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Research Article

SILVER NANOPARTICLES SYNTHESIS USING DELONIX ELATA FLOWER EXTRACT BY BIOGENIC APPROACH

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ABSTRACT

The importance of Delonix elata flower and silver nanoparticles as revealed by various literature resources, we planned to carry out biogenic synthesis of silver nanoparticles using the Delonix elata flower extract. Silver nanoparticles were prepared by employing the standard procedure. The formations of silver nanoparticles from the extracts were identified first by observing the colour changes. The Delonix elata flower extract colour changed from yellow to dark brown colour during the formation of silver nanoparticles. The Silver nanoparticles formed were characterized by UV, FT-IR, XRD and SEM. UV absorbance at 467nm for Silver nanoparticles. The IR spectrum of Silver nanoparticles showed Ag–O stretching at 408cm-1. On comparing the IR spectra of the extract and the nanoparticles confirmed that Silver nanoparticles bonded to OH group present in the bioactive constituents of Delonix elata flower. XRD & SEM analysis of the Silver nanoparticles showed that the nano particles lies in the range of 10µm sizes and exist in rectangular shape.

Keywords: Delonix elata flower, Silver nanoparticles, FT-IR and SEM.

INTRODUCTION

Delonix elata commonly known as white gold mohur and family Leguminosae[1]; subfamily Caesalpiniaceae commonly known as "Sandesaro" in Gujarati[2]. Delonix elata has been reported to have large red-orange color five petals, one petal contains a white color streaks and little bit big as compare to other petals, four spreading scarlet or orange-red petals up to 8 cm long having same size and colour, a fifth upright petal called the standard, which is slightly larger and spotted with yellow and white. Sepals 5, thick, green outside and reddish with yellow border within, reflexed when the flowers are open, pointed, finely hairy, about 2.5 cm long. 5 Stamens with 10 red filaments. Pistil has a hairy 1celled ovary about 1.3cm long. Style about 3 cm long[3-5]. The members of the genus are flowering trees, native to the East Africa, has been used in traditional Indian medicine for the treatment of rheumatism, stomach disorders[6]. The Delonix plant was reported to have antioxidant, anti-arthritic, anti-ulcer and anti-inflamatory activities[7]. Flavonoids, tannins, alkaloids, saponins, steroids carotenoids(lycopene, phytoene, phtofluene, β-carotene, prolycopene, neolycopene, δ-lycopene and γ-lycopene), phenolic acid (gallic acid, protocatehuic acid, salicylic acid, trans-cinnamic acid andchlorogenic acid), anthocyanins (cyanidin-3-glucoside and cyanidin-3-gentiobioside and β-sitosterol[7, 8-10] were found to be present in the Delonix elata .

EXPERIMENTAL METHOD

a) MATERIALS

Delonix elata flowers collected from theni district and double distilled water were used.

b) METHODS

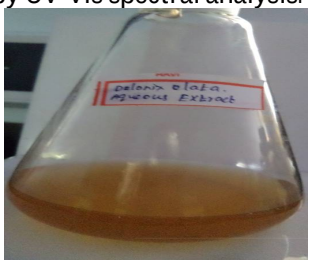
i) Preparation of the Delonix elata flower Extract

Delonix elata flower aqueous extract were used for the reduction of silver ions (Ag^+) to silver nanoparticles (Ag^0). The aqueous extract of

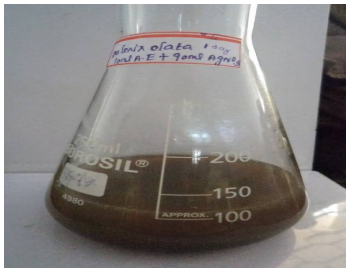
Delonix elata flower were prepared by placing 5g of washed dried fine cut flowers in 250ml round bottom flask along with 200ml of double distilled water. The mixture was then boiled for 4 hours until the color of the aqueous solution appeared as yellow **(fig. 1a)**. Then the extract was cooled to room temperature and filtered with Whatman No.1 filter paper.

ii)Synthesis of Silver Nanoparticles

1mM aqueous solution of silver nitrate (AgNO3) was prepared and used for the synthesis of silver nanoparticles. The Delonix elata flower extract of 10ml was added to 90ml of 1mM silver nitrate solution and kept at room temperature. As a result, a dark brown solution was formed indicating the formation of silver nanoparticles (**Fig.1b)**and it was further confirmed by UV-Vis spectral analysis.



