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RESEARCH ARTICLE

ECO - FRIENDLY SYNTHESIS OF SILVER NANO PARTICLE FROM LEAF EXTRACT OF *Azadirachta indica* and *Phyllanthus emblica*

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Abstract

The synthesis of silver nanoparticles is developing into an important stem of nanotechnology. The current reading describes a novel green synthesis of silver nanoparticles by means of *Azadirachta indica* and *Phyllanthus emblica* leaf extract. The preliminary confirmation leaf extract of *A.indica* and *P.emblica* react with silver nitrate solution in 1:4 ratio respectively and kept on a water bath at 60°C until the brown color was observed. After that the green synthesized silver nanoparticles have been confirmed by UV-Vis spectrophotometer and FT-IR based on the conclusion, based on the findings the plant resources can efficiently used in the production of silver nanoparticle and it could be utilized in various biotechnological and pharmaceutical fields.

Introduction

The biological molecules undergo highly controlled assembly for making them suitable for the metal nanoparticle synthesis which was found to be reliable and eco friendly (Harekrishna Bar *et al.,* 2009) The synthesis of metal and semiconductor nanoparticles is a vast area of research due to its potential applications which was implemented in the development of novel technologies. The field of nanotechnology is one of the upcoming areas of research in the modern field of material science. Nanoparticle show completely new or improved properties, such as size, distribution and morphology of the particles etc. Novel applications of nanoparticles and nanomaterials are emerging rapidly on various fields (Kaviya *et al.,* 2011).

The need for environmental non-toxic synthetic protocols for nanoparticles synthesis leads to the developing interest in biological approaches which are free from the use of toxic chemicals as by products. Thus, there is an increasing demand for green nanotechnology" (Garima Singhal *et al.,* 2011). Many biological approaches for both extracellular and intracellular nanoparticles synthesis have been reported till date using microorganisms including bacteria, fungi and plants (Mukherjee *et al.,* 2011; Spring *et al.,* 1995). The antibacterial properties of Gr-Ag-NPs have received most attention; they were made to interact with Pseudomonas aeruginosa and Staphylococcus aureus. We also evaluated the leaf extract for their antibacterial properties using the same experimental methods in order to compare them with Gr-Ag-NPs. The results suggested that Gr-Ag-NPs had better antibacterial properties. Thus greener

synthesis of Ag-NPs which not only have environmental advantages but also showed better antibacterial properties than those plant leaf extract. Plants provide a better platform for nanoparticles synthesis as they are free from toxic chemicals as well as provide natural capping agents. Moreover, use of plant extracts also reduces the cost of microorganism's isolation and culture media enhancing the cost competitive feasibility over nanoparticles synthesis by microorganisms (Klaus *et al.,* 1999). In the recent days, silver nanoparticles have been synthesized from the naturally occurring sources and their products like green tea (Camellia sinensis), Neem (Azadirachta indica) , leguminous shrub(Sesbania drummondii), various leaf broth, natural rubber, starch , Aloe vera plant extract , lemongrass leaves extract, etc. (Vijayaraghavan *et al.,* 2012). The synthesis of silver nanoparticles using several methods have been reported, they are Chemical Reduction (Santos and Marzan, 1999), Thermal decomposition (Plante *et al.,* 2010), Phytochemical (Bera *et al.,* 2010), Reverse Micelles (Lim *et al.,* 2004), Radiation Assisted (Cheng *et al.,* 2011), Electrochemical (Hirsch *et al.,* 2005), Sonochemical (Korotchenkov *et al.,* 2006), Microwave assisted (Nadagouda *et al.,* 2011) The current reading is moreover intended for the plant mediated synthesis of silver nanoparticles using leaf extract of *A. indica* and *P. emblica* the silver nanoparticles be characterized with UV-spectroscopy and FT-IR.

Material and Methods:

Collection of Plant Leaf Samples:

The young leaves of *A. indica* and *P. emblica* were collected from the college campus of Puthanampatti at Tiruchirappalli district.

Chemicals:

The chemicals, media and reagents used in the present studies were taken from Hi Media Laboratories; the chemicals were of AR grade.

Preparation of plant leaf extract:

The plant leaves of *A. indica* and *P. emblica* were washed thrice with tap water and distilled water and kept in the room temperature for air dry. After drying the known amount of leaf samples were chopped into fine and small pieces. The chopped 25 gram of leaves added with 100 ml of distilled water and boiled up to 100°C for 30 minutes. After the desired reaction period the desired samples were filtered through Whattman filter paper to get the leaf extract. Leaf extracts were stored at -4°C for further study.

Preparation of Silver Nanoparticles Solution:

1mM silver nitrate, 0.0421gm of AgNO3 was added to 100 ml of double distilled water. The solution was mixed thoroughly and stored in brown bottle in order to prevent auto oxidation of silver.

Green synthesis silver nanoparticles:

For the synthesis of plant mediated silver nanoparticles, the leaf extract and 1mM silver nitrate solution were taken in 1:4 ratio respectively and kept on a water bath at 60°C for 30 minutes until the color change was observed. This indicates the preliminary confirmation for the formation of plant mediated silver nanoparticles. UV spectrophotometer is the technique to examine the silver nanoparticles in the aqueous suspension. Green synthesized silver nanoparticles from *A. indica* and *P. emblica* were taken for UV spectra Analysis (320- 750 nm).

