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Advances in Applied Science Research, 2013, 4(4):274-278

Pelagia Research Library

ISSN: 0976-8610
CODEN (USA): AASRFC

Green synthesis of silver nanoparticles from leaves extract of ethnomedicinal plants- *Pogostemon benghalensis (B) O.Ktz.*

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ABSTRACT

The byproducts obtain from to synthesis nanomaterials by using physical and chemical methods are toxic, environmentally hazardous and above all the whole procedures are costly. For alternative, either using micro organisms or using plant extract methods environment friendly biosynthesis methods are chosen at present to synthesis nano-materials. In the present study, silver nano-particles are synthesized from local traditional medicinal plant- Pogostemon benghalensis (B) O.Ktz. (Assamese vernacular name-shukloti). As preliminary investigations, formations of silver nano-particles are confirmed from their optical properties by UV-VIS spectroscopy and EDX.Synthesised particles are characterized by FTIR spectroscopy and SEM.

Keywords: Ethnomedicinal Plants, Green synthesis, Nanoparticle

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INTRODUCTION

Nanotechnology one of the fastest developing field at present times due to its vast application fields According to PUBMED (database for literature, service of the U.S. national Library of Medicine) especially nano particles had been studied extensively (8662 articles published between 1st January 2005 and 24th April2008) [1].The multidisciplinary field of nanotechnology mainly concern to synthesis and design nano materials and device within the range of 1-100nm. But the range of size of nanoparticles in some literature grater than 100nm[2].The nano materials are generally synthesis by using physical and chemical methods but the byproducts from these methods are toxic, environmentally hazardous and above all the whole procedure are costly. For alternative, environment friendly biosynthesis methods are chosen at present to synthesis nano-materials by two ways—either using micro organisms or using plant extract methods.

North – Eastern region of India, one of the hot spot from bio diversity point of view in the global world in which number of ethnic groups of peoples uses traditional health practices which directly depend upon local plants and herbs with the help of their own ethno-medicinal knowledge [3]. A large of traditional medicinal plants used in the treatment of cut and injuries, blood pressure, skin diseases , dysentery, blood deficiency , jaundice, urinary trouble , cough, asthma , influenza, malaria etc[4].These plants are as source of bio-reductant and stabilizers and reported to contain alkaloids, glycosides, tannins, saponnins and aromatic compounds [5,6]. The most common major materials used for manufacturing nano -products at present is silver, then followed by carbon, Titanium,silicon,Zinc and Gold. Silver nano particles are used as anti-bacterial agents, as catalytic and also as optical sensor. By using plant extract methods, a lot of groups are involved to synthesis silver nanoparticles from plants like aloe Vera[7], clove (Syzygium Aromaticum), onion (Allium Cepa)[8], Geranium leaf[9], Rose leaf, neem[10], Tulasi (Ocimum sanctum)[11], Brahmi [12]etc.

To synthesis silver nano particles by plant extract biosynthesis method from leaves of *Pogostemon benghalensis (B) O.Ktz. (Family-Lamiaceae, Assamese vernacular name-shukloti)* and study their characterization, this traditional medicinal plant is selected for the applications used in cut and injuries by local peoples. Mainly leaves of this plants use by local women's after delivering a child. It is a shrub with a height of 4 to 5ft, leaves are elliptic. The whole plants use as medicinal purpose.Leaves, Young shoots and juice of leaves are used to cure stomach problems, increase digestive power, stop bleeding and mainly for menstrual disorders.

MATERIALS AND METHODS

All leaves of *Pogostemon benghalensis (B) O.Ktz. (Assamese vernacular name-shukloti)* are collected some villages near Dibrugarh University campus. After collecting, 20gm of fresh leaves are washed with tap and de-ionised water and finely cut. These cut leaves are placed in a 300ml Erlenmeyer flask with 100ml of sterile de-ionised water and boil the mixture for 5minute and filtered through whatmann no 42 filtre paper. Plant extract 4ml are added into 100ml aqueous solution of 1mM silver nitrate in conical flask of 250ml content at room temperature. The solution is shaked and boil at some certain temperatures ranges 30degreeC by hot plate magnetic stirrer for 24hours at 150rpm (REMI-1MLH). Again, the solution is shaked in a high speed centrifuge at 18,000rpm for 5 min (REMI-R-24). The colour change in reaction mixture (metal ion solution + plant extract) is record through visual observation. Yellowish black colour appearance indicates formation of silver nanoparticle.This colour changes due to surface plasmon resonance of silver nano particles.

