BIOGENIC SYNTHESIS, CHARACTERIZATION OF SILVER NANOPARTICLES USING VINCAROSEA FLOWER EXTRACT

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(Received on Date: 17th August 2016 Date of Acceptance : 10th November 2016)

ABSTRACT

The importance of vincarosea flower and Silver nanoparticles as revealed by various literature resources, we planned to carry out biogenic synthesis of Silver nanoparticles using the above extract. Silver nanoparticles were prepared by adopting standard procedure. The formations of Silver nanoparticles from the extracts were identified first by observing the colour changes. The extract colour changes during the formation of Silver nanoparticles from light yellow to dark brown for vincarosea flower extract. Silver nanoparticle formations were characterized by UV, FT-IR, XRD and SEM. UV absorbance at 420nm for Silver nanoparticles derived from the above flower extract. FT-IR stretching frequencies at FT – IR spectral stretching frequency indicated the presence of the functional groups as 1388, 1458 represents the presence of NO_2 which may be proved the formation of silver nanoparticles. XRD & SEM analysis of silver nanoparticles indicated that they exist in spherical, face centered cubic (fcc) crystalline structure with size range 21nm.

Keywords: Vincarosea flower extracts, Silver nanoparticles, UV, FT-IR, XRD &SEM.

No: of Figures :6 **No: of References**: 20

INTRODUCTION

Nanotechnology is one of the most active areas of research in modern materials science [1] and now creating a growing sense of excitement in the life sciences especially biomedical devices and Biotechnology [2] and making an impact in all spheres of human life [3]. Nanomaterials have extensive applications for improving human health and the environment [4&5]. Silver nanoparticles are well known as one of the most universal antimicrobial substances in the field of biology and medicine due to their strong biocidal effect against microbial species, which has been used for centuries to prevent and treat various diseases, most notably infections [6-8]. Vincarosea (Apocynaceae) is one of the most important and high value medicinal plants known for its anticancer alkaloids belonging to the family Apocynaceae [9]. Tincture of Vincarosea has more than 400 known alkaloids. Main chemical components are ajmaline, catharanthaine, leurosidine, vincristine, vinblastine, vindesine, vincamine, vinorelbine and rosinidin. Rosinidin is an anthocyanidin pigment found in the flowers. The alkaloids are hypotensive, sedative and have transquilizing properties, and are anticancerous and also helps in relieving muscle pain, depression of central nervous system and wasp stings. They have vasodilating, blood thinning and memory - enhancing actions and are used as a cerebral stimulant and vasodilator and to treat arteriosclerosis. They are effective in curing dementia caused due to insufficient blood supply to the brain ; and interfere with cell ' s ability to synthesize DNA & RNA . Best for treatment for cancers like Lymphomas , Hodgkin 's Disease , breast cancer , acute Lymphocytic tendency , soft tissue sarcoma , Multiple Myeloma , Neuroblastoma , testicular cancer , childhood leukomia and cancer tumours. Ajamalicine, Serpentine, Reserpine are well known for their hypotensive and antispamodic properties. Hodgkin's disease is a generally fatal disease characterised by progressively enlargement of the lymph nodes, lymphoid tissue, and spleen. The synthesis of silver nanoparticles were carried out using Vincarosea flower extract as reducing agent.

EXPERIMENTAL METHOD

Materials and method

Materials:

Materials of VincaRosea flower were purchased from Theni, India. $AgNO_3$ merck grade was used.

Methods

i) Preparation of the Flower Extracts:

vincarosea flowers were washed several times with water to remove the dust particles and then aerial dried to remove the residual moisture. The vincarosea

flower extract used for the reduction of silver ions (Ag^+) to silver nanoparticles (Ag^0) was prepared by placing 50g of washed dried fine cut flowers in 250ml round bottom flask along with 200ml of distilled water. The mixture was then boiled for 2hours until the color of the aqueous solution changes to light yellow. Then the extract was cooled to room temperature and filtered with Whatman No.1 filter paper. The aqueous flower extract was used as a reducing agent for further nanoparticle synthesis. These extracts can be stored at 4 °C for one week.

ii) Synthesis of Silver Nanoparticles:

1mM aqueous solution of Silver nitrate ($AgNO_3$) was prepared and used for the synthesis of silver nanoparticles. 10ml of Vincarosea flower extract was added to 90 ml of aqueous solution of 1mM Silver nitrate for reduction into Ag+ ions and kept at room temperature. As a result, a dark brown solution was formed indicating the formation of silver nanoparticles and it was further confirmed by UV-Vis spectrum analysis.

