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## Green Synthesis of Nano Particles from Leaves of Ethno Medicinal Plants -A New Approach

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### ABSTRACT

Due to rich biodiversity and different cultures and traditions of various ethnic groups, the whole north eastern parts of India has own identity from indigenous health concern side. Importance of green synthesis of nano particles from traditional medicinal plants increases at present from environmental concerns and cost effective measures. Silver nano-particle can act as antimicrobial agent, also act as catalytic agent and used as optical sensors. In the present study, silver nano-particles are synthesized from six local traditional plants; *Centella asiatica* (Assamese vernacular name-Maani muni), *Psidium guayava* (Assamese vernacular name-Modhuri Aam), *Bryophyllum pinnatum* (Assamese vernacular name-Dupor Tenga), *Adhatoda vasica* (Assamese vernacular name-Bogaa Baahok), *Lincus linifolia* (Assamese vernacular name-Dooron Bon) and *Pogostemon cablin* (Assamese vernacular name-shukloti). As preliminary investigations, formation of silver nano-particles are confirmed from their optical properties by uv-vis spectroscopy and EDX. Synthesised particles are characterized by FTIR spectroscopy. Near future green synthesis of nano particles from ethno medicinal plants plays a major role in nano medicinal area.

**Keywords:** Ethnomedicinal Plants, Green synthesis, Nanoparticle

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## INTRODUCTION

North-Eastern region of India, one of the hot spot from bio diversity point of view in the global world. This region has a large number of ethnic groups of peoples and famous for their unique cultures. Their traditional health practices which directly depend upon local plants and herbs with the help of their own ethno-medicinal knowledge comes from their forefathers. Their indigenous traditional health practices are one of the major heritages of this region [1].

Nanotechnology one of the fastest developing field at present times. 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 1<sup>st</sup> January 2005 and 24<sup>th</sup> April 2008)[2]. The multi-disciplinary field of nanotechnology mainly concern to synthesis and design nano materials and device within the range of 1-100nm. 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. In north east India, there are 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.[3]. These plants are as source of bio-reductant and stabilizers and reported to contain alkaloids, glycosides, tannins, saponins and aromatic compounds [4, 5]. 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[6], clove (*Syzygium Aromaticum*), onion (*Allium Cepa*)[7], Geranium leaf[8], Rose leaf, neem[9], Tulasi (*Ocimum sanctum*)[10], Brahmi [11] etc.

## MATERIALS AND EXPERIMENTAL METHODS

To synthesis silver nano particles by plant extract biosynthesis method from some traditional medicinal plants and study their characterization, six available traditional medicinal plants are selected which are given below with their applications-

- i. *Centella asiatica* (Assamese vernacular name-Maani Muni) --- used in cut and injuries, blood pressure, skin diseases.
- ii. *Psidium guayava* (Assamese vernacular name-Modhuri Aam) --- used in cut and injuries, dysentery, blood deficiency.
- iii. *Bryophyllum pinnatum* (Assamese vernacular name-Dupor Tenga) --- used in wounds, boils, jaundice, urinary trouble.
- iv. *Adhatoda vasica* (Assamese vernacular name-Bogaa Baahok) --- used in cough, asthma.
- v. *Lincus linifolia* (Assamese vernacular name-Dooron Bon) --- used in influenza, cough, skin diseases, malaria, worm.

vi. *Pogostemon cablin* (Assamese vernacular name-Shukloti) --- used in cut and injuries.

All leaves of these plants are collected some villages near Dibrugarh University campus. After collecting, 20gm of fresh leaves from different plants are washed with tap and de-ionised water and finely cut. These cut leaves are placed in a 300ml/500ml 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/5ml/10ml) are added into (120ml/100ml/90ml) aqueous solution of 1mM silver nitrate in conical flask of 250ml content at room temperature. The solution is shaken and boil at some certain temperatures ranges (room temperature/30dgree C /75dgreeC) by hot plate magnetic stirrer for (12/24/48 hours) at 150rpm (REMI-1MLH). Again, the solution is shaken 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.



