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CHARACTERIZATION OF GREEN SYNTHESIZED SILVER NANOPARTICLE OF COMMIPHORA CAUDATA BARK

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Abstract- The myrrh genus, *Commiphora*, is the most species rich genus of flowering plants in the frankincense and myrrh family, Burseraceae. Use of myrrh resin is frequent and pronounced throughout historical texts of cultural significance, including the Bible. The objective of the present piece of research work is to green synthesis and characterize the silver nanoparticle from the bark of *Commiphora caudata* (wight&Arn) Engl. The appearance of dark reddish brown colour was a clear indication of the formation of AgNPs in the reaction mixture; the colloidal entity was subjected to UV spectral, FTIR, FESEM, DLS, XRD and Zeta Potential. FESEM analysis revealed the AgNPs coalesced to nano-clusters predominantly globe-shaped nanocrystals and the images revealed that the sizes were ranged between 8 and 84 d.nm with globular shape with aggregation. The particle size distribution was observed by diffuse light scattering (DLS) method. The distribution of the particles exhibited interesting facts. The large particles were distributed by an intensity of 1.8% and the smallest ones distributed by 93% and the rest by the intermediate particles.FTIR analysis revealed the presence of the functional groups C-H(Amines), C-H(Alcohol), N-H(Primary amines), C-C(Aromatics), C-N(Aromatic amines), C-H(Alkyl-halides), C-N(Aliphatic-amines), C-Cl(Alkyl-halide) and C-H(Alkynes). XRD results revealed that the silver ions reduced to silver oxide in *C. caudata* are crystalline nature.

***Key word* – *Commiphora caudata*, Green synthesis, Silver nanoparticle, FESEM, FTIR**

I. INTRODUCTION

The myrrh genus, *Commiphora*, is the most species rich genus of flowering plants in the frankincense and myrrh family, Burseraceae. *Commiphora* can serve as a model genus for understanding plant evolution in the drier regions of the Old World tropics, particularly in eastern continental Africa and Madagascar, where diversity in the genus is concentrated. Products from many species of *Commiphora* have been used for various purposes as timber, building material, and natural fencing, but more often valued for the aromatic resins produced by several members of the genus. "Myrrh", the common name for these dried resins, is fragrant and has been used both as fragrance and for medicinal purposes (e.g., Balsam of Mecca, *C. gileadensis*) Use of myrrh resin is frequent and pronounced throughout historical texts of cultural significance, including the Bible (Musselman, 2007). Hill Mango, Kiluvai, Pachaikiluvai, Green *Commiphora* (Syn: *Protinum caudatum*,Wight & Arn) or *Commiphora caudata* (Wight & arn) Engl is a member of the Burseraceae family was given this name by Heinrich Gustav Adolf Engler in 1883. It is found in India: Andhra Pradesh, Karnataka, Kerala and Tamil Nadu and in Sir Lanka, growing in-between 750 and 1100 meters altitude. It grows mostly in gravely soil, receiving some water in summer and none in winter and full sun. The stem can grow to 15-25 centimetres in diameter and 12-20 meters high. The flowers are greenish yellow. Bark and leaves yield a gum resin which is antiviral in properties (http://www.indianetzone.com).The objective of the present piece of research work is to green synthesis and characterizes the silver nanoparticle from the bark of *Commiphora caudata* (Wight&Arn) Engl.

II. MATERIALS AND METHODS

Pure and analytical grade chemicals were used for the synthesis of silver nanoparticles (AgNPs), media preparation and culture of the pathogens. Silver nitrate ($AgNO_3$) and Streptomycin were purchased from Hi-Media Laboratories Pvt. Ltd., Mumbai, India. Glass double distillated water was used. *Commiphora caudata* (Wight&Arn.) Engl was collected from the campus of Government Arts College (Autonomous), Coimbatore - 641 018, Tamilnadu, India, identified and authenticated by Botanical Survey of India, Southern Regional Centre, Coimbatore-641003 with the reference number BSI/SRC/5/23/2013-14/Tech.2035 dated 21.03.2014.

III. CHARACTERIZATION OF THE SYNTHESIZED AgNPs

The characterization of AgNPs were carried out by UV-Visible spectroscopy (UV-Vis), Fourier Transform Infra Red Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), Direct Light Scattering analysis (DLS) and Zeta Potential.

