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Research Article

Phytochemical screening of silver nanoparticles extract of *Eugenia jambolana* using Fourier infrared spectroscopy

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ABSTRACT

Silver nanoparticles were synthesized using leaves extract of *Eugenia jambolana.* Therefore, the present study is evaluate the phytochemical constituents of silver nanoparticles plant extract of *Eugenia jambolana* using FTIR. For synthesis of silver nanoparticles using leaf extracts of *Eugenia jambolona*, plant extract or filtrate was prepared by grinding the leaves and allowed to boil using water and finally filter the content with Whatman no.1 filter paper. This filtrate was then added to silver nitrate solution for silver nanoparticles formation which was characterized by UV-Vis spectroscopy. The silver nanoparticle extract that formed was then analysed for various phytochemical test and the functional groups present in the extract were identified by fourier transform Infrared Spectroscopy. As a result, the reduction of silver ions to form silver nanoparticles occurred within an hour of reaction at the absorption spectrum of 300–540 nm. The silver nanoparticles extract were found to contain secondary metabolites like alkaloids, flavonoids, phenolic compounds, saponins and sugars. The spectrum recorded between 350 cm^{-1} to 4000 $cm^{-}1$ which showed the presence of various functional groups of phytochemicals. Plant extract used for the synthesis of silver nanoparticles was proved to be less toxic and also need less purification as compared to chemical methods. The use of silver nanoparticles in drug delivery systems becomes the milestones in the field of medicine.

Keywords: Drug delivery; Herbal plant *Eugenia jambolana*; Nanotechnology; Phytochemicals; Phenols.

INTRODUCTION

Nanotechnology, one of the specific research area in scientific world today concerned with production of materials in nanometre (1 to 100nm). This nanoparticles changes in their biochemical and physical properties and are useful in various fields. Among all metal nanoparticles, silver nanoparticles are noble with good conductivity, catalytic activity and chemical stability. In the field of medicine, they are used in antiseptic creams as they have a broad spectrum effect against microorganisms by affecting their enzymatic activities and makes them completely inactive (Ahmed et al., 2016).

This silver nanoparticles are synthesized by processes such as chemical reduction, thermal decomposition and photo reduction. These methods are highly expensive with environmental and biological health hazards as they involves toxic chemicals (de Villiers et al., 2008). In order to avoid toxicity of this chemicals, biological synthesis of nanoparticles are preferred nowadays and they can be produced by microorganisms, enzymes, fungus and plant extracts. Even green synthesis using plant extracts was advantageous over other biological methods which is cost effective and eco-friendly method and avoiding the complicated and elaborate processes of culturing the microbes (Shankar et al., 2004).

In case of nanomedicine, silver nanoparticles have more potential use in cancer therapy and in drug delivery. Previous studies have reported using various silver nanoparticles plant extracts such as neem leaves, geranium leaves, Alfalfa, *Aloe vera* and *Emblica officinalis* (Kumar and Yadav, 2009).

The present study deals with *Eugenia jambolana* plant. *Eugenia jambolana* which is commonly known as black plum. It is widely distributed throughout Asian

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countries like India, Srilanka, Malaysia and also in Australia. It is a large tree with bark pale brown and slightly rough on old stems. Leaves opposite, elliptic to broadly oblong, leathery with short pointed at tips. Flowers are white with 4 petals fused into a cap. Fruits appears in different size which are ellipsoidal in shape that are crowned with truncate calyx-limb with pink juicy pulp (Ayyanar and Subash-Babu, 2012).

It is an important medicinal plant in India with various traditional systems of medicine that are used effectively during diabetes mellitus, inflammation, ulcers, digestive disorders and diarrhoea. It also function as liver tonic to enriche the blood and for strengthening teeth and gums. It is also used in form of lotion for removing ringworm infection. It has a good source of vitamin A and C and has the ability to control blood pressure (Chandrasekaran and Venkatesalu, 2004). Hence, the objective of the present study is to synthesize silver nanoparticles with the plant leaves extract of *Eugenia jambolana* and to study the phytochemical analysis in the leaf extracts of *Eugenia jambolana* using Fourier Infrared Spectroscopy.

MATERIALS AND METHODS

Preparation of plant materials

The current study was an attempt to evaluate the phytochemical constituents of silver nanoparticles plant extract of *Eugenia jambolana.* Fresh leaves of *Eugenia jambolana* free from diseases (shown healthier externally) were collected from Madurai Kamaraj University campus, and then washed thoroughly with tap water for two to three times followed by washing with sterile water. After washing, 20 g of fresh leaves were finely chopped, grinded using mortar and pestle with 100 ml of Distilled water and was stirred continuously at 60^0C for 1 h. After boiling, the mixture was cooled and filtered with Whatman paper No. 1. Filter paper and finally the filtrate was collected.

Synthesis of silver nanoparticles using *Eugenia jambolana*

For the synthesis of silver nanoparticles, ammonium solution (2.5ml) was mixed with 1 mM silver nitrate ($AgNO_3$) solution (5ml). To this, 10 ml of prepared filtrate of *Eugenia jambolana* extract was added. The solution was adjusted to final volume of 50 ml by adding de-ionized water in appropriate amount. The solution turned to bright yellow and to dark brown which confirmed the synthesis of silver nanoparticles. The solution were kept incubated at 200 rpm at about 37 °C under continuous agitation for 48 h (Kasthuri et al., 2009).