Fig-1.i *Centella asiatica* (Assamese vernacular name -Maani Muni) Fig-1.ii *Bryophyllum pinnatum* (Assamese vernacular name- Dupor Tenga)

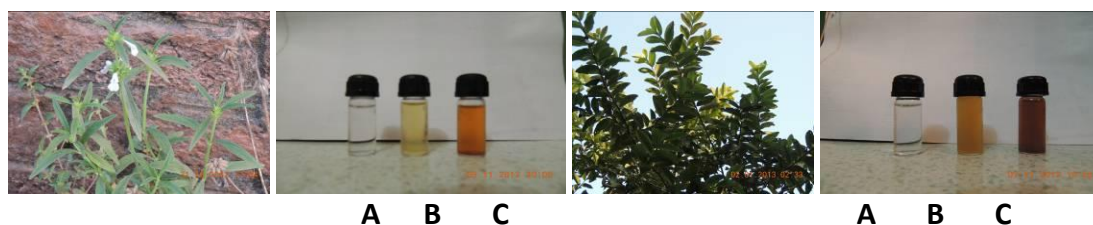


Fig-1.iii *Lincus linifolia* (Assamese vernacular name -Dooron Bon) Fig-1.iv *Psidium guayava* (Assamese vernacular name -Modhuri Aam)

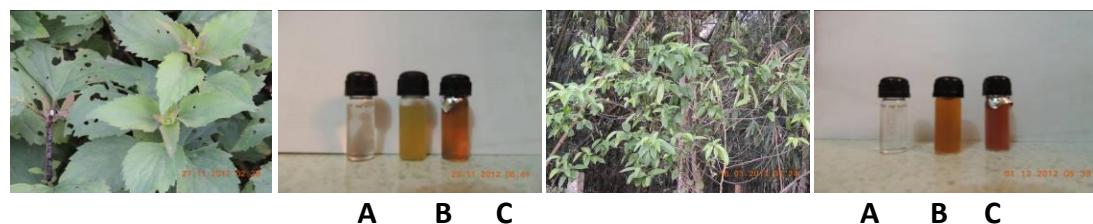


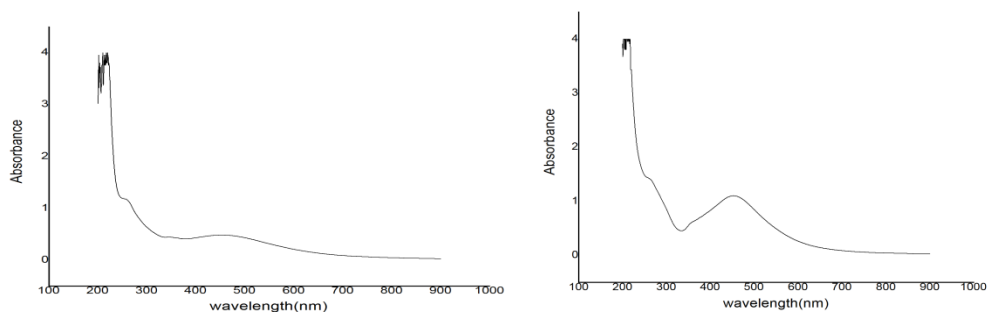
Fig-1.v *Pogostemon cablin* (Assamese vernacular name- Shukloti) Fig-1.vi *Adhatoda vasica* (Assamese vernacular name- Bogaa Baahok)

In the Fig-1. (i.ii.iii.iv.v.vi); (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