A B C

Fig-1. Pogostemon benghalensis (B) O.Ktz. (Assamese vernacular name- *Shukloti*)

In the Fig-1. (A) represents colour of silver nitrate solution, (B) represents colour of leaves extract, (C) represents colour of formation of silver nano particles in leaves extract

RESULTS AND DISCUSSION

UV-VIS Spectra analysis-

Surface plasmon resonance (SPR), one of the optical properties exhibited by metallic nano-particles. Free electrons in metal oscillate co-operatively from their equilibrium position where the positive charges of metal (atomic nucleus) bind the ensemble of the free electron. This plasma oscillation localizes at the surface or interface. When the wave vector of the incident light matches the wavelength of the surface plasmon, the electron resonate which is called as SPR. The coupling of the incident light to the surface plasmon results in a loss of energy and for this, a reduction in the intensity of the light .A dip occurs. With the help of Gaustav Mie theoretical work on electrodynamics, Plasmon resonance depends explicitly on the particle size [13]. Both absorption wavelength and peak width increases as the particle size increase. These resonances are recorded by uv-vis spectrometer (Shimadzu uv-vis spectometer-1700 series) and spectra's are show in fig-2.

From various literature, formation of silver nano-particles are detected by UV-Vis spectrometer at different nm(Range-340-620nm).The sharp bands of silver colloids are observed at 329.50nm,436.00nm and 449.50nm.For morphological study of nano-particles, UV-VIS Spectroscopy can be used and comparing other reports[14,15] , Size of silver nano particles synthesized from leaves of this plant greater than 80nm.

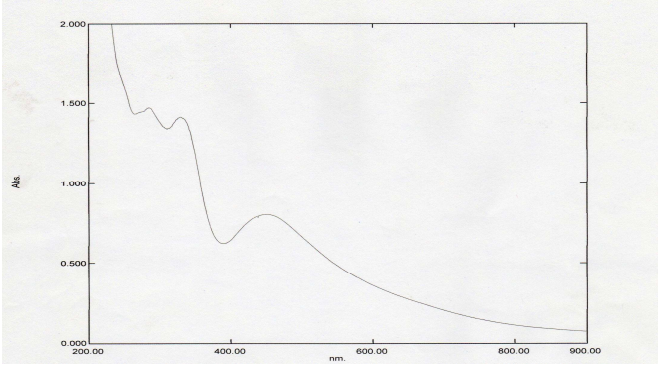


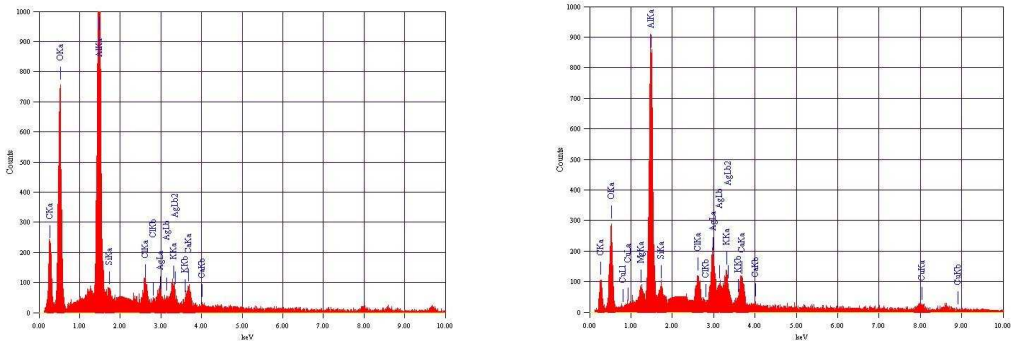
Fig-2. UV-VIS spectra of Pogostemon benghalensis (B) O.Ktz. *(Assamese vernacular name— Shukloti)*

