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Silver Nanoparticle Synthesis Using *C.Caesia* and *C.Amada* Rhizome Extract

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Abstract: Silver nanoparticles can be synthesized by physical methods, chemical methods or biological methods. Biological approach is the most emerging approach of preparation, as it easier than the other methods and less time consuming. In this present study, silver nanoparitcles were synthesized using hydroalcoholic extract of *Curcuma caesia* and *C.amada* rhizome. Synthesized silver nanoparticles were characterized using SEM, TEM and XRD analysis. The comparative characterization analysis reveals that the synthesized nanoparticles were spherical in shape with the size of 31.07nm and 31nm.
Key words: *Curcuma caesia, C.amada,* silver nanoparticle, hydroalcoholic extract.

Introduction

Nanoparticles have wide range of applications in the fields of catalysis, photonics, optoelectronics, biological tagging, pharmaceutical applications environmental pollution control, drug delivery systems, and material chemistry. Various strategies are employed for synthesis of silver nanoparticles. Silver nanoparticles are synthesized by reduction in solutions, thermal decomposition of silver compounds, microwave assisted synthesis, laser mediated synthesis and biological reduction method [1]. Plant-mediated synthesis of silver nanoparticle is considered as an ecofreindly method [2]. The fascinating properties of silver nanoparticles mostly depend on the size and shape of the nanoparticles. It has also been widely reported that less aggregated, small, and spherical-shaped silver nanoparticles have proven more effective for most applications than silver nanoparticles with other morphologies [3].

Medicinal plants play a major role in the discovery of new therapeutic agents for drug Development [4]. *Curcuma caesia* Roxb, a member of the family *Zingiberaceae* and commonly known as black turmeric, is a perennial, erect rhizomatous herb with bluish-black rhizome of high economical importance because of its medicinal values. It is native to North-East and Central India. Rhizomes of the plant are aromatic with intense camphoraceous odour .The rhizomes are reported to contain anti-inflammatory agents, and the paste of fresh rhizomes is used as a remedy for insect and snake bite by the *Khamti* tribe of Lohit district of eastern Arunachal Pradesh [5]. Rhizomes of the plant are used for sprains and bruises and also employed in the preparation of cosmetics [6].

Mango ginger (*Curcuma amada* Roxb.) is a unique perennial herb and its rhizomes have a morphological resemblance to ginger (*Zingiber officinale*) but impart a mango (*Mangifera indica*) flavour. The main use of mango ginger is in the manufacture of pickles, as a source of raw mango flavour for foods and for therapeutic purposes [7]. *C. amada* has pharmacological significance for a variety of ailments for example effective in skin allergies, effects on blood cholesterol and possess antioxidant properties as well as antibacterial activity. Of the 130 bioactive compounds of *Curcuma*, *C. amada* rhizomes reported to have 121 bioactive compounds including curcuminoids [8].

Materials & Methods

Sample collection

C. caesia and *C.amada* were commercially collected from local siddha medical shop, Chennai.

Hydroalcoholic Extraction

10g of *C. caesia* and *C.amada* fresh rhizome were cut into small pieces, placed in 100ml of hydro alcoholic solvent (70mlalcolhol, 30ml water) and left for 7days with occasional shaking(cold maceration)[9]. The extract was filtered, concentrated, weighed and stored in cool place.

Silver nanoparticle synthesis

10ml of extract was added to 90ml of 1mM silver nitrate solution and incubated at room temperature for 24hours[10]. The color changes from pale yellow to brown indicating that the silver nanoparticles are formed as a result of the reaction of extracts of C. caesia and *C.amada* with silver metal ions.

