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GREEN SYNTHESIS AND CHARACTERIZATION OF METALLIC NANOPARTICLES USING CAESALPINIA BONDUCELLA EXTRACT AND THEIR INVITRO ANTIMICROBIAL PROPERTIES

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Abstract

Recent advances in nanoscience and nanotechnology changes the way of diagnostics, using silver nanoparticles for treating disease is more effective way. Compare to the other metallic nanoparticles silver nanoparticles are more effective in diagnostics. In our present study, we taken the medicinal plant extract Caesalpinia bonduc and had undergone the synthesis of silver nanoparticles using green synthesis method The prepared nanoparticles were characterized and elucidated by using UV visible spectrometer, SEM (Scanning electron microscopy), TEM (Transmission electron microscopy) and XRD (X-ray diffraction). And we also check antimicrobial properties of silver nanoparticles by well diffusion method against Escherichia coli and Pseudomonas aeruginosa. By undergoing various study we observed that our plant sample Caesalpinia bonduc was showing good antimicrobial properties.

Key words: *Green Synthesis, Silver nanoparticles, Caesalpinia bonduc, UV spectrometer, SEM, TEM, XRD, Antimicrobial properties.*

Introduction:

Globally, metallic nanoparticles having prominent role in medical field as well as biology, physics, material science and chemistry due to their medicinal properties. Among the several noble metal nanoparticles, silver metal nanoparticles have attained special focus in view of their distinctive properties, like good electrical conductivity, chemical stability, catalytic and antibacterial activity. So we go for a synthesising of silver nanoparticles. Using plant extract for synthesis of silver nanoparticles is most beneficial way, because of having less biohazards compare to chemical method.

We used Caesalpinia Bonducella as our sample. Caesalpinia Bonducella is a medicinal plant from a Fabaceae family, commonly known as grey nicker, nicker bean, fever nut or knicker nut, have a lot of beneficial properties, like anti diabetic properties. The aqueous solution of the outer shell of the seeds of the plant traditionally is used for the relief of the symptoms of diabetes mellitus and also have antibacterial, antifungal, and wound healing properties.

Materials and method:

Preparation of plant extract:

2.5 g of *Caesalpinia Bonducella* plant powder were added in 100 ml of distilled water and boiled for 2 minutes. After cooling down in room temperature, extract were filtered by using wattman filter paper.

Biosynthesis of silver nanoparticles:

5 ml of plant extract were added to 50 ml of 1mM AgNo3 (1:10 ratio) and it was kept in room temperature, dark condition for 24 hours. The plant sample serves as a reducing agent and AgNO3 serves as a oxidizing agent. After 24 hours the extract were changed in brown color indicating the formation of Ag nanoparticles.

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Time of added AgNO3

After 24 hours

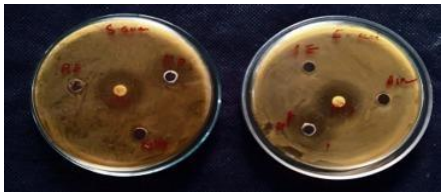
Characterization of silver nanoparticles: Firstly, the characterization is done by UV-Vis spectrometer. The visible range of UV-vis spectrometer is 200-700. In our study, the absorption spectra of the samples were taken 300–540 nm to identify silver nanoparticles The de-ionized water was used as the blank. The samples from the maximum time point of production of silver nanoparticles were used to further analysis. The morphological, structural and chemical composition of Silver NP's were analyzed by employing SEM-(Scanning Electron Microscopy)., Transmission Electron Microscopic (TEM) analysis and X-Ray diffraction (XRD) was done.

Antimicrobial activity test for synthesized AgNps by well diffusion method:

Antimicrobial properties of silver nanoparticles by well diffusion method against Escherichia coli and Pseudomonas aeruginosa. Using micropipette, 25 µL, 50 µL and 65 µL of the sample of nanoparticles solution were poured into well on all plates. And for control study, crude extract (without adding AgNO3) and blank AgNO3 solution were added in another separate wells. After incubation at 35 C for 18 h, the different levels of zone of inhibition were measured. Using- E.coli - about 15 mm zone formation had observed, using pseudomonas

- about 20 mm zone formation had observed.

Result and Discussion:



The detailed study on biosynthesis of silver nanoparticles by natural plants extract Caesalpinia bonduc. It was observed that the color of the solution turned from white to dark brown after 24 h of the reaction, which indicated the formation of silver nanoparticles. The formation and stability of the reduced silver nanoparticles in the colloidal solution was monitored by UV–vis spectrophotometer analysis. The UV–vis spectra showed maximum absorbance at 460 nm, which increased with time of incubation of silver nitrate with the plants extract (Fig 1). The curve shows increased absorbance in various time intervals and the peaks were noticed at 460 nm. In order to verify the results of the UV–vis spectral analysis, the samples of the silver ions exposed to the extracts of natural plants were examined by XRD. Fig 2 shows the XRD pattern for silver nanoparticles synthesized using natural plants extract. The mean particle diameter of silver nanoparticles was calculated from the XRD pattern according to the line width of the plane, refraction peak using the Scherrer's method. X-Ray Diffraction: pattern of silver nanoparticles (NPs). Peaks are assigned to diffraction from the (111), (200) and (220) planes of silver. Peaks of XRD pattern can

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be indexed as a pattern shows the presence of the diffraction peaks corresponding to the (111), (200), and (220) planes. Next, Fig3 (SEM) Scanning electron micrographs of Ag NPs synthesized from N. arbor-tristis with ethanol precipitation at 2 µm resolution. Micrographs show the encapsulation of Ag NPs in the extracted matrix. Fig 4 (TEM) Transmission electron microscopy analysis were attached.