a



b

Fig. 1: Photographs of a) Pure Delonix elata flower Extract b) Formation of Silver nanoparticles

iii) Separation of Silver nanoparticles

The synthesized Silver nanoparticles were separated by means of centrifugation (Spectrofuge 7M) at 3000 rpm for 15 mins.

iv) Characterization of Silver nanoparticles

a)UV-Visible Spectral Analysis

Characterization of copper nanoparticles was first carried out using UV-Visible absorption spectrometer 2400PC with a resolution of 1nm between 200 and 800nm possessing a scanning speed of 200nm/min.. Absorption spectra of silver nanoparticles formed (**Fig.2)** in the reaction media have absorbance peak at 467nm.

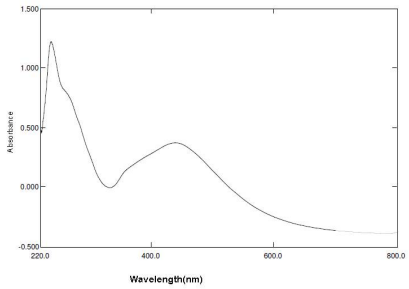


Fig. 2: UV- Visible Spectra of Silver nanoparticles

b)FTIR

The characterization of functional groups on the surface of silver nanoprticles by flower extracts were carried out a by FT-IR Instrument IRTRACER-100 Model and the spectra was scanned in the range of 370-4000 cm^{-1} range at resolution of 4 cm-1. FT-IR gives the information about functional groups that binds during the formation of silver nanoparticles by the action of the different phytochemicals which would act simultaneously as reducing, stabilizing and capping agent. FT-IR of silver nanoprticles was given as **Fig. 3.**

c)X-Ray Diffraction

X-Ray Diffraction patent of the silver nanoparticles were determined using Bruker Eco D8 Advance X-pert PRO operating at a voltage of 40kV, a current of 20mA with copper Kα radiation at 2θ angle ranging from 10^0 to 80^0 and was given as **Fig. 4.**

d) SEM

The SEM image of Delonix elata stabilized silver nanoparticles was shown in **Fig. 5.**

