IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

Human Journals
Research Article
June 2016 Vol.:3, Issue:4

Green Synthesis, Characterization and Antimicrobial Screening of Silver Nanoparticles (SNP) of *Jatropha gossypiifolia* Extract

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Shelar Uttam B.*, Thorve Sandip S.

P.G. Department of Chemistry, Shri Shiv Chhatrapati College Junnar, Pune, Maharashtra, India – 410 502

Submission: 10 June 2016
Accepted: 15 June 2016
Published: 25 June 2016

HUMAN JOURNALS
www.ijsrm.humanjournals.com

Keywords: Silver Nanoparticles, Green Synthesis, leaf extract, antimicrobial

ABSTRACT

Jatropha gossypiifolia (Linn.) is small shrub, common ornamental garden plant and medicinal plant belonging to family Euphorbiaceae. The whole plant of *Jatropha gossypiifolia* (Linn.) is rich in many bio-active compounds. The species is rich in anthocyanins, carotenoids, carbohydrates, proteins, phytosterols and amino acids. In the present study the synthesis of silver nanoparticles using leaf extract of *Jatropha gossypiifolia* and its antibacterial activity was performed. The silver phyto nanoparticles were prepared by adding silver nitrate solution to the extract. The synthesized nanoparticles were characterized using UV-Visible absorption and FTIR studies. Further the synthesized silver phyto nanoparticles were tested for antimicrobial activity. The antibacterial activities of nanoparticles showed maximum inhibitory rate using 120 µg of these plants extract. The silver nanoparticles from leaf extract showed a good antibacterial property. Further studies needed to find out the efficacy, longevity and toxicity to improve the current investigation.

INTRODUCTION

Jatropha gossypiifolia (Linn.) is small shrub, common ornamental garden plant and medicinal plant belonging to family Euphorbiaceae. The plant is monoecious, erect, soft wooded and deciduous. The plant attains an average height of 1.8-2.5m. Stems are non woody and hairy with Height 8.5cm to 10.5 cm and width 10cm to 12 cm. Surface of the stem is reddish brown to greenish in colour.[1,2]

The whole plant of *Jatropha gossypiifolia* (Linn.) is rich in many bio-active compounds. The plant parts contain different phytochemical constituents. These chemical constituents have been extracted by using various solvent systems. Phytochemicals like alkaloids, flavonoids, diterpenoids, tannins, steroids, saponins, phenolic compounds have been found to be present in this species. The species is also rich in anthocyanins, carotenoids, carbohydrates, proteins, phytosterols and amino acids.[3,4]

Biosynthesis of nanoparticles provides advancement over chemical and physical methods as it is cost effective and environmental friendly method. Silver nanoparticles have been found effective against *E. coli, Pseudomonas aeruginosa, Bacillus cereus, Staphylococcus aureus*.[5,6]

In the present study the synthesis of silver nanoparticles using leaf extract of *Jatropha gossypiifolia* and its antibacterial activity was performed.

MATERIALS AND METHODS

Plant Collection and Preparation of Extract: The leaf of *Jatropha gossypiifolia* were collected and powder was obtained by grinding the leaf. Extraction was done using ethanol which was then concentrated by evaporation.

Synthesis of Silver Nanoparticles[7-8]

5ml of the leaf extract was taken and added to the 50ml aqueous solution of 1mM silver nitrate in an Erlenmeyer flask (200 ml). It was then stirred by using the magnetic stirrer for 1 hr with 50 rpm. Then it is kept aside for 24 hrs. The marked color change was observed when compared to the control silver nitrate solution (without extract). The color change confirms the indication for the synthesis of the silver nanoparticles. The appearance of reddish brown colour after 3 hrs

indicates the formation of silver nanoparticles. The completion of the reaction was monitored by UV-visible spectroscopy.

Separation of Silver Nanoparticles [9]:

The synthesized silver nanoparticles were separated by centrifuging at 3,000 rpm for 15 mins. The process was repeated by dispersion of pellets in water, to obtain colored supernatant solutions. The sample was then stored at - 4^0C.

Characterization of Silver Nanoparticles by UV-Visible Spectroscopy[10]:

The formation and completion of silver nanoparticles was characterized by UV-visible spectroscopy using a Double beam spectrophotometer. The reduction of the Ag+ ions by the supernatant of the test plant extracts in the solutions and formation of silver nanoparticles were characterized by UV-visible spectroscopy monitored by sampling the extract (2ml) and measuring the UV-VIS spectrum of solutions. The UV-VIS spectra of these samples were measured on a UV-2450 (Shimadzu) spectrophotometer operated at a resolution of 1 nm. The bioreduction of silver ions in aqueous solution was monitored by UV-VIS spectra of the solution between 300 nm-600 nm. Distilled water was used to adjust the baseline.

Antimicrobial Activity[10]:

Antimicrobial activities of synthesized silver nanoparticles were determined using the agar cup assay method. The assay was done on *E. coli, S. aureus and P. aeruginosa*. Nutrient Agar and Mueller Hinton Agar were used to cultivate bacteria and fungi respectively.

RESULT AND DISCUSSION

Visual observation:

It is well known that silver nanoparticles exhibit dark brownish colour in ethanolic solution due to excitation of surface plasmon vibrations in silver nanoparticles. As the extract was mixed in the aqueous solution of the silver ion complex, it started to change the colour from watery to yellowish brown and finally to dark greenish brown colour due to reduction of silver ion; which indicated formation of silver nanoparticles.

UV-VIS spectra analysis:

The reaction mixture, extract with ethanol solution of silver nitrate, started to change its colour from yellowish brown to dark green brown (Fig 1). This indicated the formation of silver nanoparticles with the reduction of silver ion. The characteristic surface plasmon absorption bands were observed at 440 nm. There was also an increased in absorbance at 260 nm with regular time intervals observed.

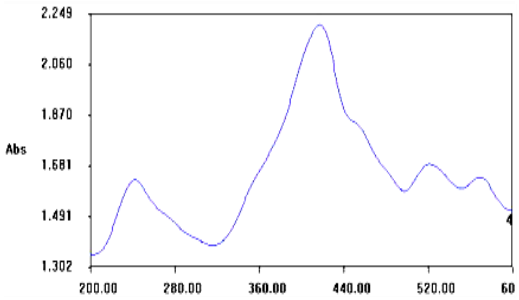

Fig 1: UV-VIS spectra analysis of silver nanoparticles

Antimicrobial activity:

Antimicrobial activities of synthesized silver nanoparticles synthesized using *extract* were checked on gram +ve bacteria (*S. aureus*), gram –ve bacteria *P. aerogenosa* and compared with that of pure extract and silver nitrate aqueous solution.

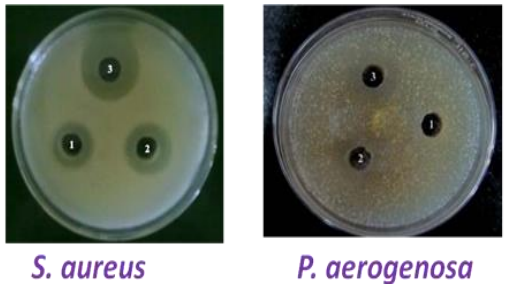

Fig 2: Antimicrobial activities of synthesized silver nanoparticles

CONCLUSION

It can be concluded from the study that silver ions exposed to the plant extract were reduced and the nanoparticles were synthesized. The presence of nanoparticles was confirmed by the brown color formation. The antimicrobial efficacy activity of *Jatropha gossypiifolia* was found to be significant against tested microorganisms.

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