Characterization of silver nanoparticles

For maximum production of silver nanoparticles, the samples were taken under the absorption spectrum in range of 300–540 nm using a UV–vis spectrophotometer. The duration and progress of the reaction between metal ions and the leaf extract were observed. The reduction of silver ions and formation of silver nanoparticles was occurred within an hour. Control was maintained by using $AgNO_3$ and de-ionized water was used as a blank (Logeswari et al., 2015).

Phytochemical Analysis

The filtrate of *Eugenia jambolana* leaves extract was subjected to qualitative analysis for the presence of various known phytochemicals such as alkaloids, phenolic compounds, flavonoids, sugars and saponins using the methods of (Khandelwal, 2008)

FTIR Analysis

Fourier transform Infrared Spectroscopy transforms infrared spectra which was produced by the absorption of electromagnetic radiation in the frequency range of 400 to 4000 $cm^{-1.}$ Various functional groups present in the solution were absorbed at their own characteristic frequencies. The frequency and intensity of absorption were the indication of the band structures and structural geometry of the molecule. In this present study, FTIR spectra were taken using Perkin Elimer-spectrum RXI model to identify the functional group of the active components present in the plant extract based on the peak value in the region of infrared radiation (Sasidharan et al., 2011). The peak values of FTIR were recorded where the readings was repeated twice for the spectrum confirmation.

RESULTS AND DISCUSSION

The reduction property of the *Eugenia jambolana* extract using silver nitrate solution was studied, by which silver nanoparticles were derived from the plant leaf extract. Reduction of silver nitrate solution by the plant leaf extract and the formation of silver nanoparticles after 24 hours incubation in a dark room was shown in Figure 1.

Figure 1: This was due to the phytochemical components present in the leaf extracts, which helps in the reduction of silver ions. Similar results were reported for silver reduction by urease (Sharma et al., 2013). In another study done by (Aghili et al., 2016), trptophan and tyrosine residues were involved in lysozyme silver nanoparticle synthesis.

The synthesized Silver nanoparticle using *Eugenia jumbolana* plants extracts were detected by UV Vis spectrophotometer as shown in Figure 2, where the given sample extract showed maximum absorption peak at 400nm. Gudikandula and Charya Maringanti, (2016), reported that UV-Vis spectrum of colloidal solution of Silver nanoparticles from *Eugenia jumbolana* has maximum absorbance peak at 400 nm, which is proved the synthesis of silver nanoparticles in the colloidal solution. This report was in accordance with our present study.

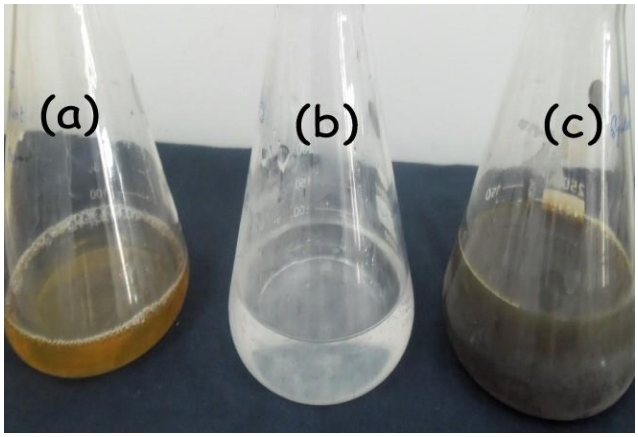

Figure 1: Green synthesis of silver nanoparticles of Eugenia jambolona with a. Eugenia jambolona filtrate; b. Silver nitrate solution and c. Synthesis of silver nanoparticles

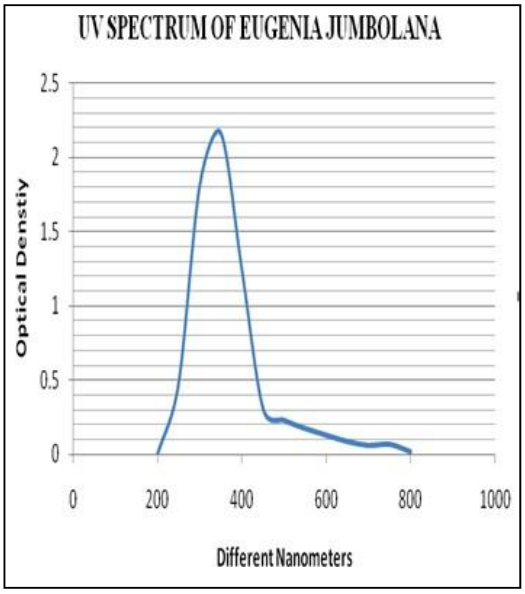

Figure 2: Characterization of silver nanoparticle leaves extract of Eugenia jumbolona using UV spectrum

