used to study the surface morphology of nanoparticles, energy- dispersive x-ray (EDX) analysis at 20 kV to dictate the elemental composition of the particles. The particle size and shape was confirmed using Transmission electron microscopy (TEM) at an accelerating voltage of 100 kV.

5.2 Scanning Electron Microscopy (SEM)

The SEM images of silver nanoparticles from aqueous extract of ***Turmeric roots*** after stirring for 1 hr at 80^0C. The average size was indicates that from 14 to 20 nm. (fig.2).The larger sizes of particles were observed due to highly agglomeration. The morphology and average size of synthesized silver nanoparticles was established by SEM-EDS The silver nanoparticles were criticize using EDX profile display an absorption peak around 3 kev due to their surface plasmon resonance (13) this proves the presence of nano crystalline elemental silver.

5.3 TEM analysis

Transmission electron microscopy (TEM) analysis has been clearly illustrated that the size, shape and morphology of nanoparticles. It is inform that silver nanoparticles are well dispersed and mostly silver nanoparticles are spherical in shape ,while some of the nanoparticles were found irregular in shape.

6. Result and discussion

Colour change and UV-vis spectroscopy

The initial formation of silver nanoparticles is represented by a change in the colour of the solution from yellowish to brown [13].The addition of plant extract of Zingiber officinale into aqueous solution of AgNO3 (1mM) led to the instantaneous change in the colour of solution yellowish to brown within 1 hr reaction due to excitation of surface plasmon vibrations. The surface plasmon resonance band AgNP observed at 420-430 nm similar to those reported in literature [14] . From the UV-vis spectra recorded, indicate that most rapid bio-reduction of silver ions was achieved using *Ginger root* extract as reducing agent. The visuals colour change and UV-vis spectra revealed that formation of AgNPs within 1 hr.

7.Conclusion

The biological synthesis of silver nanoparticles is rapid, simple, safe, one-step, cost effective, eco- friendly and novel synthesis route for preparing silver nanoparticles was carried out using Zingiber officinale (Ginger) roots extract as a reducing and capping agent at given temperature. The synthesized silver nanoparticles were characterized by UV-visible spectrophotometer, SEM-EDX and TEM analysis. The size of the nanoparticles ranges from 14 to 20 nm with spherical shape.

8.Figures

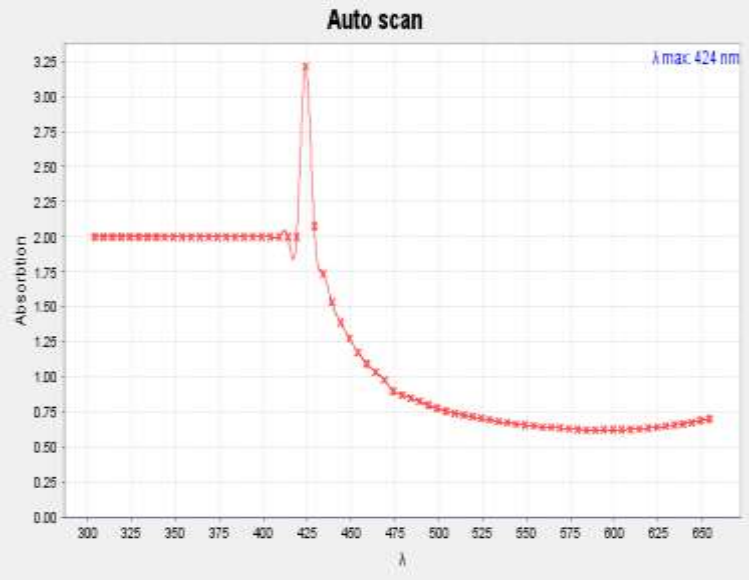

Fig.1 UV–Vis spectra of silver nanoparticle containing solutions synthesised from Turmeric root extract samples and AgNO3 after 1 h of reaction (424 nm)

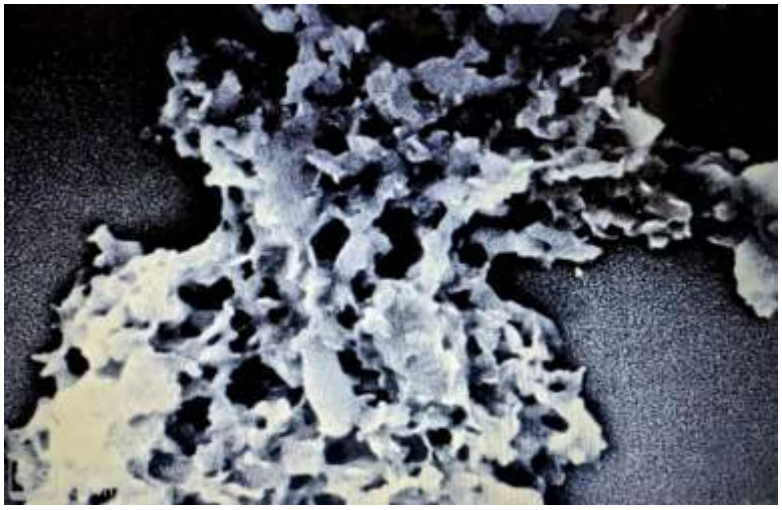

Fig.2 shows SEM image showing the size of synthesized silver nanoparticles obtained from aqueous extract of *Ginger root*

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