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Research Article

SYNTHESIS AND CHARECTARIZATION OF SILVER NANOPARTICLE FROM EMILIA SONCHIFOLIA (L) LEAF EXTRACT AND THEIR ANTIBACTERIAL ASSAY

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ABSTRACT

Nanoparticles are fundamental building blocks of nanotechnology. An eco-friendly approach for green synthesis of nanoparticles using natural plant extract is gaining a notable importance now a days. The present study deals with the synthesis of silver nanoparticles using Emilia sonchifolia(L) leaf extract. The complete reduction of silver ions was observed after 48hrs of reaction at 30°C under shaker condition. The formation of silver nanoparticles was confirmed by UV-VISIBLE spectroscopy, XRD and SEM analysis. The antifungal activity evaluate against Aspergillus niger and cladosporium. The antibacterial activity evaluated against E-coli and Salmonella typhi.

INTRODUCTION

Nanoscale materials have emerged as novel antimicrobial agents owing to their high surface area to volume ratio and the unique physical and chemical properties.[Gong *et al*., 2007. Nanoparticles are clusters of atoms in the range 1 - 100nm. "Nano" is a Greek work synonymous to dwarf meaning extremely small. [Khan, 2006]. Green synthesis provides advancement over chemical and physical method as it is cost-effective, environment friendly, easily scaled up for large scale synthesis and in this method there is no need to use high pressure, energy, temperature and toxic chemicals.

[Preetha devaraj *et al*., 2014]. Green synthesis has been considered as one of the promising method for synthesis of nanoparticles because of their biocompatibility, low toxicity and eco-friendly nature. [Malik *et al*, 2014]. *Emilia sonchifolia(L)* is an herbaceous plant growing up to 0.6m heigh. The flowers are hermaphrodite and insect pollinated. It has been used in traditional medicine for the treatment of fever, sore throat, diarrhea, eczema and as an antidote for snake bite.

Figure 1 *Emilia sonchifolia(L)*

The aim of this work is to use *Emilia sonchifolia(L)* leaf extract as a low cost and ecofriendly approach to the green synthesis of silver Nanopaticles. My work upon nanoparticle has been charectarized by UV-spectroscopy, SEM and XRD-Analysis.

MATERIALS AND METHOD

Preparation of Leaf Extract

Fresh and young green leaves of Emilia were used to make the aqueous extract. 20gm of each leaf sample were washed thoroughly with double distilled water, cut into small pieces. The finely cut pieces were placed in a 500 ml Erlenmeyer flask containing 100ml sterile double distilled water. After that

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the mixture was boiled for 5 minutes and filtered through whatman filter no.1 (C. Udayasoorian *et al*.,2011).

Synthesis of Silver Nanoparticles

Silver nitrate was used as a precursor in synthesis of silver nanoparticles. 5ml of leaf extract was added to 100ml of 1mM $AgNO_3$ aqueous solution in conical flask of 250ml content at room temperature. The flask were thereafter put in shaker (150rpm) at 30°C and reaction was carried out for a period of 48hrs.

Antibacterial Activity

Since silver and its salts exhibit strong antibacterial activity , this property was evaluated for the Ag-nano particles prepared by using Emilia leaf extract.

Analysis Method

UV-Visible spectral analysis

Spectroscopy analysis of biosynthesised silver nanoparticles was carried out using UV-Visible spectrophotometer. The gradual change in the colour of a sample from light green to dark brown colour was observed and the bioreduction of Ag+ in the solvent extracts were monitored by periodic evaluation of the suspension (2ml) of incubation of 48hrs under dark condition. The aliquotes were subsequently measured for the UV-Visible spectra by scanning in the region from 200-800 .(Jyothi *et al* in 2016).

SEM Analysis of Silver Nanoparticles

Sem analysis was undertaken to know the size and shape of the silver nanoparticles biosynthesised using the plant leaf extract of *Emilia sonchifolia(L)*. The analysis was done using Noran system, S-3400N model.

XRD Analysis

The sample was drop-coated onto copper plate by just dropping a small amount of sample on the plate frequently allowed to dry and friendly thick coat of sample was prepared. The XRD measurement was performed on a Rigako model with step size 0.02 and an angle of 60-70°

The particle size of the prepared samples were determined by using Scherrer's equation as follows

$$D=\frac{k\lambda}{\beta cos\theta}$$

where D is the crystal size , λ is the wave length of x-ray, θ is the Braggs angle in radians and β is the full width at half maximum of the peak in radians. K is constant.

RESULTS AND DISCUSSION

The interaction between the silver nitrate and the leaf extract led to the formation of silver nanoparticles. The color was changed in the reaction mixture with respect to time. Color change was observed at 48hrs from colorless to brown color, indicating the formation of silver nanoparticles.

Figure 2 Plant extract with AgNPs before incubation and after incubation

UV-Visible spectroscopy

The reduction of silver is confirmed in the samples by visual observation. The sample exhibit dark brown. This colour variation may be attributed to excitation of surface plasmon vibration in silver nanoparticles. After 48hrs incubation in dark room condition, the light coloured reaction mixture turned into dark brown indicating silver nanoparticles formation. Before incubation, the synthesized AgNPs shows peak at 268nm of Emilia respectively. After the incubation period of 48hrs the synthesized AgNps showed broad surface Plasmon resonance at 441nm of Emilia.