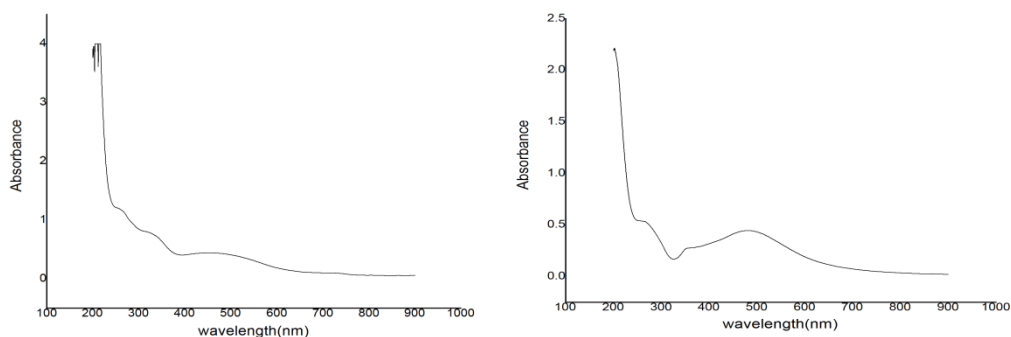
## RESULT AND DISCUSSIONS

### UV-VIS Spectra Analysis

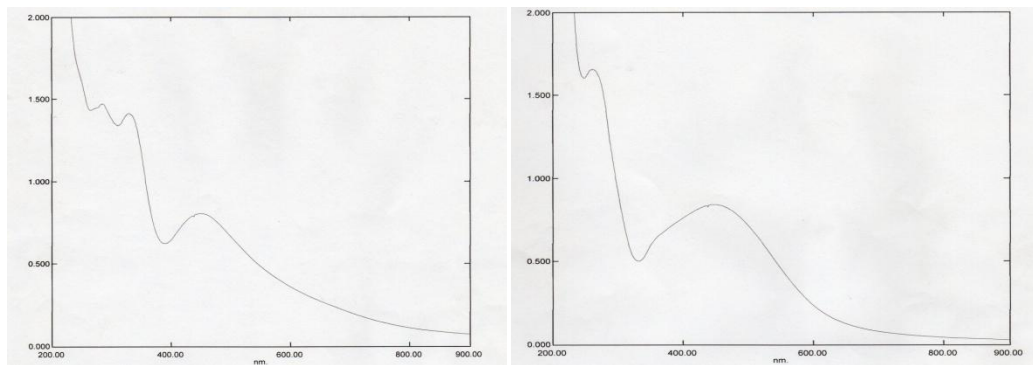
Surface plasmon resonance (SPR), one of the optical properties exhibited by metallic nano-particles. Free electrons in metal oscillate co-operatively from their equilibrium position where the positive charges of metal (atomic nucleus) bind the ensemble of the free electron. This plasma oscillation localizes 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 [12]. Both absorption wavelength and peak width increases as the particle size increase. These resonances are recorded by uv-vis spectrometer (Shimadzu uv-vis spectrometer-1700 series) and spectra's are show in fig-2. (i.ii.iii.iv.v.vi) -



**Fig-2.i Centella asiatica (Assamese vernacular name- Maani Mun Fig-2.ii Bryophyllum pinnatum (Assamese vernacular name -Dupor Tenga)**



**Fig-2.iii Lincus linifolia (Assamese vernacular name- Dooron Bon ) Fig-2.iv Psidium guayava (Assamese vernacular name- Modhuri Aam)**



**Fig-2.v Pogostemon cablin (Assamese vernacular name— Shukloti) Fig-2.vi Adhatoda vasica (Assamese vernacular name- Bogaa Baahok )**

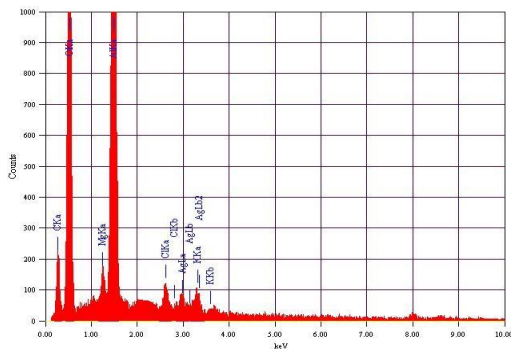
From various literature, formation of silver nano-particles are detected by uv-vis spectrometer at different nm(Range-340-620nm).For morphology study of nano-particles, UV-VIS Spectroscopy can be used and comparing other reports[13,14], Size of silver nano particles of these plants are within the range of --10-70nm, some particles greater than 80nm.

**Table-1. UV-Vis Spectrum peak Pick Report**

Serial no.	Plants name	Wavelength (nm)	Abs.
1	Centella asiatica (Assamese vernacular name -Maani Muni)	346.50 452.50	0.446 0.486
2	Bryophyllum pinnatum (Assamese vernacular name- Dupor Tenga)	451.50	1.102
3	Lincus linifolia (Assamese vernacular name - Dooron Bon)	453.00	0.443
4	Psidium guayava (Assamese vernacular name -Modhuri Aam)	361.00 482.00	0.278 0.446
5	Pogostemon cablin (Assamese vernacular name- Shukloti)	329.50 436.00 449.50	1.417 0.792 0.805
6	Adhatoda vasica (Assamese vernacular name- Bogaa Baahok)	436.00 446.50	0.836 0.843

**EDX spectra Analysis**

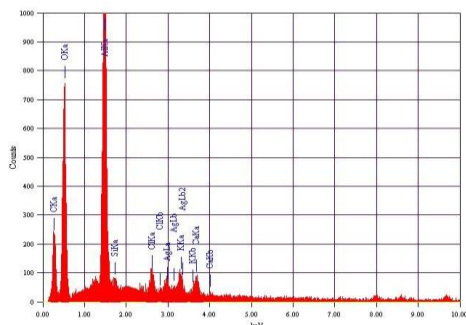
Energy dispersive X-ray spectrometer is based on photon nature of light and formation of metallic nano particles in a solution strongly confirmed by EDX spectras.The vertical axis represents number of X-ray counts and the horizontal axis represents energy in KeV. EDX spectra of these plants leaves extract solution are recorded by JEOL Model JED – 2300.One of the spectra of these plants is shown in fig-3.