Characterization of the synthesized silver nanoparticles

The reduction of pure Ag^+ ions was monitored by UV-Visible spectrophotometer ((Shimadzu UV-2700) [11] after diluting a small aliquot of the sample in distilled water. Scanning electron microscopy (SEM) analysis of synthesized AgNPs was done using a Hitachi S-4500 SEM machine. The TEM images of synthesized AgNPs were obtained by using TECHNAI 10 Philips. Transmission electron microscopy (TEM) technique was used to visualize the morphology of the Ag NPs [1]. For XRD analysis, the powdered nanoparticles were coated on the amorphous silica substrate. The spectra were recorded by using XDL 3000 powder X-ray diffractometer with 40kV and a current of 30mA with Cu Ka (1.5405° A) radiation [10]. The crystallite domain size was calculated from the width of the XRD peaks, assuming that they are free from non-uniform strains, using the Scherrer formula.

$$D= 0.94\ \lambda / \beta \cos\theta \qquad (1)$$

where D is the average crystallite domain size perpendicular to the reflecting planes, λ is the X-ray wavelength, β is the full width at half maximum (FWHM), and θ is the diffraction angle[12].

Result & Disscussion

UV-Vis absorption spectroscopy is an important technique to monitor the formation and stability of metal nanoparticles in aqueous solution. The absorption spectrum of metal nanoparticles is sensitive to several factors, including particle size, shape, and particle–particle interaction (agglomeration) with the medium [3]. The yellow colour changed to brown colour indicates the synthesis of silver nanoparticle. The color change observed was due to excitation of surface Plasmon vibration in the silver nanoparticles. The surface plasmon resonance of AgNPs of *C. caesia* rhizome was found to be at 426 nm and for *C.amada* it was at 408 (Figure: 1). The metal nanoparticles have free electrons, which give the surface plasmon resonance absorption band, due to the combined vibration of electrons of metal nanoparticles in resonance with light wave [1,2]. SEM analysis revealed that synthesized silver nanoparticles were spherical in shape (Figure: 2).The morphology of silver nanoparticles were further confirmed by TEM and XRD analysis. Shape is critical parameter which effects cell uptake and/or the rate and site specific drug delivery from the system. Preferential interaction with specific proteins could be achieved on proper shape selection of nanomaterials. Spherical nanoparticles are good option for drug delivery, however anisotropic structures could be the best option due to their large surface area e.g. dendrite [13]. This kind of structures can make good seating and binding arrangements for the drug which can be useful for sustained drug delivery. However, sharp edges of anisotropic structures can be responsible for injury of blood vessels. The TEM and XRD analysis also revealed that the size of the silver nanoparticles was 31.07nm (*C. caesia) and* 31nm (*C.amada)* (Figure:3, 4). Small size of nanoparticles are preferred, since after drug loading overall diameter should be more than enough to circulate though out the blood circulatory network for sustained period of time.

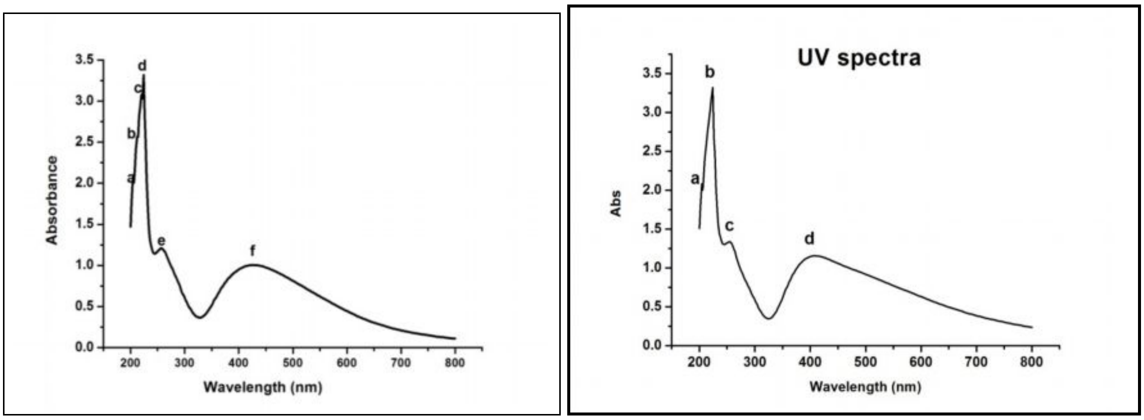

Figure: 1 UV- Spectra of silver nanoparticle synthesized by *C. caesia* and *C. amada*