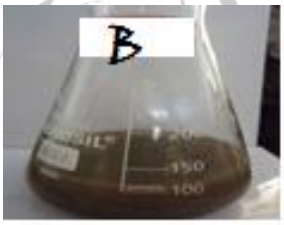

Figure 1A **Figure 1B**

Photographs showing **A**) Pure vincarosea flower Extract
B) Colour changes after adding flower Extract to $AgNO_3$ solution.

iii)Separation of Silver nanoparticles:

The synthesized AgNP's was separated by means of centrifugation (Spectrofuge 7M) at 10,000 rpm for 30 mins. The pellets was redispersed and again centrifuged for 30 mins. The supernatant solution thus obtained was stored at -4°C.

iv)Characterization of AgNPs:

Characterisation of silver nanoparticles was carried out using UV-visible absorption spectrophotometer 1650PC with a resolution of 1 nm between 200 and 600 nm possessing a scanning speed of 300 nm/min. FT-IR measurements were carried out on a Shimadzu FT-IR 8400S Model and the spectra was scanned in the range of 4000-500cm-1range at a

resolution of 4 cm-1. The sample were prepared by dispersing the AgNPs uniformly in a matrix of dry KBr, compressed to form an almost transparent disc. KBr was used as a standard analyze the samples [49]. The particle size and nature of the AgNPs were determined using XRD PW3050/60 X-pert PRO operating at a voltage of 45 kV, a current of 40 mA with Cu K a radiation at 2θ angle ranging from 10^0 to 80^0 [15]. A thin film of the silver nanoparticle was made by dipping a glass plate in a solution and carried out for X-ray diffraction studies. SEM analysis was done by using a JSM 6701F – 6701Model.

Results:

Biogenic synthesis of silver nanoparticles using vincarosea flower extracts were confirmed by UV-Visible Spectroscopy, Fourier Transform Infrared Spectroscopy, X-ray Diffraction and Scanning Electron Microscopy studies. The formation of silver nanoparticles can be observed by the changes in the color of the solution from light yellow color to brown color for vincarosea flower extract. Color of silver colloid is attributed to surface Plasma resonance (SPR) arising due to the collective oscillation of free conduction electrons induced by an interacting electromagnetic field. **Figures 3** showed the UV absorption spectra of the silver nanoparticles . Surface Plasmon Resonance bands of the colloids are centered at 420 nm for vincarosea flower extract .

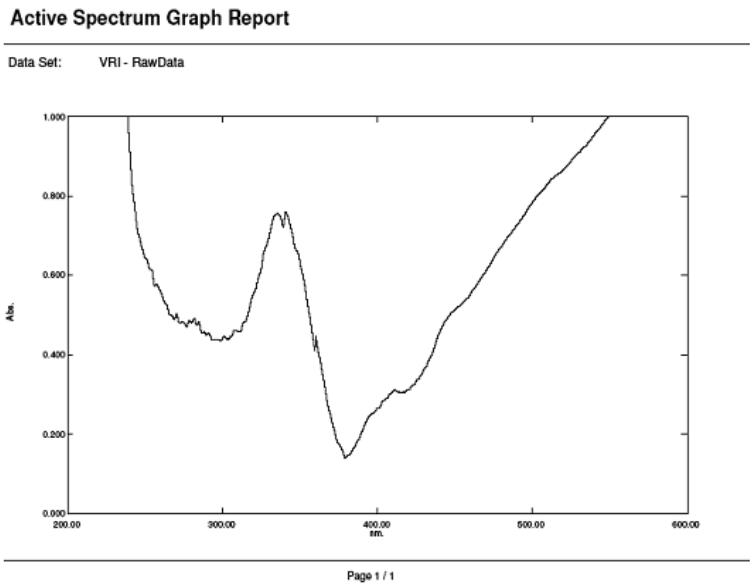

Figure.3. UV-Vis spectroscopy analysis of synthesized silver nanoparticles by treating 1mM $AgNO_3$ solution with 10%flower extract.

The FT-IR spectra of vincarosea flower extract, as given in **Figure 4** showed the very strong absorption peaks at 1543, 1635, and the strong absorption peaks at 1388,

1458 represents the presence of NO_2 which may be from $AgNO_3$ Solution, the metal precursor involved in the Ag nanoparticles synthesis process. Strong interaction of water with the surface of Silver could be the reason for the O-H stretching mode peaks at 2345, 2368, 2924 and O-H in plane bending mode peaks at 1388, 1458 [39,40].

