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PLANT MEDIATED GREEN SYNTHESIS OF SILVER NANOPARTICLES BY USING CLEOME GYNANDRA (L)

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ABSTRACT

To search ecofriendly process for a synthesis of nanoparticles in the field of nanotechnology. Among the all metallic nanoparticles, silver nanoparticles draw more attention due to its unique, physical, chemical and biological properties. Green synthesizing nanoparticles as an alternative method to overcome the limitation of conventional method. In this study the AgNP's were prepared from aqueous solution of silver nitrate using aqueous plant extract. The synthesized AgNP's have been characterised by UV spectroscopy shows Plasmon resonance at 420 nm. The morphology was characterised by SEM (Scanning electron microscope), XRD (X-ray diffraction). XRD confirm the presence of silver and crystalline substance.

KEYWORDS: Nanotechnology, Nanoparticles, Cleome Gynandra (L) FTIR, XRD and SEM.

INTRODUCTION

Cleome gynandra (L) is used as medicinal plant and can be found in all over world. It grows as weed in paddy fields and also in road sides and in open grass lands. The medicinal application of the plant is also described in Ayurvedic Pharmacopoeia of India and also in other ancient medicinal texts. In Marathi commonly known as Tilvan.

Fig.1. Cleome gynandra (L) plant

Botanical Description/information/ morphology

It is an erect, annual herb up to 250-600 mm tall having more branched stem is sticky with grandular hairs and marked with longitudinal parallel lines. Leaves are palmately compound with grandular hairs. The leaflet radiated from the tip of leaf stalk are 20×100×8-40 mm smooth or with glands and taper towards the base, on the under surface are smooth to finely grandular and often with multicellular hairs on the main nerves. In ayurvedic medicine, it is the chief constituent in Narayanachurna. In Ayurveda it is used as an Anthelmentic in air diseases, pruitis and several other diseases like gastrointestinal disorder and gastrointestinal infections. Carotenoiuds, Cardiac glycosides, cyanogenic, glycosides, flavonoides, saponins, Triterpenes, sugar, tannins etc were found to be present in the Cleome gynandra (L). In view of the importance of Cleome Gynandra (L) and silver nanoparticles the present work has been planned to synthesized and characterized. The silver nanoparticles synthesized from the leaf extract of Cleome gynandra (L) using silver nitrate as a green technique.

MATERIALS AND METHODS

Collection of plant materials

Fresh leaves of Cleome gynandra (L) collected from Ratangad, Tahshil Akole and doubled distilled water were used.

Preparation of Cleome gynandra (L) leaves extract

The aqueous extract of Cleome gynandra (L) leaves were used for the reduction of silver.10 gm of fine powder of leaves with 100ml doubled distilled water. These mixtures were boiled for 30 min until the colour of aqueous solution shows brownish yellow colour. Then the extract filter through Whatmann no.41

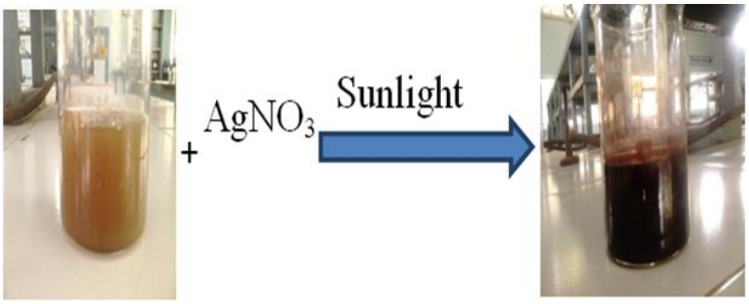
Synthesis of silver nanoparticles using leaves extract of Cleome gynandra (L)

0.1 M aqueous solution of Silver Nitrate was prepared and used for the synthesis of silver nanoparticles. The Cleome gynandra (L) leaves extract of 90 ml was added

to 10 ml of silver Nitrate solution and place in sunlight for 2 hours. A dark brown solution were form indicating the formation of silver nanoparticles (fig 3) and then it was confirm by UV –Visible spectroscopy as a Plasmon resonance wavelength at 420 nm.

Separation of silver nanoparticles

The synthesized silver nanoparticles separated by cooling centrifugation (Remi C 24BL) at 10000 rpm for 5 min. the silver nanoparticles collected in petri dish & dried.



Pure Cleome gynandra aqueous leaf extract *Formation of silver nanoparticles*

Fig.2

4) Characterization of synthesized silver nanoparticles

(a) UV- visible spectra analysis

Firstly, UV-visible spectrophotometer was used for the characterization of silver NPs between 400-700 nm scanning range. The Plasmon resonance spectra of silver NPs found at 420 nm.

(b) FTIR

The functional groups on the surface of synthesized silver NPs by leaves extract were carried out by FTIR instrument JASCO 4100 model and 400 -4000 cm^{-1} scanning range. It gives the information about the functional group which was bind during the formation of silver nanoparticles. FTIR of silver NPs was shown in fig. 4

(c)X- ray diffraction

The structural and chemical composition of silver NPs were analyzed by SEM (JEOL JSM- 6360) coupled with EDAX for analysis of elemental composition of the sample (fig. 7) and XRD (Brukar D8 Advanced diffractometer) (fig. 5)

RESULT AND DISCUSSION

UV-Visible analysis

The green synthesis of silver NPs using Cleome Gynandra (L) leaves extract can be observed by the colour changes from the brownish yellow to dark brown. The appearance of dark brown colour were due to the excitation of surface Plasmon of silver NPs and it was confirmed be UV-Visible spectrophotometer at 420 nm.