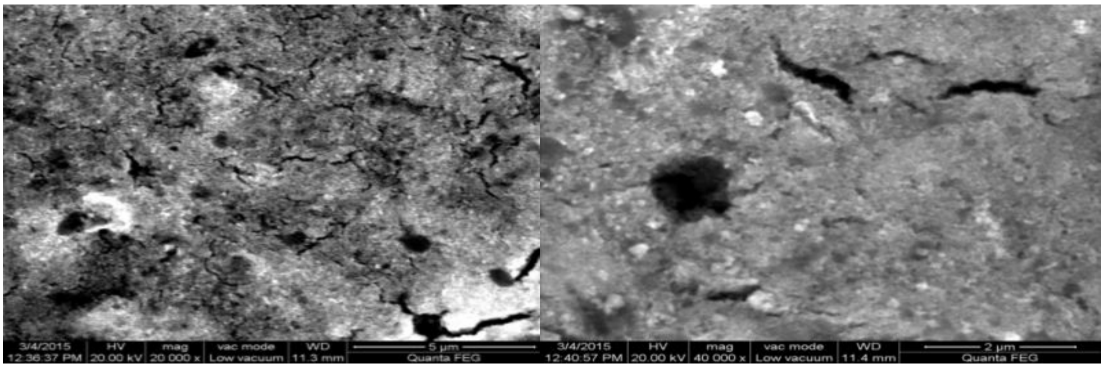

Figure: 2 Scanning electron micrograph of the silver nanoparticles of *C.caesia* and *C.amada*

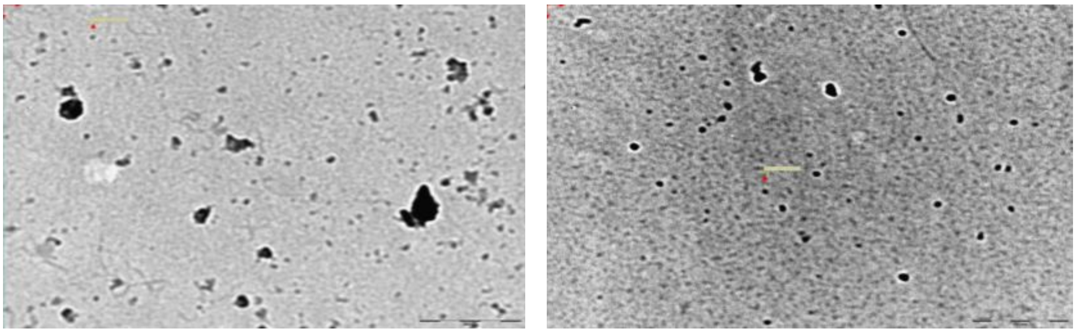

Figure: 3 TEM micrographs of Silver nanoparticles synthesized using *C. caesia* and *C.amada*

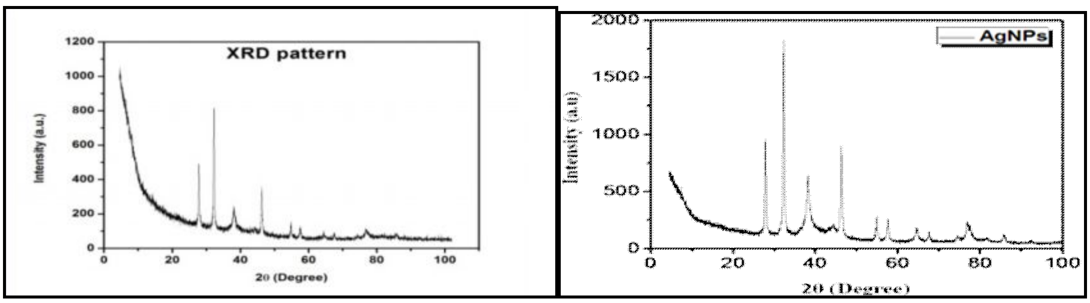

Figure: 4 XRD pattern of silver nanoparticles synthesized using *C. caesia* and *C.amada*

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