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Biosynthesis And Characterization of Silver Nanoparticles Derived from Ethanol and Aqueous Extract of Tarragon

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ABSTRACT

Background: Silver nanoparticles and their potential applications in cancer diagnostics and therapy have been studied. The biological activity of AgNPs is dependent on surface chemistry, particle size, size distribution, particle shape, and particle composition. Nanoparticles' physicochemical qualities are crucial to their behavior, safety, and efficacy.

Aim: To prepare and evaluate the properties of silver nanoparticles obtained for ethanol and aqueous extracts of tarragon.

Materials and Methods: Tarragon was powdered and 3 gms of Tarragon was added to 100ml of water and ethanol, separately.It was kept in shaker for 24 hours in 40 degree Celsius.It is filtered and solution is stored in 50 ml cc tube beaker. 40 mM solution of silver nitrate was added and 3 ml of of the extract was added. The red wine color change was seen in the solution.Characterization is performed using a variety of analytical techniques including UV-vis spectroscopy, X-ray diffractometer (XRD), Fourier transform infrared spectroscopy (FTIR), Scanning electron microscope (SEM).

Result: AgNP synthesis was suggested by the solution's gradual transformation to a wine-like hue. UV-visible spectroscopy was an effective technique for the preliminary confirmation of nanoparticle production.

Conclusion: Ethanolic extract of tarragon is more effective as compared to aqueous extract and it showed better antimicrobial activities.Silver nanoparticles have been discussed and focussed on potential applications in cancer diagnosis and therapy. The biological activity of AgNPs depends on factors including surface chemistry, size, size distribution, shape, particle composition. The physicochemical(Abd-Elsalam, 2021) properties of nanoparticles are important to their behavior, safety and efficacy.

Keywords: *Silver nanoparticles; Tarragon; ethanol; water; antimicrobial properties*

INTRODUCTION

AgNPs have been focussed on potential applications in cancer diagnosis and therapy.The biological activity of AgNPs depends on factors including surface chemistry,size,size distribution,shape,particle composition.(Maaz, 2018)The physicochemical properties of nanoparticles are important for their behavior safety and efficacy.Characterization is performed using a variety of analytical techniques including UV-vis spectroscopy,X-Ray diffraction (XRD),Fourier transform infrared spectroscopy(FTIR),Scanning electron microscope (SEM). (Abd-Elsalam, 2021)

The nanoparticles are prepared by green synthesis approach including mixed valence polyoxometalates polysaccharides, Tollens, biological, and irradiation method which have advantages over conventional methods involving chemical agents associated with environmental toxicity(Rai, Bhattarai and Feitosa, 2021).The chemical synthesis of nanoparticles is rapid but requires the use of toxic ,hazardous chemicals such as sodium borohydride,hydrazine,hydroxylamine,and ethanol.AgNP synthesis have been evaluated in different extract synthesis have been evaluated in different extracts including Medicago sativa,Ulva flexuosa,Achiella bieterstenii,Green tea.We developed a simple rapid and green method to synthesize AgNPs using MMT and Tarragon leaf extract.(Wilson, 2020)This method is easily adopted for large scale synthesis of NPs without requiring any extra compoundsor physical processes. (Kumar, Kumar and Pathak, 2021)

Simple collection and widespread availability of Tarragon coupled with its remarkable biological activity have led to its use as a medicine in many countries.Tarragon has been shown to have antimicrobial activities against two bacteria Staphylococcus aureus and Escherichia coli .The size of synthesized AgNPs with tarragon extract is smaller as compared to the many earlier green synthesis.(Shukla and Iravani, 2018)

Reaction of Tarragon extract with aqueous metal solution yields only spherical nano particles.The leaf extract and metal solution concentration was estimated to improve AgNP synthesis.AgNP synthesis were characterized by methods including powder X Ray diffraction ,Uv-vis spectroscopy , Transmission and electron microscopy. The aim was to evaluate silver nanoparticle preparation using the ethanolic and aqueous extract of Tarragon. (Alarcon, Griffith and Udekwu, 2015)

MATERIALS AND METHODS

The tarragon was acquired from the Chennai local market. Powdered Tarragon was added to 100ml of water and 100ml of ethanol, and the mixture was agitated for 24 hours. The solutions were filtered and kept at 4 degrees Celsius. The solution of silver nitrate (40 mM) was combined with 3 ml of ethanolic or aqueous tarragon extract. There was a red wine hue shift in the solution.

Characterization of Silver nanoparticles

The prepared solution was analysed using UV-visible spectrophotometer (JASCO V730). Using a field emission scanning electron microscope (FESEM, JOEL JSM IT800), the morphology of the prepared natural apatite was viewed. The elemental composition was calculated using an energy-dispersive X-ray analysis and an X-ray microanalyser (EDX, Oxford instruments).