FTIR

In IR spectrum of silver NPs synthesized by Cleome Gynandra (L) leaf extract shows 3268.75 cm^{-1},1643.05 cm^{-1},1385.6 cm^{-1} and 417.51 cm^{-1} . A broadband at 3268.75 cm^{-1} indicate the presence of bonded OH group and peak at 1643.05 cm^{-1} indicate the presence of carbonyl group and 1385.6 cm^{-1} indicate the presence of NO bending.

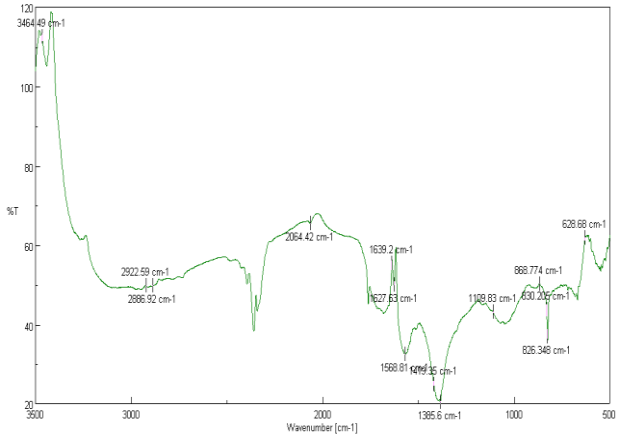


Fig3.FTIR spectroscopy analysis of silver nanoparticles

EDAX

EDAX show the strong peak at silver region and also gives the information about elemental composition. Metallic silver Nano crystals generally show typical absorption peak approximately at 3 KeV due to surface Plasmon resonance.

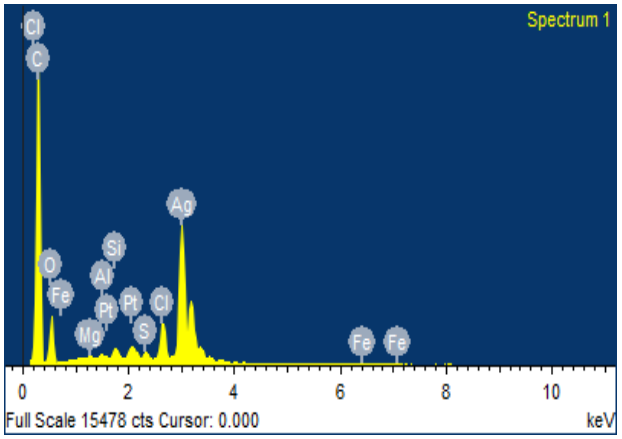


Fig. No. 4 : EDX spectrum of synthesized silver nanoparticles

SEM

SEM image indicate that as prepared silver nanoparticles are likely of well defined and highly ordered Silver Island. Most importantly these silver island exhibit remarkable aggregated alignment to each other over large area.

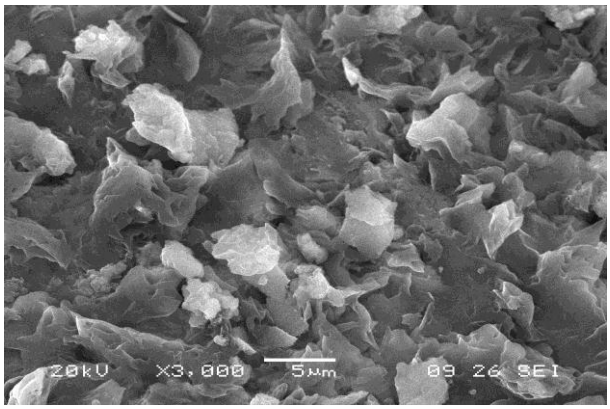


Fig.5.SEM analysis of silver nanoparticles

XRD

X-ray diffraction (XRD) pattern for silver nanoparticles is shown in fig 5.These study releaved that the silver nanoparticles are in crystalline nature. The XRD pattern shows four intense peak at 2θ values of 38.1, 44.52,64. 32 and 77.43 corresponding to (111) (200) (220) and (311) planes of silver is observed and compared with the standard powdered diffraction card of joint committee on powder diffraction standard (JCPDS), silver file number 04-0783.It also observe that the peaks are broaden, which mean that the nanoparticles smaller in size

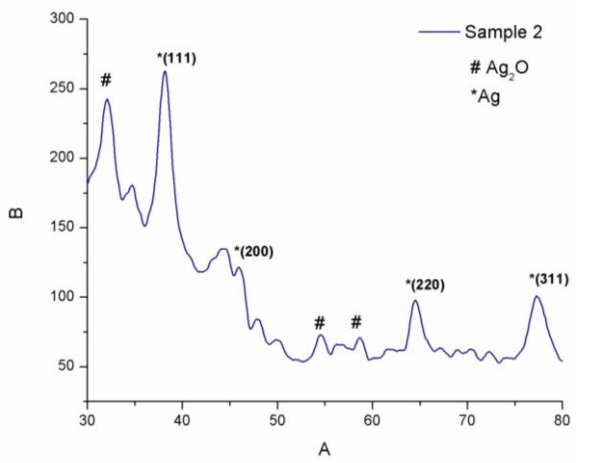


Fig.6. XRD analysis of silver nano particles.

CONCLUSION

The plant mediated method for silver nanoparticles synthesis is a very good eco-friendly method and also a non-toxic. The plant sample contains naturally occurring reducing agent for the synthesis of metal nanoparticles. For these characterizations UV-Visible spectroscopy, FT-IR, XRD and SEM with EDAX were used. The phase formation of silver was confirmed by XRD and the presences of silver were confirmed by EDAX as an elemental analysis. The SEM shows the average particle size 100nm.

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