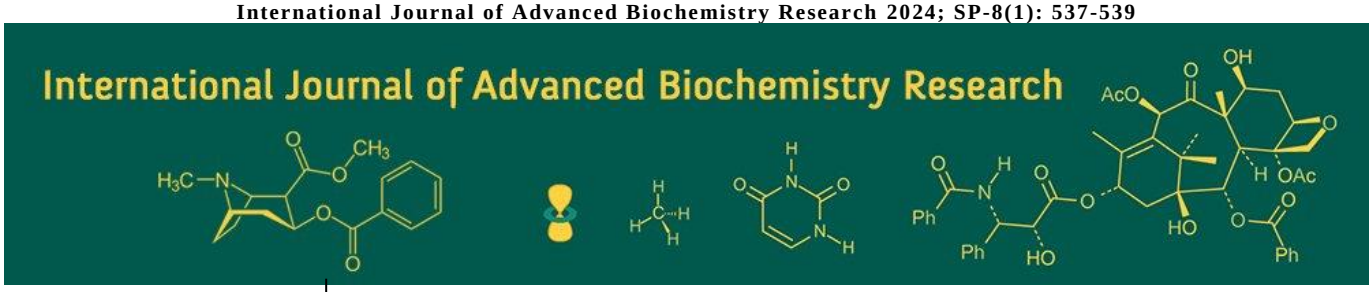

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Sadabahar (*Catharanthus roseus*): Utilizinging green potential for antimicrobial activity

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Abstract
Medicinal plants have garnered global attention for their healing properties, particularly in nanoparticle synthesis, a method recognized for its environmental friendliness, low toxicity, and cost-effectiveness. *Catharanthus roseus* (Periwinkle or Sadabahar), a traditional medicinal plant abundant in tropical regions, stands out as a key player. Rich in phytochemicals, especially alkaloids, its leaves and roots have proven medicinal benefits, including anticancer and antihypertensive effects. Beyond its medicinal uses, the plant finds application in textiles, particularly medical textiles, aligning with the global trend toward sustainable practices. The green synthesis of nanoparticles using *C. roseus* is gaining traction due to its eco-friendly, non-toxic, and cost-effective nature compared to traditional methods. The study focused on the antibacterial activity of the extract against common pathogens, utilizing the well-diffusion method. The resulting aqueous extract exhibited notable antibacterial efficacy, particularly against *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus*, and *Bacillus cereus*. *C. roseus* emerges not only as a versatile medicinal resource but also as a valuable tool for eco-friendly and cost-effective applications in medicine and industry.

Keywords: Sadabhar, sustainable, extract, bacteria and antibacterial

Introduction
The escalating significance of medicinal plants in contemporary times is attributed to their remarkable therapeutic attributes. In this context, the biosynthesis of nanoparticles derived from medicinal plants emerges as a highly efficacious approach, harnessing the unique dual properties inherent in the materials. *Catharanthus roseus*, commonly known as Periwinkle or Sadabahar, is a standout example in this realm. Belonging to the *Apocynaceae* family and ubiquitously found in tropical and subtropical regions, *C. roseus* is a treasure trove of phytochemicals, particularly alkaloids. Employing plant materials for nanoparticle biosynthesis presents a myriad of advantages, rendering the process not only environmentally friendly but also less toxic and more cost-effective. The leaves and roots of *C. roseus* enriched with alkaloids, have been extensively studied for their medicinal prowess, showcasing anticancer and antihypertensive effects. Furthermore, the plant's extracts exhibit notable antiviral, antibacterial, antioxidant, and antifungal activities.

Beyond its medicinal applications, *C. roseus* extends its utility to various industries, including textiles, particularly in the production of medical textiles. The green synthesis of nanoparticles from this botanical source aligns seamlessly with the global shift toward sustainable and eco-friendly methodologies. As the demand for such practices intensifies, *C. roseus* stands as a beacon, symbolizing the potential of harnessing nature's bounty for innovative and environmentally conscious advancements in medicine and industry alike.

Alkaloids are considered the major chemical constituents of this plant (Muktha *et al*, 2024) [5]. The leaves and roots of *C. roseus* are rich in phytochemicals; for instance alkaloids, which have been demonstrated to have anticancer and antihypertensive effects (Al-Shmgani *et al*, 2017) [3]. *C. roseus* is a plant that is mostly used in traditional medicines. These extract showed high zones of inhibition against *Shigella dysenteriae*, *Klebsiella pneumoniae*, *Bacillus anthraces*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* (Ahmed *et al*, 2020) [1].

They possess a wide range of applications in medicine; including pharmaceutical, cosmetics, and medical devices because of their broad bactericidal and fungicidal spectrum (Palaniselvam *et al*, 2014) [9].

Green synthesis of nanoparticles is gaining interest worldwide because of its advantages, such as being ecofriendly, non-toxic, and economic, over chemical and traditional physical methods (Mohanpuria *et al*, 2008) [6]. Several biological methods have been used for nanoparticle production from organisms involving bacteria, fungi, and plant extracts (Aruna *et al*. 2014) [4]. *Catharanthus roseus* (Madagascar periwinkle or Sadabahar), which belongs to the plant family Apocynaceae, has been widely introduced as one of the important medicinal plants that is used for different application in textile industry (medical textile).

