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GREEN SYNTHESIS OF SILVER NANOPARTICLES FROM AQUEOUS LEAF EXTRACT OF MUSSAENDA ERYTHROPHYLLA AND ITS ANTIMICROBIAL ACTIVITY

Biological Science

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ABSTRACT

The synthesis of silver nanoparticles from medicinal plant extracts has been carried out due to its environment-friendly approach. Mussaenda erythrophylla of the family Rubiaceae has traditional medicinal values. Silver nanoparticles are synthesized from the fresh leaf extract of this plant using AgNO3. The synthesis of nanoparticles is confirmed by the FTIR spectrophotometer which shows maximum absorption at 440 nm. The UV spectra and visual observation showed that the color of the fresh leaf extract turned brownish-yellow after forming silver nanoparticles. The anti-microbial activity of aqueous leaf extract and AgNPs on E.coli is studied by disc diffusion method. It is found that the AgNPs has more antimicrobial property than the leaf extract.

KEYWORDS

Nanoparticles, Mussaenda erythrophylla, E.coli, medicinal plant, antimicrobial , Silver nitrate

INTRODUCTION

Nanoparticles are particles with sizes ranging from 1- 100 nm. The metal nanoparticles are easy to synthesize. They are found to have many properties such as catalysts, antimicrobials, antivirals, etc. The Synthesis of silver nanoparticles is studied more in concern with medicine and health. Ag has strong antibacterial activity. The silver nanoparticle has more strong effect as an antibacterial than the Ag alone(Rai et al,2009). The silver nanoparticles were synthesized by physical, chemical, and biological methods. It was found that the chemically synthesized silver nanoparticles have adverse and harmful effects on their application (Singh et al, 2010).

The biological method of synthesis of silver nanoparticles is more utilized. The secondary metabolites serve as a phytochemical to help in the reduction of Ag ions and the synthesis of nanoparticles.(Chandran et al, 2006). , Mussaenda erythrophylla of the family Rubiaceae serves as a traditional medicinal plant with antibacterial, antiviral, and antioxidant properties. (Bharathi v et al,2013) In the present study, the AgNps synthesized from the aqueous leaf extract of this plant are carried out to evaluate its antibacterial activity on gram -ve bacterial Escherichia coli.

MATERIALS AND METHODS

Preparation of leaf extract

The fresh leaves of Mussaenda erythrophylla were collected and washed with tap water to remove the dirt. It was then washed with distilled water to remove the impurities. The fresh leaves were cut into pieces and 10 gm was weighed and put into a beaker with 100 ml of sterile distilled water. The mixture was heated for 20 minutes at 60°C while stirring occasionally and then allowed to cool at room temperature. The mixture was filtered twice using the Whatman 42 filter paper and then centrifuged at 2000 rpm for 20 minutes. The extract was stored in the refrigerator for further use to synthesize Ag nanoparticles.

Synthesis of Silver Nanoparticles (AgNPs)

10 ml of leaf extract was added in 90ml of 1mM $AgNO_3$ solution in a conical flask. The mixture was kept in a boiling water bath for 20 min at 65°C until the visible color change. Allowed the mixture to cool and stored it in the refrigerator for further use. The formation of AgNPs was confirmed by the visual observation of brown colour and by the FTIR spectrophotometer.

Antibacterial Activity of AgNPs

The antimicrobial activity of synthesized AgNPs from the leaf extract was evaluated against gram -ve bacteria i.e Escherchia Coli by disc diffusion technique. To determine
the antibacterial activity, the diameter of the inhibition zone was measured around the disc.

RESULTS AND DISCUSSION

The aqueous leaf extract of Mussaenda erythrophylla was made and it was added in $AgNO_3$ (1nM) solution. The colour of the mixture change may due to the reduction of Ag+ ion by heat and the phytochemical which results in the formation of AgNPs.(G. Marslin et al) Fig:2

Fig :1 Mussaenda erythrophylla plant

Fig :2 Aqueous leaf extract and AgN

The synthesis of AgNPs was confirmed by the visual observation of the formation of brownish-yellow color of the mixture and by FTIR spectrophotometer. The absorption is maximum at 440 nm indicating the formation of nanoparticles. Fig :3

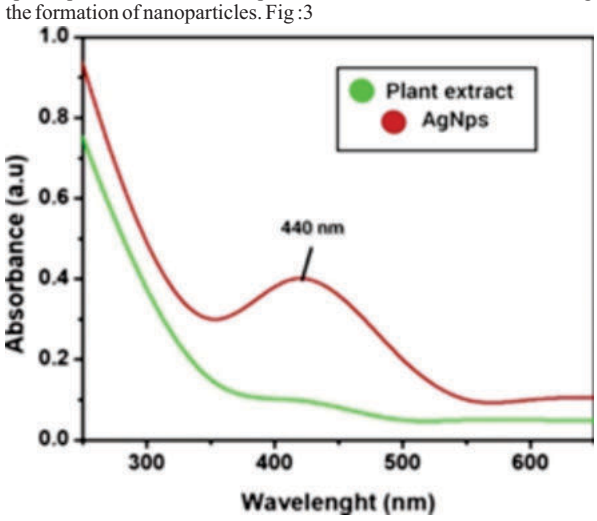

Fig :3 Maximum absorbance at 440 nm

Mussaenda erythrophylla has antimicrobial, antiviral, and antioxidant properties (Shylaja Gunasekaran et al,2015). The genus with different species has also been studied and found to have many medicinal uses. (Vidyalaxmi et al ,2008). The antimicrobial activity of the biologically synthesized silver nanoparticles was studied by the disc diffusion method on the gram -ve bacteria Escherichia coli on agar plates. The growth of the microorganism was measured in the Petri dish. The inhibition zone diameter is measured near the disc and found as 1.8mm. The aqueous leaf extract hardly shows any inhibition zone. The AgNPs antimicrobial activity is more compared to the leaf extract. The diameter of the inhibition zone by AgNPs is more than the leaf extract.

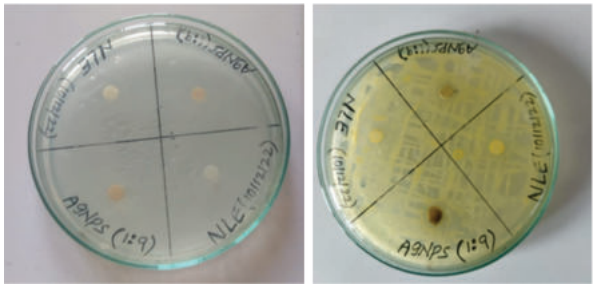

Fig : 4 Disc diffusion before and after the inoculation

CONCLUSION

Silver nanoparticles were successfully synthesized from the aqueous leaf extract of Mussaenda erythrophylla by bio reduction of Silver nitrate. The phytochemicals present in the plant were responsible for the process. The formation of AgNPs was confirmed by FTIR spectrophotometer and by visual observation of color change. The antimicrobial activity of the AgNPs indicates more efficiency than the aqueous leaf extract. These synthesized nanoparticles can be further studied for its use in medicine and for other useful products for mankind.

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