**Fig-3. EDX spectra of Lincus linifolia (Assamese vernacular name- Dooron Bon)**

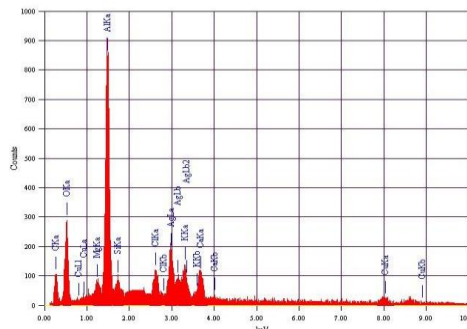
For Silver nano-particles optical absorption peaks should be situated within 3 to 4 KeV range. From these spectra, peaks of silver nano-particles are observed which directly confirmed formation of silver nano-particles.

Similarly, the solution of Pogostemon cablin (Assamese vernacular name-Shukloti) is stirred different time duration-12hours and 36 hours respectively and corresponding EDX spectra shown in Fig-4(i,ii) respectively and due to presence of Ag peaks within 3KeV to 4 KeV strongly confirmed formation of Ag nano particles. Scanning Electron microscopic (SEM) images in Fig-5(i, ii) of both samples again confirmed formation of Ag nano particles.



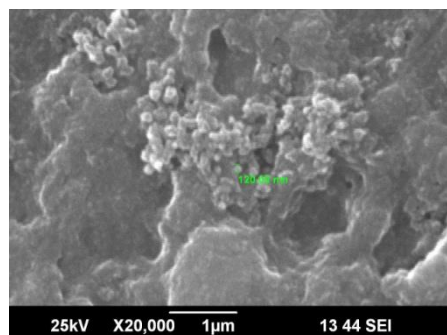
**Stirring time-12hours**

**Fig-4.i.EDX spectra of Pogostemon cablin**



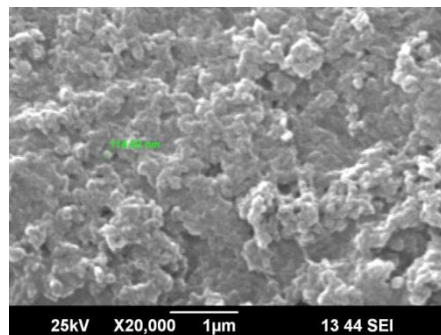
**Stirring time-36hours**

**Fig-4.ii. EDX spectra of Pogostemon cablin**



**Stirring time-12hours**

**Fig-5.i. SEM of Pogostemon cablin**



**Stirring time-36hours**

**Fig-5.ii. SEM of Pogostemon cablin**

## FTIR Spectra Analysis

FTIR spectra's of these plants are recorded by using Thermo Nicolet, Avatar 370 within the range of 4000-400  $\text{cm}^{-1}$  having resolutions 4  $\text{cm}^{-1}$ . 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. Out of all FTIR spectras, here only *Pogostemon cablin* (Assamese vernacular name- *Shukloti*) and *Adhatoda vasica* (Assamese vernacular name- *Bogaa Baahok*) are shown. By FTIR spectra, biomolecules for capping and stabilization of the silver nano particles can be identified.

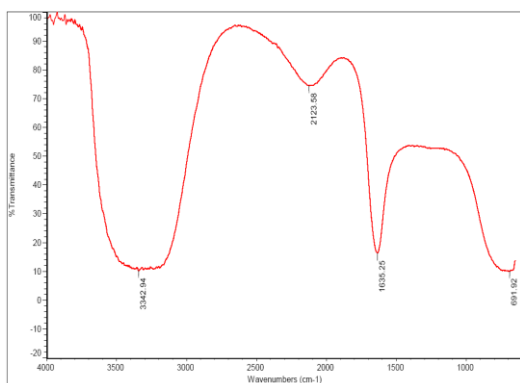


Fig-8.i. FTIR spectra of Solvent and Solution

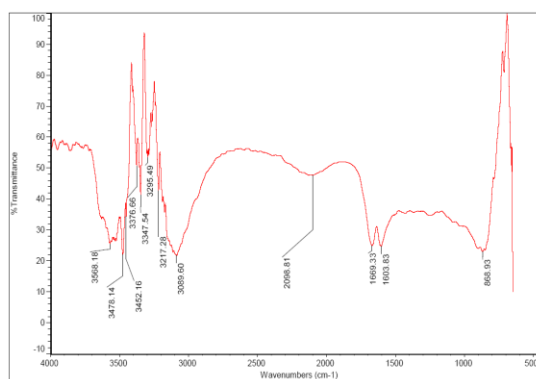


Fig-8.ii. FTIR Spectra of solution *Pogostemon cablin* (Assamese vernacular name- *Shukloti*)

