Assessment of Anti-bacterial Activity of Herbal Silver Nanoparticles of *Peristrophe bicalyculata* (R.) Nees

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KEYWORDS

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ABSTRACT

Herbal medicinal plants have been used in traditional medicine for generations, and it's fascinating to see how contemporary research has found the key components responsible for their healing properties. Silver nanoparticles were synthesised utilising a hydroalcoholic extract of *Peristrophe bicalyculata* (R.) Nees leaves (HAEPBL) and various concentrations of silver nitrate. The antibacterial activity of plant extracts and silver nanoparticles was then tested against several pathogenic bacteria using the disc diffusion method.The results show that herbal silver nanoparticles have promising antibacterial properties.

Introduction

Peristrophe bicalyculata (R.) Nees also known as kali aghedi, belongs to the Acanthaceae family and includes alkaloids, tannins, steroids, and flavonoids. The herbs demonstrated antibacterial properties (tuberculostatic), snake poison, bone fracture, sprain, fever, cold, cough, and ear and eye therapies. The plantis a subshrub that can reach 3-4 feet tall. It features ovate, hairy leaves and pink, hairy blooms with two lips. The plant grows in tropical Africa, India, Myanmar, Malaya, and Indochina. In India, it can be found in the Bellary district of Karnataka, Tamil Nadu, and the Kurnool district of Andhra Pradesh [1-2]. Plant sources have played a significant role in the synthesis of green materials-mediated nanoparticles throughout the last decade. In the present investigation anti-bacterial activity of synthesized silver nanoparticles were evaluated.

Material and Methods

Preparation of Silver Nanoparticles using Extract

Silver Nanoparticles were prepared using hydro-alcoholic extract of leaves of *Peristrophe bicalyculata* (R.) Nees (HAEPBL) and varying concentration of silver nitrate. The powder of $AgNO_3$ was dissolved in distilled water to make and prepare stock solution of 10mM $AgNO_3$ Solution. From the above solution 1 mM, 2mM and 3 mM solution were prepared. The $AgNO_3$ solutions were then mixed by HAEPBL in the ratio of 1:1 and 1:2 v/v using VF of 50 ml. The VF was then wrapped with aluminum foil and was then heated using water bath at 60^0 C for about 5 hour. After that the mixture of solution was stored in the refrigerator [3-4].

Antibacterial Activity of Silver Nanoparticles

The antibacterial activity of silver nanoparticles containing hydro-alcoholic extract of leaves of *Peristrophe bicalyculata* (R.) Nees (HAEPBL) was performed by disc diffusion method against pathogenic bacteria, *S. aureus, S. epidermidis, B. subtilis, P. auruginosa* and *E.coli.* A fresh overnight culture of each strain was swabbed uniformly onto the individuals' plates containing sterile Luria Bertani agar, and four 3 mm diameter discs were produced. After adding 25 μL of

pure silver nanoparticles, leaf extract, and silver nitrate solution to each disc, commercial antibiotic discs were used as a control and incubated for 24 hours at 370C. After incubation, various amounts of zonation formed around the disc and were measured. The experiment was repeated three times [5-6].