A. UV-Visible Spectroscopy

The reduction process of the solution was monitored in a Perkin-Elmer Lambda-35 UV-Visible spectrophotometer to know the kinetic behaviour of the AgNPs. The reaction of the solution analyzed at different reaction times in the wavelength ranges between 200 and 800nm at a scan speed of 480 nm /min. The spectrophotometer was equipped with "UV Winlab" software to record and analyze the data. Base line correction of the spectrophotometer was carried out by using a *blank reference*. The UV-Vis absorption spectra of all the samples (concentration) were recorded along with the resulting data recorded in graphical format. Readings were taken for all the concentrations mentioned.

B. FTIR

FTIR measurements were carried out for dried biomass of extract treated with AgNPs to find out the compound responsible for the synthesis of AgNPs. Infra red spectroscopy was used to investigate and predict any

physicochemical interactions between different components in a formulation using FTIR. FTIR Spectroscopy measurements were taken for the AgNPs synthesized after 0hr, 1hr, 5 hrs and 24 hrs of reaction. These measurements were carried using FTIR Perkin Elmer Model – Spectrum RX I instrument with a wavelength range of 4000 to 400 nm where the samples were incorporated with Potassium bromide (KBr) pellets to acquire the spectra. The results were compared for shift in functional peaks.

C. FESEM

FESEM was used to characterize mean particle size, morphology of the AgNPs. A field-emission cathode in the electron gun of a scanning electron microscope provides narrower probing beams at low as well as high electron energy, resulting in both improved spatial resolution and minimized sample charging and damage. On a broader sense FESEM has its application in semiconductor device cross section analyses for gate widths, gate oxides, film thicknesses, and construction details; advanced coating thickness and structure uniformity determination; and small contamination feature geometry and elemental composition measurement.

FESEM produces clear images with spatial resolution down to 1 1/2 nm that are electro-statically less distorted, i.e. 3 to 6 times better than conventional SEM. Smaller-area contamination spots can be examined at electron accelerating voltages compatible with energy dispersive X-ray spectroscopy. Reduced penetration (of low kinetic energy electrons) probes closer to the immediate material surface. High quality, low voltage images are obtained with negligible electrical charging of samples (accelerating voltages range from 0.5 to 30 kV). The powder sample and freeze dried sample of the AgNPs solution was sonicated with distilled water; small drop of this sample was placed on glass slide allowed to dry. A thin layer of platinum was coated to make the samples conductive. FEI - QUANTA–FEG 250 FESEM machine was operated at a vacuum of the order of 10-5 torr. The accelerating voltage of the microscope was kept in the range 10-20 kV.

D. XRD

The phase evolution of calcined powder as well as that of sintered samples was studied by X-ray diffraction technique (Philips PAN analytical, The Netherlands) using Cu Kα radiation. The generator voltage and current was set at 35 KV and 25 mA respectively. The Ag samples were scanned in the 2θ ranges 15 to 70^0C range in continuous scan mode. The scan rate was 0.04o/sec.

E. DLS

A laser diffraction method with a multiple scattering technique has been used to determine the particle size distribution of the powder. It was based on Mie-scattering theory (Thiele and French, 1998). This theory provides rigorous solutions for light scattering by an isotropic sphere embedded in a homogeneous medium. Extensions of Mie theory include solutions for core/shell spheres and gradient-index spheres. In most applications theoretical calculations predict the relative effects of particle size, particle composition, composition of the surrounding medium and wavelength of light. These trends correlate well with experimental data. The optical theories applied in the present study describe the light scattering properties of an isolated spherical particle and therefore cannot be applied to systems in which the particles are crowded together and near-field interactions between particles are significant. In order to find out the particles size distribution the Ag powder was dispersed in water by horn type ultrasonic processor (Vibronics, VPLP1). The data on particle size distribution were extracted in Zetasizer Ver. 6.20 (Mal1052893, Malvern Instruments Limited, 2007).

F. SEM

In this research work, VEGA3 TESCAN SEM machine were used to characterize mean particle size, morphology of nanoparticles. The powder sample and freeze dried sample of AgNP solution was sonicated with distilled water; small drop of this sample was placed on glass slide allowed to dry. A thin layer of platinum was coated to make the samples conductive. JSM-6480 LV SEM machine was operated at a vacuum of the order of 10-5 torr. The accelerating voltage of the microscope was kept in the range 10-20 kV. Compositional analysis on the sample was carried out by the energy dispersive X-ray spectroscopy (EDS) attached with the SEM.