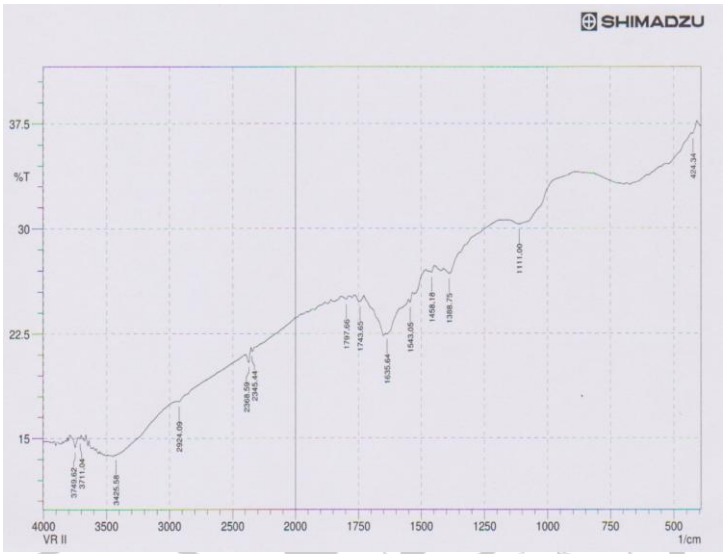

Figure.4. FT – IR spectroscopy analysis of synthesized silver nanoparticles by treating 1mM $AgNO_3$ solution with 10%flower extract.

The biosynthesized silver nanostructure was further confirmed by the characteristic peaks observed in the XRD pattern. The particle size and nature of the AgNPs were determined using XRD PW3050/60 X-pert PRO operating at a voltage of 45 kV, a current of 40 mA with Cu K a radiation at 2θ angle ranging from 10^0 to 80^0. A thin film of the silver nanoparticle was made by dipping a glass plate in a solution and to carried out for X-ray diffraction studies. The XRD spectrums of silver nanoparticles were given in **Figure5**. All diffraction peaks correspond to the characteristic face centered cubic (FCC) silver lines. These diffraction lines observed at 2θ angle 38.2,44,64.47 and 77.43 respectively, have been indexed as (111), (200), (220) and (311) planes respectively(JCPDS 04-0783)for Vincarosea extract. The average particle size of silver nanoparticles formed in the process was estimated from Debye-Scherrer's equation (d = (kλ×180)/ β Cos θβ Π) by determining the width of the (111) Bragg's reflection .The average size of silver nanoparticles were found to be 21nm corresponding to vincarosea flower extract mediated AgNPs respectively.

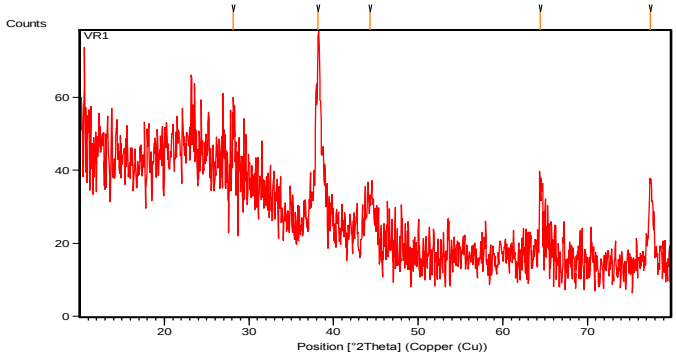

Figure 5 XRD pattern of silver nanoparticles synthesized by treating 1mM $AgNO_3$ solution with 10% flower extract.

The SEM image provided the morphology and size of the silver nanoparticles. SEM image showed individual silver nanoparticles as well as a number of aggregates Fig-6. The morphology of the silver nanoparticles was aggregated into larger irregular structure with no well-defined morphology. SEM image as given in **Figure6** Vincarosea flower extract confirm the formation of silver nanoparticles.

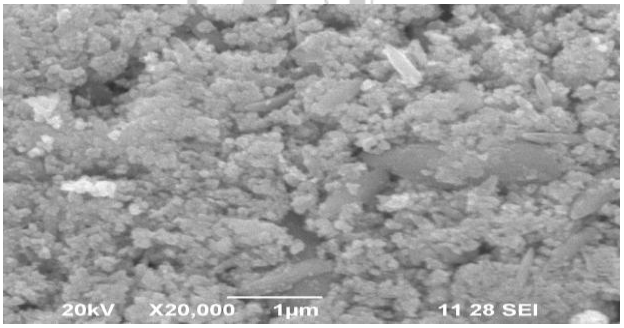

Figure 6: SEM Spectrum of Silver nanoparticles using 1mM $AgNO_3$ solution with 10% flower extract.

CONCLUSION

Biogenic synthesis of Silver nanoparticles using Vincarosea flower extracts were performed by adopting standard procedure were characterized by UV–visible, FT-IR ,XRD and SEM studies. Due to surface Plasmon resonance during the reaction with the ingredients present in the flower extracts color changes which

result in the formation of silver nanoparticles. The typical XRD pattern revealed that the average size of silver nanoparticles was found to be 21nm corresponding to Vincarosea flower extract mediated AgNPs and exist in face-centered cubic (fcc) Ag crystals. The SEM image provided the morphology and size of the silver nanoparticles. The morphology of the silver nanoparticles was aggregated into larger irregular structure with no well defined morphology.

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