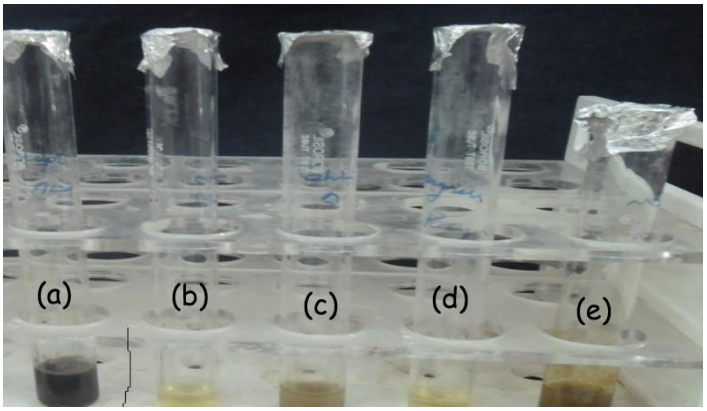

Figure 3: Qualitative phytochemical analysis of Eugenia Jambolana a. Phenol with Bluish Black Color; b. Flavonoids with yellow color precipitate; c. sugar with brick red color; d. Saponins with foam and e. Alkaloids with reddish brown color

Figure 2: The leaves extract of *Eugenia jambolana* have been analysed for their phytochemical constituents that was shown in Figure 3. The test results confirm that the leaf extract contains secondary metabolites like alkaloids, flavonoids, phenolic compounds, saponins and sugars. The results were qualitatively positive. From the previous studies done by Jasmine et al. (2010), study showed the presence of saponin phytochemical in plant extract of *Eugenia jambolana*. Myricetin was the new flavonoid isolated from the same plant extract that has anti-inflammatory and anti-microbial actions (Williams, 2010).

Figure 3: FTIR spectrum of *Eugenia jambolana* leaves extract was shown in Figure 4 where different

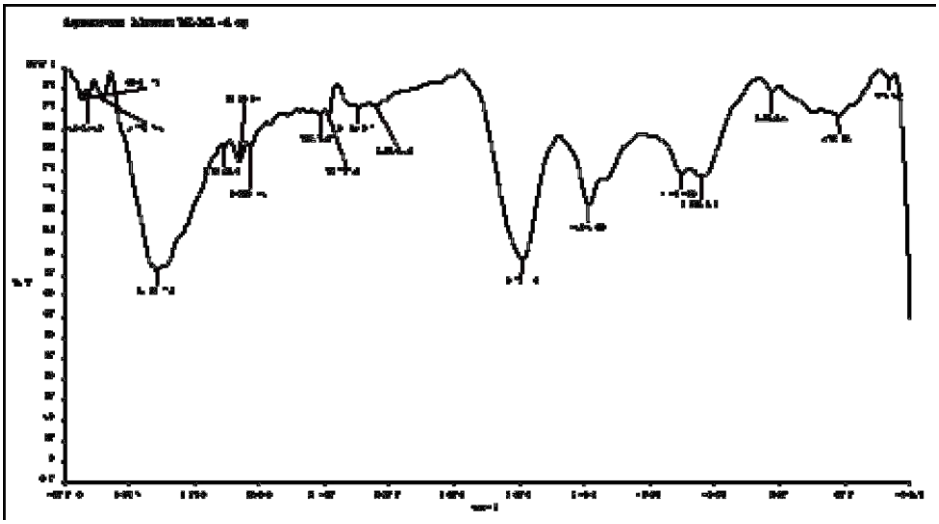

Figure 4: FTIR analysis of Eugenia jumbolana extract

functional groups of different compounds was found. The spectrum was recorded in the wavelength region between 350 cm^{-1} to 4000 cm^{-1}.

Figure 4: The FT-IR spectrum showed peak at 3855.13^{-1} and 3772.78cm^{-1} which indicates the presence of O-H stretching of alcohols and phenols. The peaks at 3433.78 cm^{-1} and 3016.84 cm^{-1} indicate the presence of C-H stretching of alkanes. The peak observed at 2928.04 cm^{-1} represents the C=O stretch of aldehydes. The peak at 2859.13 cm^{-1} represents N-O asymmetric stretch of nitro compounds. The C-H bend of alkanes occurs at 2432.67 cm^{-1}. Further, the peaks at 2377.63 cm^{-1}, 2195.87cm^{-1}, 2084.16 cm^{-1}, correspond to C-N stretch of aliphatic amines. The C-Cl stretching occurs as a weak band at 1388.58 cm^{-1}, correspond to C-N stretch The C-Cl stretching occurs as a weak band at cm^{-1}. FTIR spectroscopy is one of the reliable and sensitive method for detection of biomolecular fractions of various plant extract (Joshi, 2012).

CONCLUSION

Nanotechnology might produce many new materials with a vast range of applications such as medicine, electronics, biomaterials energy production, and consumer products. The silver nanoparticles from *Eugenia jambolana* leaves extract was characterized by the reduction property of silver nanoparticles that was due to the phytochemical components present in the leaf extracts, which helps in the reduction of silver ions. This green synthesized silver nanoparticle can be used as a novel therapeutic agent in many biomedical applications.

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