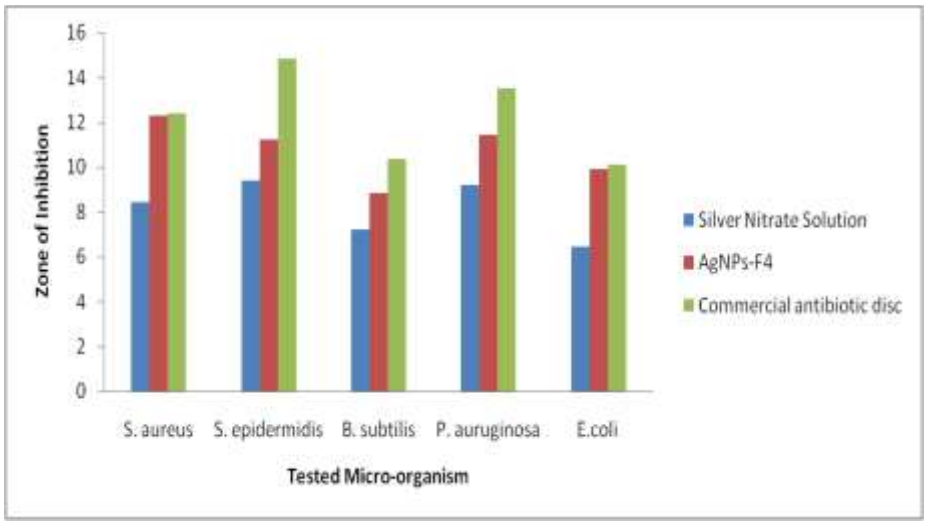
Results and Discussion

Antibacterial activity of silver nanoparticles - AgNPs-F4 was tested against *S. aureus, S. epidermidis, B. subtilis, P. auruginosa* and *E.coli* using the disc diffusion method. The antibacterial activity of optimized silver nanoparticles- AgNPs-F4 was compared to silver nitrate and a commercial antibiotic disc. The zone of inhibition was measured and marked in millimetres (mm) in diameter. Triplicate studies were performed to determine the zone of inhibition in diameter (Table 1 and Graph 1). Silver nanoparticles, out of the four antibacterial agents, have the strongest inhibitory effect on harmful microorganisms. The highest inhibition was observed against E. coli and S. aureus.

Table 1: Anti-bacterial Activity of Silver Nanoparticles - AgNPs-F4

Treatment	***S. aureus***	***S. epidermidis***	***B. subtilis***	***P. auruginosa***	***E.coli***
HAEPBL	11.10±0.17	9.10±0.14	7.98±0.10	10.24±0.22	8.17±0.11
Silver Nitrate Solution	8.43±0.11	9.38±0.10	7.20±0.06	9.18±0.17	6.43±0.86
AgNPs-F4	12.28±0.17	11.22±0.22	8.82±0.17	11.45±0.45	9.89±0.02
Commercial antibiotic disc	12.41±0.18	14.82±0.15	10.37±0.11	13.49±0.16	10.11±0.14

Note: Reading are expressed as Mean±SEM, n=3



Graph 1: Antibacterial Activity of Silver Nanoparticles

Conclusion

Antibacterial activity of optimized silver nanoparticles - AgNPs-F4 was tested against *S. aureus, S. epidermidis, B. subtilis, P. auruginosa* and *E.coli* using the disc diffusion method. The highest inhibition was observed against E. coli and S. aureus.

References

1. Odedra, K. N., Shukla, K., & Bhupendrasinh, A. (2024). Green Traditions: Unearthing Uncommon Plant Uses among the Maher Tribe in Porbandar District, Gujarat, India. *Int. J. Curr. Microbiol. App. Sci*, *13*(03), 64-77.
2. Yong, P. H., Yi, W. X., Azzani, M., Mac Guad, R., & Ng, Z. X. (2024). Potential of Medicinal Plants to Inhibit Neurodegenerative Activities in Diabetes: A Systematic Review. *Journal of Young Pharmacists*, *16*(4), 620-632.
3. Balamurugan, V., Ragavendran, C., Arulbalachandran, D., Alrefaei, A. F., & Rajendran, R. (2024). Green synthesis of silver nanoparticles using Pandanus tectorius aerial root extract: Characterization, antibacterial, cytotoxic, and photocatalytic properties, and ecotoxicological assessment. *Inorganic Chemistry Communications*, *168*, 112882.
4. Shereen, M. A., Ahmad, A., Khan, H., Satti, S. M., Kazmi, A., Bashir, N. & Zouidi, F. (2024). Plant extract preparation and green synthesis of silver nanoparticles using Swertia chirata: Characterization and antimicrobial activity against selected human pathogens. *Heliyon*, *10*(6).
5. Singh, R., Singh, R., Parihar, P., & Mani, J. V. (2024). Green synthesis of silver nanoparticles using Solanum sisymbriifolium leaf extract: Characterization and evaluation of antioxidant, antibacterial and photocatalytic degradation activities. *Process Biochemistry*.
6. Tunay K. (2024). Green synthesis of silver nanoparticles using Sambucus ebulus leaves extract: characterization, quantitative analysis of bioactive molecules, antioxidant and antibacterial activities. *Journal of Molecular Structure* 1296:136836.