Emission Scanning electron microscope was used to visualize the nanoparticle. The material was dehydrated with 70%ethyl alcohol for 10 sec and nitrogen gas was applied for drying. After critical point drying the sections were sputter coated with platinum for 30 sec to induce conductivity for FESM analysis.Finally images were captured at the acceleration voltage of 3.00kVand projected.Further energy dispersive X Ray spectroscopy was used for elemental analysis and chemical characterization performed biosynthesis of silver nanocomposite with tarragon leaf extract and it showed antibacterial properties against E-coli, S aureus, E faecalis, and C albicans.(Mirhashemi *et al.*, 2021)(Zhang *et al.*, no date)

Uv-Vis Spectroscopy

An effective method for NP analysis is UV-Vis spectroscopy, particularly for figuring out how stable metal NPs are in aqueous solutions. The aqueous extract and the spectra was being recorded at 320nm concentrations of AgNO3 nm [34]. The wavelength of maximum absorption was then determined. The Tarragon extract's ability to biosynthesize AgNPs was demonstrated by the way its colour changed when AgNO3 was added.(Zhang *et al.*, no date)

X Ray Diffractometry

XRD analysis was used to determine and confirm the crystal structure of AgNPs. Using an X-ray diffractometer (Cu K radiation, 2 configuration; PANalytical) with an X'Pert Pro generator174 (30 mA; 40 kV), the air-dried NPs were placed on an XRD grid and evaluated in terms of AgNP forma-tion. The XRD peak width was calculated to determine the crystallite domain size under the presumption that non-uniform stresses are not present.(Noori, Aadim and Hussein, 2022)

Anti-inflammatory studies

30 mg of the material was added to 1.5 ml of 2% Bovine Serum Albumin (made with 0.05 M Tris HCl) in a variety of concentrations. Tris HCl was used to create a 2 ml final solution volume. For 30 minutes, the samples were incubated. The prepared samples were submerged in a water bath set at 75 °C for 10 minutes. The samples were then chilled for 20 minutes. Finally, a UV-visible spectrophotometer was used to assess the optical density at 660 nm (JASCO, V730).

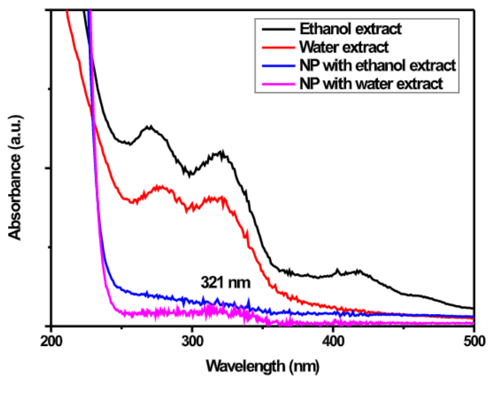
Antimicrobial studies

We have taken 4 bacterias in this research for both ethanolic and water extract.For both ethanolic as well as water extract the zone of inhibition of Eschericia coli is more as compared to other three bacterias (Staphylococcus aureus,Enterococcus faecalis,Candida albicans).24 h were spent combining ethanol and aqueous extract of tarragon with 40 mM ofAgNO 3 . AgNP synthesis was suggested by the solution's gradual transformation to a wine-like hue. UV-visible spectroscopy was an effective technique for the preliminary confirmation of nanoparticle production. A broad peak was seen in the spectrum at 314 nm.The ability of the tarragon extract to manufacture AgNP was assessed by the color changes induced by the addition of silver nitrate.

RESULTS

We mixed an aqueous extract of tarragon with 1,2,3 mM of AgNo3 for 24 hours.AgNP production was indicated by solutions gradual color change to red wine.An efficient method for nano particle analysis is UV-vis spectroscopy particularly to figure out how stable metal nanoparticle are in aqueous solution.(Massey *et al.*, 2022)The aqueous concentration and spectra were recorded at 320 nm.The wavelength of the maximum absorption was determined .The tarragon extract ability to synthesize AgNP were determined by the way its color changed when silver nitrate was added.

The Scanning electron microscope analysis showed the silver nanoparticles of 321nm size with spherical morphology. The chemical composition of the particles were confirmed with elemental peak of silver, 321nm in XRD.



The antimicrobial activity of the silver nanoparticle derived through alcoholic and aqueous extract of tarragon in a concentration of 25µl was demonstrated to be 15mm & 17mm against Escherichia coli, 12mm & 13mm against staphylococcus aureus, 11mm & 12mm against Enterococcus faecalis, respectively.

