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Biosynthesis of silver nanoparticles using *Mytragyna parvifolia* leaf extract

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ABSTRACT

Over the last decade, a number of plant extracts have been studied for synthesis of silver nanoparticles due to simple, effective and eco-friendly nature. In the present work, one step bio-synthesis of silver nanoparticles using *Mytragyna parvifolia* leaf extract was studied and optimum conditions for the formation of stable silver nanoparticles were established. Aqueous leaf extracts were prepared using microwave assisted extraction method and used for synthesis of silver nanoparticles. Bio-reduction of Ag^+ ions to silver nanoparticles by aqueous leaf extracts was monitored by UV-visible spectrophotometer.

KEY WORDS: *Mytragyna parvifolia*, silver nanoparticles, Biosynthesis.

1. INTRODUCTION

Over the last decade, biosynthesis of silver nanoparticles (AgNPs) using plant extracts has received much attention due to its simplicity, eco-friendliness and economically viable nature, compared to other methods. Therefore, a vast number of plants extracts have been used for the synthesis of AgNPs. Leaf extract of a plant contains phytochemicals, which played an important role for reduction of Ag^+ ions of $AgNO_3$ solution and stabilization of AgNPs.

Mytragyna parvifolia is commonly known as cadamb and it belongs to Rubiaceae family. *The plant is* deciduous tree and mainly found in Asia and Malesia. In traditional folk medicine its leaves and bark are reputed to cure many diseases. In traditional medicine in India the bark and roots of the tree are used for fever, colic, muscular pains, burning sensations in the stomach. Studies on synthesis of AgNPs using aqueous leaf extract of *Mytragyna parvifolia are reported*. The aqueous leaf extract of *Mytragyna parvifolia* prepared using conventional method and used for the synthesis of AgNPs. The phytochemicals present in the aqueous leaf extract are responsible for the reduction of Ag+ ions to AgNPs and stabilization of AgNPs. Therefore, it is clear that the formation properties of AgNPs vary with phytochemical composition of leaf extract. Nevertheless, phytochemical composition of leaf extract dependent on the extraction conditions especially the extraction method. Synthesis of AgNPs from *Mytragyna parvifolia* leaf extract prepared using microwave assisted extraction method was not reported sofar.

In the present work, AgNPs were synthesized using *Mytragyna parvifolia* leaf extracts prepared from microwave assisted extraction (MAE) method. Bio-reduction of Ag^+ ions from $AgNO_3$ solution was monitored by UV-visible spectrophotometer. The optimum conditions to form stable AgNPs were established. In order to assess the phytochemical composition, *Mytragyna parvifolia* leaf extracts was screened for important and common phytochemicals such as alkaloids, phenolic compounds, flavonoids, tannins, terpenoids and diterpenoids.

2. MATERIALS AND METHODS

Preparation of leaf extract by microwave assisted method (MAE): *Mytragyna parvifolia* leaves are collected from the Andha loyola college campus, vijayawada, Andhra pradesh. Fresh leaves were washed several times with distilled water and air dried. 5 gm of freshly cut leaves were added to 100 ml double *distilled* water in 250 ml conical flask. The contents were heated in a domestic microwave oven (Electrolux) for 10 minutes to disperse the extract in water. The solution was filtered using Whattman No.42 filter paper to obtain a clear solution.

Synthesis of silver nanoparticles: The AgNPs were synthesized using a constant volume of 1mM silver nitrate solution with different volumes of the leaf extract (0.1, 0.5 and 1.0 ml). The appearance of dark yellow color after 4 h indicates the formation of AgNPs. The formation of AgNPs was characterized by UV-visible spectroscopy using a spectrophotometer (Elico spectrophotometer).

Phytochemicals screening of *Mytragyna parvifolia* leaf extract: *Mytragyna parvifolia* leaf extract prepared by means of microwave assisted extraction method was screened for phytochemicals like alkaloids, phenolic compounds, flavonoids, tannins, saponins, terpenoids and diterpenoids using standard qualitative methods [4].