Table-1. UV-Vis Spectrum peak Pick Report

Plants name	Wavelength (nm)	Abs.
Pogostemon benghalensis (B) O.Ktz. (Assamese vernacular name- *Shukloti*)	329.50 436.00 449.50	1.417 0.792 0.805

EDX spectra Analysis-

Energy dispersive X-ray spectrometer is based on photon nature of light and formation of metallic nano particles in a solution strongly confirmed by EDX spectras.The vertical axis represents number of X-ray counts and the horizontal axis represents energy in KeV. EDX spectra of the plant leaves extract solution are recorded by JEOL Model JED – 2300.EDX spectras are shown in fig-3 where stirring time of the solution are 12hours and 36hours respectively. For Silver nano-particles optical absorption peaks should be situated within 3 to 4 KeV range. From these spectra, peaks of silver nano-particles are observed which directly confirmed formation of silver nano-particles.



Stirring time-12hours **Stirring time-36hours**

Fig-3.EDX spectra of Pogostemon benghalensis (B) O.Ktz

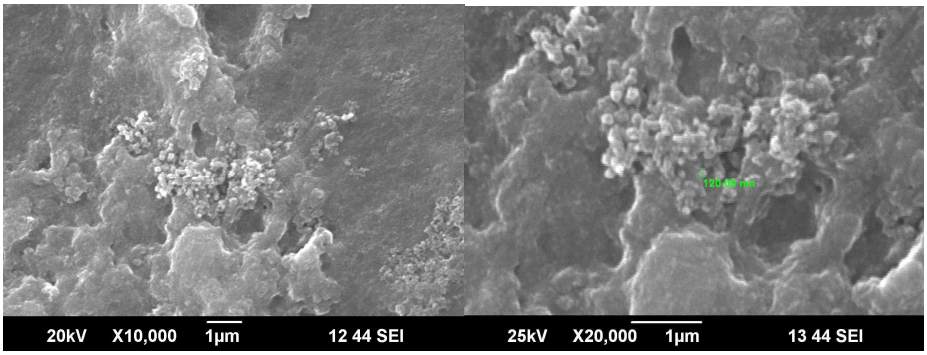
SEM observation of Silver nanoparticles-

Scanning Electron microscopic (SEM) images, recorded by JEOL Model JSM-6390LV, in Fig-4(i, ii) of both samples of the same plants having different stirring time confirmed formation of Ag nano particles. Relatively spherical nanoparticles are seen. It is observed from these images density of silver nanoparticles increases with respect to stirring time. These images are taken two months later after synthesizing silver nanoparticles in the absence of external polymeric capping agent which directly indicates stabilization of these particles by bio-organic capping agents present in the solution.

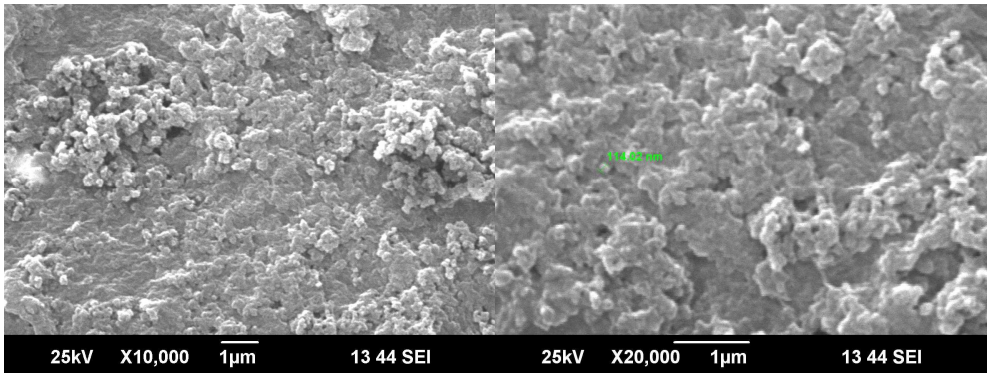
FTIR spectra analysis-

FTIR spectra's of these plants are recorded by using Thermo Nicolet, Avatar 370 within the range of 4000-400 cm -1 having resolutions 4 cm-1. In order to obtain the spectrum of a solution, it is necessary to record spectra of both the solution and the solvent alone. The solvent spectrum may then be subtracted from the solution spectrum. In this