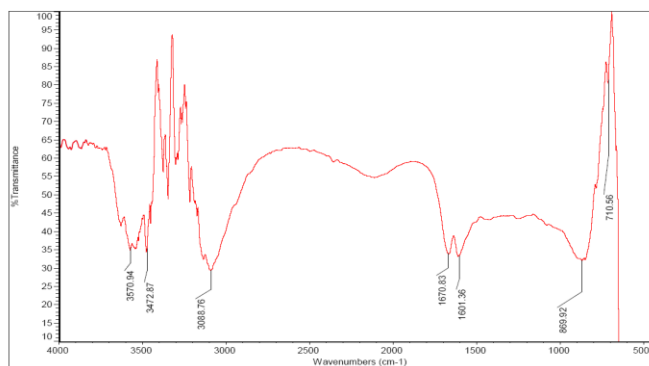


Fig-9. *Adhatoda vasica* (Assamese vernacular name- *Bogaa Baahok*)

The peaks in the region of 3570-3230 $\text{cm}^{-1}$  are assigned to O-H stretching of alcohol and phenol compounds and peaks in the region of 3333-2500 $\text{cm}^{-1}$  are assigned to O-H stretching of carboxylic acids. The 1600 $\text{cm}^{-1}$  peak due to C=O stretching of amino acids. The 1670  $\text{cm}^{-1}$  peak due to peptide P1 has a characteristics  $\beta$ -turn conformation [15]. 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 [16]. In aqueous medium, biomolecules may act as capping agent for stabilize nano particles.



## CONCLUSION

Leaf extract of these 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 and nano-science, may give some useful results in different sector and mainly in nano medicinal area.

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## REFERENCE

- [1] Baishya D. Traditional science and material culture of early Assam, EBH Publishers, Guwahati, 2009, pp.101-105.
- [2] Ed. Kosk-Bienko J. Workplace exposure to nanoparticles, European Risk observatory, Literature review, Published by European agency for safety and health at work, 2009
- [3] Sikmon JE, Morales MR, Phippe WB, Vieira RF, Janick J. (Ed.). Z. H.). ASHS press, Alexandria, VA 495 (1990).
- [4] Mallikarjuna, Narasimha G, Dillip GR, Praveen B, Shreedhar B, Sree Lakshmi C, Reddy B V S, Deva B, Prasad R. Digest Journal of Nanomaterials and Biostructures 2011;6:181 – 186.
- [5] Mano Priya K, Karunai Salvia B, John Paul J. Digest Journal of Nanomaterials and Biostructures 2011;6:869 – 877.
- [6] Chandra S. P., Chaudhary M., Pasricha R., Ahmad A., Sastry M., Biotechnol Prog. 2006;22:577.
- [7] Saxena A, Tripathi R.M., Singh R. P.,Digest Journal of Nanomaterials and Biostructures 2010;5: 427 – 432.
- [8] Shankar SS, Ahmad A, Sastry M. Biotchnol. Prog. 2003;19;1627.
- [9] Shankar SS. Rai A, Ahmad A, Sastry MJ. Colloid. Interf Sci 2004;275:496.
- [10] Mallikarjuna K, Narasimaha G, Dillip GR, Praveen B, Shreedhar B, Sree Lakshmi C, Reddy BVS, Raju BDP. Digest Journal of Nanomaterials and Biostructures 2011;6:181 – 186.
- [11] Mahitha B, Raju BD, Dillip GR, Reddy CM, Mallikarjuna K, Manoj L, Priyanka S, Rao KJ, Sushma NJ. Digest Journal of Nanomaterials and Biostructures 2011;6:135-142.
- [12] Mie G, Am. Phys 1908;25:3.
- [13] Li WR, Xie XB, Shi Q.S, Zeng HY, Ou-Yang YS, Chen YB. Appl Microbiol Biotechnol 2010;85(4):1115-22.
- [14] Lubick N. Environ. Sci Technol 2008;42 (23):8617.
- [15] Adochitei A, Dorchioiu Rev. Roum chim 2011;56(8):783-791.
- [16] Sathyavathi R Krishna, M B, Rao SV Rao, Saritha R, Rao D N Rao. AdvSci Lett 2010; 3:1.