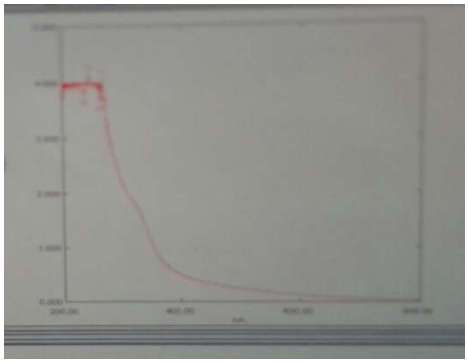

Figure 3 Spectra of Emilia Ag NPs before incubation

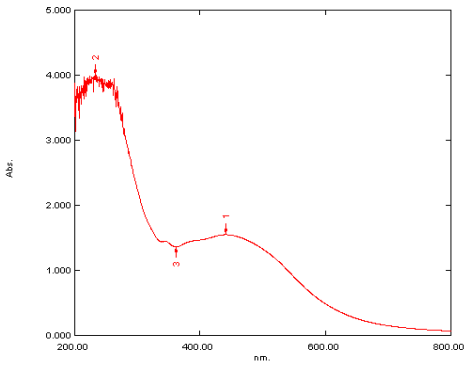

Figure 4 Spectra of Emilia Ag NPs after incubation

Scanning Electron Microscope (SEM)

The SEM images shows the AgNPs synthesized from Emilia leaf extract which is further confirms the presence of AgNPs. The shape of the AgNPs in Emilia extract was spherical & the size of AgNPs is 5.8mm as confirmed by SEM images.

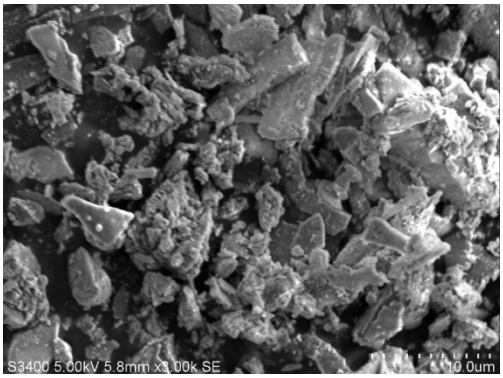

Figure 5 SEM image of *Emilia sonchifolia(L)* silver nano particle

Xrd Analysis

The XRD analysis was performed to confirm the crystalline nature of biologically synthesized silver nanoparticles. And the XRD pattern obtained has been represented in fig.6. Emilia plant extract shows two different diffraction peaks at 27.74^0, 32.11^0, 46.14^0, 54.67^0 & 57.43^0. 2θ values & crystalline planes of Ag sample. The average size of the AgNps formed in bioreduction process is determined by using $D = \frac{k\lambda}{\beta cos\theta}$ & it is estimated that average size of Emilia 289.28, 280.08, 257.53, 384.69 & 275.66 shows the XRD pattern of the silver nano particle formed in our experiment.

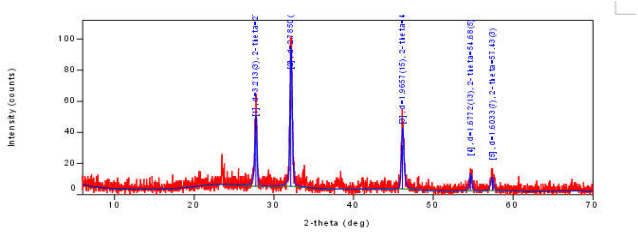

Figure 6 XRD pattern of AgNPs exhibiting the facets of silver.

A table shows XRD result of *Emilia sonchifolia(L)* silver nano particle

d-spacing	2-theta	HKL	Average size
3.21	27.74	0 1 0	289.28
2.78	32.11	0 1 0	280.08
1.96	46.14	1 0 0	257.33
1.67	54.67	0 1 0	384.69
1.60	57.43	1 0 0	275.66

Anti-Bacterial Analysis

Fo *Emilia sonchifolia(L)* r the zone of inhibition was found to be 0.7mm for *E.coli* ,0.6mm for *S.typhi.*

Antibacterial Zone Formation

Species	Basella (zone of inhibition)
E.coli	**0.7**
S.aureus	0.6

Escherichia coli

Salmonella typhi

Figure 7 Antibacterial activity of AgNPs of *Emilia sonchifolia(L))* to selected bacterial culture by disc diffusion method

A – AgNPs solution of *Emilia sonchifolia(L))*
B-Positive control(Penicillin),
C-Negative control(water)

CONCLUSION

The present study incuded the bioreduction of silver ions through medicinal plants extracts and testing for their antimicrobial activity. The aqueous silver ions exposed to the extracts, the synthesis of silver nanoparticles were confirmed by the change of color of plant extracts. Silver nanoparticles were further confirmed by using UV-Vis spectroscopy, SEM and XRD analysis. It is confirmed that silver nanoparticles are capable of rendering high antimicrobial efficiency and hence has a great potential in the preparation of drugs used against bacterial diseases.

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