UV-Vis Spectra analysis

The bio reduction of silver ions in aqueous solution was monitored by periodic sampling of aliquots (1 ml) and subsequently measuring UV-vis spectra of the solution. UV-vis spectra of these aliquots were monitored as a function of time of reaction on UV – Instrument model (Arithem etic)

FT-IR measurement

FT-IR measurement of sample was performed using Nicolet Avatar Model FT-IR spectrophotometer. The FT – IR spectra of leaf extracts was taken before and after synthesis of silver nanoparticles, were analyzed peaks may due to *A. indica* and *P. emblica*.

Result and Discussion:

The synthesis of silver nanoparticles occurred during the exposure of *A. indica* and *P. emblica* leaf extract to 1 mM aqueous silver nitrate solution. The complete decrease of silver ions was observed after silver nanoparticles demonstrate yellowish colour aqueous solution due to excitation of surface Plasmon vibrations in silver nanoparticles. The appearances of yellowish colour in the response tubes suggest the formation of silver nanoparticles. (Dipankar *et al.*, 2012) Fig.1The synthesized silver nanoparticles had been confirmed by UV-Vis spectrum of the reaction media. The UV-Vis spectrum of green synthesized silver from *A. indica* and *P. emblica* has absorbance peaks at 241nm, 292 and 362 and 242 and 362 respectively as shown in the maximum peak was found to be a both A. indica, and *P. emblica* absorbance at 362 nm. From the study carried out by (Asmita *et al.*, 2012) for the neem plant, the maximum peak found at 420nm. (Fig.2).

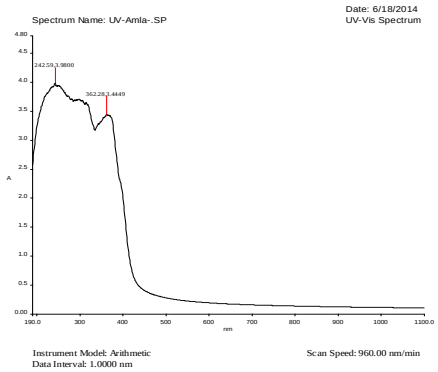
FT-IR analysis

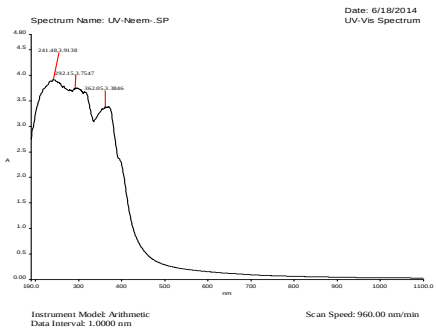
The stretching at the wave number 3237 cm-1shows the presence of O-H functional group with H bonded and the bending at wave number indicates the presence of NH functional groups in *A.indica* (Fig. 3). According to (Niraimathi *et al.*, 2013) the FTIR spectrum of plant leaf extracts which shows prominent absorption peaks at *P. emblica* 3438 cm^1, 2076 cm^1, 1637 cm^1 and 660 cm^1 , *A. indica* 3433 cm^1 , 2075 cm^1 , 1636 cm^1 and 656 cm^1(Fig.3). the broad peak were absorbed in *P. emblica* 3438 cm^1 and *A. indica* peak absorption shows 3433 cm^1 The peak area of 1350 to 1000 cm-1 communicate to -C-N- stretching vibration of the amine or -C-O- stretching of alcohols, ethers, carboxylic acids, esters and anhydrides. FT-IR analysis reveals that the peak stronger ability to bind metal indicating that the proteins could possibly form a layer of silver nanoparticles (Rajesh *et al.*, 2009).

Conclusion:

The present study, the synthesis of silver nanoparticles using leaf extract of both *A. indica* and *P. emblica* has been achieved among the rapid reduction of silver nitrate into silver nanoparticles. Fascinatingly, the reaction channel changed its colour from pale yellow to dark brown. The UV-Visible spectrum and FT – IR of the reaction channel with silver nanoparticles synthesized using *A. indica* and *P. emblica* leaf extract offers a reasonably priced, environment friendly practice for production of large scale silver nanoparticles. In further research we can be apply in different pharmaceutical and biotechnological field and their properties and appliance can be explored.

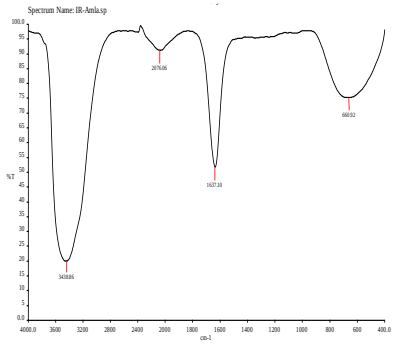
Fig.1. (A) Leaf extracts of *Azadirachta indica* and *Phyllanthus emblica* before and (B) After the synthesis of AgNPs

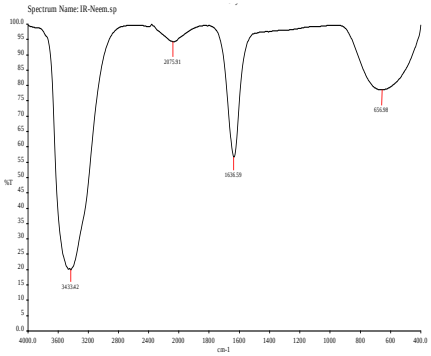




Phyllanthus emblica*.** ***Azadirachta indica

Fig.2.UV-Visible spectra of silver nanoparticles synthesized by leaf extract of *Azadirachta indica* and *Phyllanthus emblica* a function of time:





Phyllanthus emblica*.** ***Azadirachta indica

Fig.3.FT-IR spectrum of leaf Extract of both *Azadirachta indica* and *Phyllanthus emblica*.

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