Conclusion: By undergoing various study we observed that our plant sample Caesalpinia bonduc was showing good antimicrobial properties. And our plant sample has a anti inflammatory and antidiabetic activities. So we prefer this for making diabetic wound healing medicine. And we also currentl working on it.

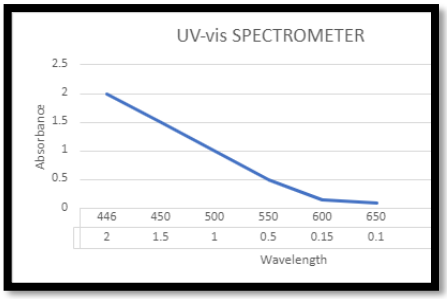

FIG 1 UV-vis spectrometer analysis

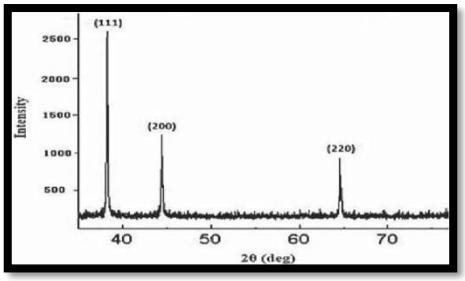

FIG 2 XRD

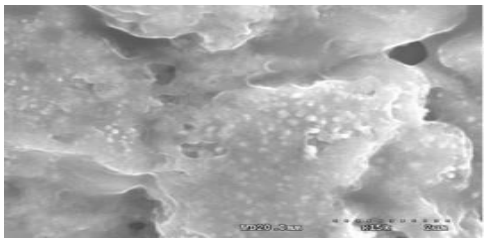

Fig 3 SEM analysis

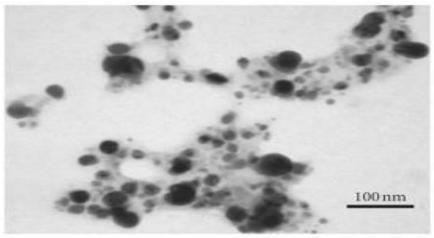

Fig 4 TEM analysis

Reference:

1. Akinnibosun, F.I., Akinnibosun, H.A., Ogedegbe, D., 2009. Investigation on the antibacterial activity of the aqueous and ethanolic extracts of the leaves of Boerhaavia diffusa
2. L. Sci. World J. 4, 15–18.
3. Chaudhry, Q., Castle, L., 2011.Food applications of nanotechnologies: an overview of opportunities and challenges for developing countries. Trends Food Sci. Technol. 22, 595–603.
4. Dibrov, P., Dzioba, J., Gosink, K.K., Hase, C.C., 2002. Chemiosmotic mechanism of antimicrobial activity of Ag+ in Vibrio cholerae. Antimicrob. Agents Chemother. 46, 2668– 2670.
5. Favero, J., Corbeau, P., Nicolas, M., Benkirane, M., Trave, G., Dixon, J.F.P., Aucouturier, P., Rasheed, S., Liautard, J.P., Devaux, C., Dornand, J., 1993. Inhibition of human immunodeficiency virus infection by the lectinjacalin and by a derived peptide showing a sequence similarity with gp120. Eur. J. Immunol. 23, 179–185.
6. Kalishwaralal, K., Deepak, V., Ram Kumar Pandian, S., Kottaisamy, M., Barathmani, K.S., Kartikeyan, B., Gurunathan, S., 2010. Biosynthesis of silver and gold nanoparticles using Brevibacteriumcasei. Colloids Surf. B: Biointerfaces 77, 257–262.
7. Kokura, S., Handa, O., Takagi, T., Ishikawa, T., Naito, Y., Yoshikawa, T., 2010. Silver nanoparticles as a safe preservative for use in cosmetics. Nanomedicine 6, 570–574.

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8. Kowshik, M., Ashtaputre, S., Kharrazi, S., Vogel, W., Urban, J., Kulkarni, S.K., Paknikar, K.M., 2003. Extracellular synthesis of silver nanoparticles by a silver tolerant yeast strain MKY3. Nanotechnology 14, 95–100.
9. Mandal, D., Bolander, M.E., Mukhopadhyay, D., Sarkar, G., Mukherjee, P., 2006. The use of microorganisms for the formation of metal nanoparticles and their application. Appl. Microbiol. Biotechnol. 69, 485–492.