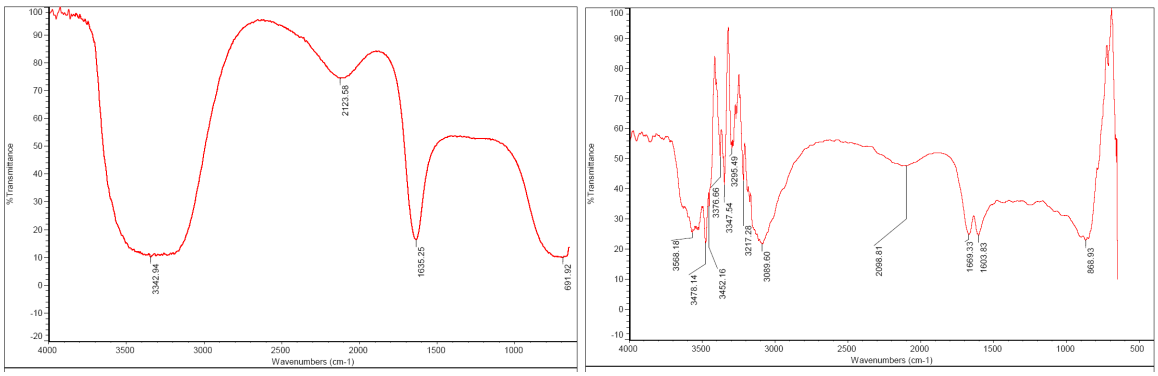
case, a de-ionised water spectrum is subtracted and obtains solution spectra. FTIR spectras of *Pogostemon benghalensis (B) O.Ktz.* (Assamese vernacular name- *Shukloti*) are shown. By FTIR spectra, biomolecules for capping and stabilization of the silver nano particles can be identified. The peaks in the region of 3570-3230cm-1 are assigned to O-H stretching of alcohol and phenol compounds and peaks in the region of 3333-2500cm-1are assigned to O-H stretching of carboxylic acids. The 1600cm-1 peak due to C=O stretching of amino acids. The 1670 cm-1peak due to peptide P1has a characteristics β-turn conformation [16]. From FTIR analysis found that carbonyl group from amino acid residues and proteins possibly form a layer over the metallic nano particles to prevent agglomeration and stabilize [17]. In aqueous medium, biomolecules may act as capping agent for stabilize nano particles.



Stirring time-12hours
Fig-4.i. SEM of Pogostemon benghalensis (B) O.Ktz



Stirring time-36hours
Fig-4.ii. SEM of Pogostemon benghalensis (B) O.Ktz



Spectra of Solvent and Solution **Spectra of solution**

Fig.5.FTIR spectra of Pogostemon benghalensis (B) O.Ktz. (Assamese vernacular name- *Shukloti*)

CONCLUSION

Leaf extract of traditional medicinal plants are suitable for synthesized silver nano-particles in aqueous solution by green synthesis method which are low cost-effective and eco-friendly. Due to presence of lot of medicinal plants along with combination of ethno-medicinal knowledge of NE-region of India and nano-science, may give some useful results in different sector and mainly in nano medicinal area.

Acknowledgement
The author acknowledges the UGC for financial assistance for this Project. Also, the author sincerely thankful to the Deptt. of chemistry,Dibrugarh University and SAIF,STIC,Cochin Univ. of Sci. & Technology for their help in UV-VIS, EDX, SEM and FTIR analysis.

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