Detection of alkaloids: Dragendroff's Test: To 1ml of extract 1 ml of Drogendroffs reagent (Potassium Bismuth iodide solution) was added. Formation of orange/red precipitate indicates the presence of alkaloids.

Wagner's Test: Filtrate was treated with Wagner's reagent (Iodine in Potassium Iodide). Formation of brown/reddish precipitate indicates the presence of alkaloids.

Detection of phenols: Ferric Chloride Test: To 1ml of extract 1 ml of 5 % of aqueous ferric chloride solution was added. Formation of dark green precipitate indicates the presence of phenolic compounds.

Detection of flavonoids: To 3ml of each extract Mg metal tuning and 2 ml of concentrated hydrochloric acid was carefully added. Formation of reddish brown coloration at interface shows the presence of flavonoids.

Detection of tannins: To 1ml of extract 1 ml of aqueous 1% of lead acetate solution was added. Formation of dark precipitate indicates the presence of tannins.

Detection of terpenoids: To 5ml of each extract 2 ml of chloroform and concentrate sulphuric acid was carefully added. Formation of reddish brown coloration at interface shows the presence of terpenoids.

Detection of diterpenoids: Copper acetate Test: Extracts were dissolved in water and treated with 1 ml of 1% copper acetate solution. Formation of emerald green color indicates the presence of diterpenoids.

3. RESULTS AND DISCUSSION

Silver nanoparticles were prepared using constant volume of 1mM $AgNO_3$ solution with different volumes of aqueous leaf extracts of *Mytragyna parvifolia*. Bio-reduction of silver ions by aqueous leaf extracts was evidenced by the visual change of solution color from pale green to yellow after 4 hr. Formation of AgNPs was monitored by UV-visible spectrophotometer (Elico spectrophotometer). The UV-visible spectrum of AgNPs is presented in figure.1. AgNPs shows maximum absorbance at 440 nm and the absorbance varies with the volume of extract. In order to establish optimum conditions for the formation of stable AgNPs, the change in absorbance with extract volume was monitored and presented in figure 1. From the figure it is clear that 0.1 ml of leaf extract is sufficient to form stable AgNPs with in 4hr. Phytochemical composition of leaf extracts presented in Table.1, shows the presence of phenolic compounds, flavonoids, tannins, terpenoids and diterpenoids in higher levels and absence of alkaloids. The result indicates that these phytochemicals are involved in formation of AgNPs. Further, it is essential to study the phytochemicals witch played an important role during the formation of AgNPs.

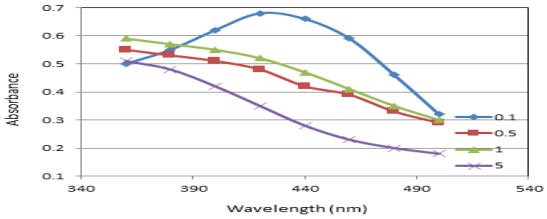

Fig.1.Variation of absorbance and wavelength with leaf extract volume

Table.1.Phytochemicals screening of *Mytragyna parvifolia* leaf extract

S.No	Test	Color	M.A.E
1	Alkaloids	Coloration not observed	-
2	Phenolic compounds	Bluish black	++
3	Flavonoids	Yellow to colour less	++++
4	Tannins	Dark precipitate	++++
5	Terpenoids	brown coloration	++++
6	Diterpenoids	emerald green	++++

Note: (++++) high intense, (++) medium intense, (+) low intense, (-) not observed

4. CONCLUSIONS

In the present work, the optimum conditions for the formation of stable AgNPs from 1mM $AgNO_3$ and *Mytragyna parvifolia* leaf extract prepared using microwave assisted extraction method was established. Studies on effect of volume of leaf extract on formation of AgNPs revealed that 0.1 ml of extract required for the formation of stable AgNPs from 1mM $AgNO_3$ solution. Phytochemical analysis of leaf extract showed that the extract contains lower phenolic compounds, higher flavonoids, tannins, terpenoids, diterpenoids and absence of alkaloids. Further, the main phytochemical concerned for AgNPs production and physical properties of AgNPs need to be studied.

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