The antimicrobial activity of the silver nanoparticle derived through alcoholic and aqueous extract of tarragon in a concentration of 100µl was demonstrated to be 17mm & 18mm against Escherichia coli, 9mm & 10mm against staphylococcus aureus, respectively.

Anti-inflammatory

The antiinflammatory activity of the 500 µL, 400 µL,300 µL,200 µL concentration of the prepared silver nanoparticles from alcoholic extract of tarragon, showed the presence of protein denaturation of 65.15%, 27.13%, 52.17% and 18.27% respectively (as assessed through the bovine serum albumin assay)

The antiinflammatory activity of the 500 µL, 400 µL,300 µL,200 µL concentration of the prepared silver nanoparticles from aqueous extract of tarragon, showed the presence of protein denaturation of 27.13%, 18.27%, 15.74% and -3.97% respectively (as assessed through the bovine serum albumin assay)

DISCUSSION

It's intriguing to look into the anti-inflammatory properties of copper and silver nanoparticles (AgNPs) utilizing ethanol and tarragon extracts. The specific effects and mechanisms of these nanoparticles in the context of their anti-inflammatory activity can, however, change depending on a number of variables, including their size, concentration, surface functionalization, and the evaluation model or system that was used.

Having said that, the following general ideas should be kept in mind when talking about the anti-inflammatory potential of AgNPs and CuNPs in combination with ethanol and tarragon extracts:AgNPs have been found to have anti-inflammatory characteristics, according to a number of research. By preventing the synthesis and release of pro-inflammatory cytokines, lowering the expression of inflammatory enzymes like cyclooxygenase-2 (COX-2) and inducible nitric oxide synthase (iNOS), and suppressing the activation of transcription factors like nuclear factor-kappa B (NF-B), they can modulate inflammatory responses. Because of their capacity to neutralise free radicals and suppress inflammatory signalling pathways, AgNPs have anti-inflammatory properties.CuNPs' anti-inflammatory qualities: CuNPs have also demonstrated potential anti-inflammatory properties. By reducing the generation of pro-inflammatory mediators including interleukin-6 (IL-6) and tumour necrosis factor-alpha (TNF-), they can have anti-inflammatory effects. The activation of NF-B, which is essential for controlling inflammatory responses, can likewise be inhibited by CuNPs.

Synergistic Effects of Ethanol and Tarragon Extracts: Flavonoids and phenolic compounds, which are bioactive substances with anti-inflammatory characteristics, may be present in ethanol and tarragon extracts. These substances may work in concert with AgNPs and CuNPs to provide an even greater anti-inflammatory effect. The active components of tarragon can also be extracted and delivered using ethanol as a solvent, enabling their interaction with nanoparticles and potential synergistic effects.Dose-Dependent Effects: It's critical to take into account the toxicity of nanoparticles and their dose-dependent effects. AgNPs and CuNPs have demonstrated promise in a number of applications, including anti-inflammatory activities; nevertheless, high doses or extended exposure to nanoparticles can result in cytotoxicity and pro-inflammatory reactions. Determine the best doses and exposure times to achieve the intended anti-inflammatory effects while minimising any possible negative effects.

Dose-Dependent Effects: It's critical to take into account the toxicity of nanoparticles and their dose-dependent effects. AgNPs and CuNPs have demonstrated promise in a number of applications, including anti-inflammatory activities; nevertheless, high doses or extended exposure to nanoparticles can result in cytotoxicity and pro-inflammatory reactions. To provide the desired anti-inflammatory effects while minimising any negative effects, optimal doses and exposure times should be carefully evaluated.

Experimental Models: A variety of in vitro and in vivo models, including cell cultures, animal models, and inflammation-related biomarkers, can be used to assess the anti-inflammatory effect. For accurate evaluation of the anti-inflammatory efficacy of AgNPs and CuNPs with ethanol and tarragon extracts, it's crucial to select models that closely resemble the inflammatory circumstances of interest.

Both silver and copper nanoparticles have been found to exhibit antibacterial properties. The nanoparticles possess a high surface area-to-volume ratio, allowing for increased interaction with bacterial cells and enhanced antibacterial activity. However, the use of ethanol and tarragon in combination with these nanoparticles for antibacterial purposes requires further clarification.

CONCLUSION

Ethanolic extract of tarragon is more effective as compared to aqueous extract of tarragon and it showed better anti microbial activities.Silver nanoparticles using the ethanolic extract and aqueous extract of tarragon should be evaluated with various other parameters in future.

Future Scope of Research

Silver nanoparticles using the ethanolic extract and aqueous extract of tarragon should be evaluated with various other parameters in future.

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