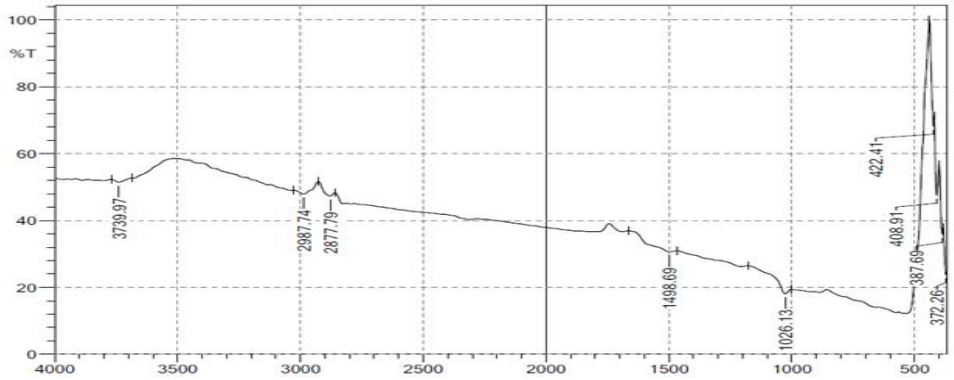


Fig. 3: FT-IR Spectrum of Silver nanoparticles

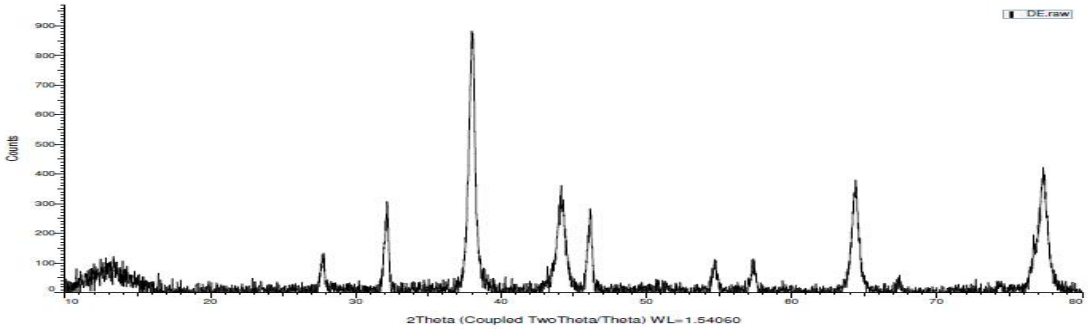


Fig. 4: XRD spectrum of silver nanoparticles

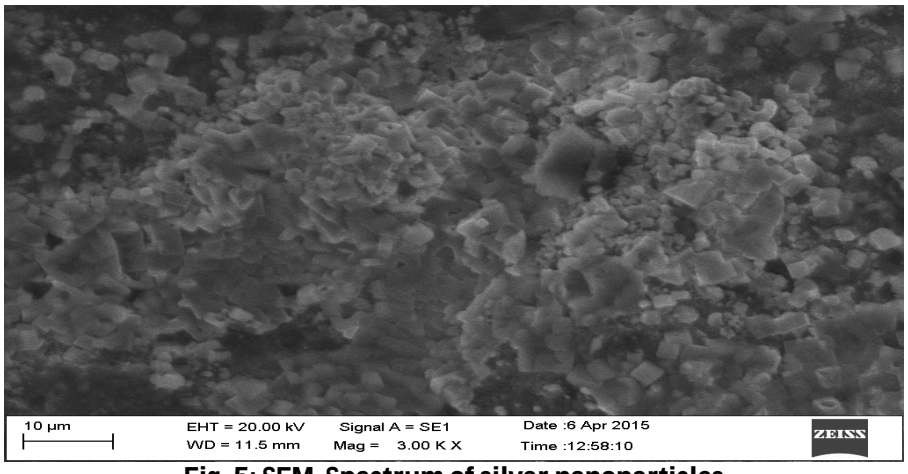


Fig. 5: SEM Spectrum of silver nanoparticles

RESULT AND DISSCUSSION

The biogenic synthesis of silver nanoparticles using Delonix elata flower extract can be observed by the color changes of Delonix elata flower extract from light yellow to dark brown. after one day at RT. The appearance of dark brown color was due to the excitation of surface plasmon vibrations of silver nanoparticles. Secondly these silver nanoparticles were confirmed by Spectral techniques as given below:

i)UV-Visible Spectroscopy

Fig.2 showed that the UV absorption spectra of the silver nanoparticles. Surface Plasmon Resonance bands of the colloids are centered at 467 nm.

ii) FT-IR Spectral studies

The IR spectrum of silver nanoparticles assisted by Delonix elata flower extract showed stretching for Ag-O bond observed at 408 cm^{-1}. On comparing the **FT-IR** spectrum of Delonix elata flower extract and the silver nanoparticles synthesized using it showed the following observations:

- A Broad band in the range 3200-3400 cm^{-1} indicates the presence of bonded O-H groups and a peak at 1643 cm^{-1} indicate the presence of carbonyl group in the Delonix elata flower extract.
- These bands present in the extract disappeared during its assisted silver nanoparticles formation and appearance of a band at 408cm^{-1} revealed that Silver binds to oxygen moiety present in the various phytochemical constituents of Delonix elata flower extract.

iii) SEM ANALYSIS

Scanning electron microscopy analysis was carried out to understand the topology and the size of the silver nanoparticles. The result showed that the synthesized silver nanoparticles exist in rectangular shape with average size of 10µm.

CONCLUSION

The Silver nanoparticles synthesized by biogenic approach using delonix elata flower extracts were identified first by observing the colour changes of the extract. The Delonix elata flower extract colour changed from yellow to dark brown colour during the formation of silver nanoparticles. Silver nanoparticle formed were characterized by UV, FT-IR, XRD and SEM.

UV absorbance at 467nm was observed for Silver nanoparticles. The IR spectrum of Silver nanoparticles showed Ag–O stretching at 408cm-1. IR spectra the nanoparticles confirmed that Silver binds to- OH group present in the bioactive constituents as on comparing the **FT-IR** spectrum of Delonix elata flower extract and the silver nanoparticles synthesized, the disappearance of bonded O-H(3200-3400 cm^{-1}) and C=O (1643 cm^{-1}) stretching frequencies in **FT-IR** of Silver nanoparticles. XRD & SEM analysis of the Silver nanoparticles showed that these Silver nano particles exist in rectangular shape and their sizes lies in the range of 10µm.

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