Materials and Methods

Plant collection: Fresh green leaves of sadabahar were plucked and their stems were removed. The selected plant parts i.e. leaves were first washed thoroughly with running tap water followed by distilled water to get rid of all dust and unwanted particles adhering to the surface of the leaves, the process was repeated 2-3 times. After that, the sadabahar green leaves were kept for drying for two hours on the water absorbent paper at room temperature. The leaves were grinded in a laboratory grinder mixer to make coarse paste. (Alkhulaifi *et al.* 2020) [2].

Extraction process

For extraction, paste of 10g of fresh leaves of sadabhar was added to 100 ml of distilled water (1:10). The solution was boiled for 15-20 minutes at 100^0C. After that the plant extract solution kept at room temperature for cooling, was filtered using Whatman No. 1 filter paper (pore size: 11µm) and stored at 4 ºC for further use.

Selection of bacteria

Pure cultures of four common human pathogenic bacteria namely Gram-positive (*Bacillus cereus* and *Staphylococcus aureus*) and Gram-negative (*Pseudomonas aeruginosa* and *Escherichia coli*) were selected.

Anti-bacterial assay

There are various methods involved in testing the antimicrobial activity of test extract, from which the agar well diffusion method (Dey *et al*. 2010) [10] with slight modification was employed to test the anti-bacterial activity of aqueous extract of sadabhar plant leaves.

The petri plates with NA was prepared and left in laminar to check the plates contamination, plates free from contamination were used to check antibacterial activity. To test the antibacterial potency of the prepared extract, 0.1ml of bacterial inoculum was taken from cultures and poured on the test petri plate of Nutrient agar and evenly spread with the help of L spreader. A uniform well was created in the centre of the plates with the help of a sterilized cork borer of 5 mm diameter and the aqueous extracts were poured into the well using a pipette. The plates were then rested for about 24 hours in incubator at 37 °C in inverted position to analyse the bacterial growth. After 24 hours, the zone of clearance was observed around the well and was considered for the anti-bacterial activity of the extract. The amount of resistance shown by the extract toward the bacterial growth was determined by measuring the diameter of the zone of inhibition formed around the wells.

Results and Discussion

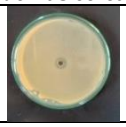
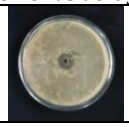
Anti-bacterial activity of sadabhar plant extract

The Sadabhar plant was assessed for their anti-bacterial activity. Aqueous extract of the leaves of sadabhar plant was prepared by maceration process and assessed for anti-bacterial efficacy against *Bacillus cereus* (Gram positive), *Staphylococcus aureus* (Gram positive), *Escherichia coli* (Gram negative) and *Pseudomonas aeruginosa* (Gram negative) using Well Diffusion Method. The result presented in Table 1 showed that the aqueous extract of sadabhar plant had anti-bacterial activity. The sadabhar leaves extract showed strong activity of 5.3±0.04 mm zone of inhibition against *Pseudomonas aeruginosa*, 3.6±0.04 mm, zone of inhibition against *Escherichia coli* 4.6±0.04 mm, zone of inhibition against *Staphylococcus aureus* and 3.3±0.04mm zone of inhibition against *Bacillus cereus*, respectively.

Table 1: Antibacterial activity of sadabhar green leaves extract

Sr. No	Local name of plant	Scientific name of plant	Zone of inhibition (mm)			
			Bacillus cereus	***Staphylococcus aureus***	***Pseudomonas aeruginosa***	***Escherichia coli***
1.	Sadabahar	*Catharanthus roseus*	3.3±0.04mm	4.6±0.04 mm	5.3±0.04 mm	3.6±0.04 mm

Plate 1: Sadabhar leaves extract zone of inhibition

Sr. No	Local name of plant	Scientific name of plant	Zone of inhibition			
			Bacillus cereus	***Staphylococcus aureus***	***Pseudomonas aeruginosa***	***Escherichia coli***
1.	Sadabahar	*Catharanthus roseus*				

Conclusion

In conclusion, the study demonstrated the potent antibacterial activity of the aqueous extract of *Catharanthus roseus* (Sadabahar) leaves against common human pathogenic bacteria, including *Bacillus cereus*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Escherichia coli*. The well-diffusion method revealed substantial zones of inhibition, indicating the effectiveness of the Sadabahar plant extract in inhibiting bacterial growth. The observed antimicrobial efficacy against both Gram-positive and Gram-negative bacteria underscores the broad-spectrum potential of the extract. This research supports the utilization of Sadabahar as a valuable source for green synthesis of nanoparticles, particularly silver nanoparticles, presenting an eco-friendly and cost-effective alternative for combating bacterial infections. The findings contribute to

the growing body of knowledge on the therapeutic applications of medicinal plants and their potential in nanotechnology for sustainable and effective biomedical interventions.

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