

TAMILNADU STATE COUNCIL FOR SCIENCE AND TECHNOLOGY

DOTE Campus, Chennai-600 025

STUDENT PROJECT SCHEME 2023-2024

Terms and Conditions of the grant

1. The project team SHOULD NOT change the topic of the project and should not deviate from the objectives of the sanctioned proposal. In the event of any such changes, sponsoring will be treated as cancelled.
2. Every sanctioned project is allotted with a Project code Number. Please refer this number while corresponding with TNSCST.
3. The project sanction letter will be sent to the Principal/Registrar/Dean of the institution with a copy to the Project guide.
4. The sanctioned completed project's, Utilization Certificate (UC) and seminar paper should be reached to 'The Member Secretary, Tamilnadu State Council for Science and Technology, DOTE Campus, Chennai-600 025' on or before 25th October 2024.
5. The Utilization Certificate should be signed by the Guide, HOD and Principal/Registrar/Dean with official seal as the case may be.
6. For the completed project, 2 pages seminar paper (500 words, Times New Roman, 12 font size, single column, margins left- 2.5cm, right-2cm, top-2cm & bottom- 2cm, 1.5 line space in Word format without any figures, tables & references) should be submitted/uploaded in the council website (<https://forms.gle/YYzjWfkSWEgGEcE16>) along with a scanned copy of the Utilization Certificate (PDF file) and Institutional Bank account details.
7. The institution heads informed to collect all the sanctioned project's the utilization certificate (s), seminar paper and institution bank details and send to the council address at the earliest.
8. The seminar paper will be included in the form of Proceedings which will be brought out during Seminar cum Exhibition, only for those who submit the UC.
9. If the guide wishes to leave the Institution where the project is based, the Institute/guide will inform the same to the Council and in consultation with Council, evolve steps to ensure successful completion of the project, before relieving the guide.
10. The Council reserves the right to order verification/audit of accounts by any Officer authorized by it. The bills and accounts shall be kept safely.
11. Students/faculties are encouraged to publish the research papers emerging out of the project work in peer reviewed Journals.
12. They should acknowledge the Council in reports and technical/scientific papers publishing based on the research work done under the project.
13. If the results of research are to be legally protected by way of patent/copy rights etc. the results should not be published in any form without action being taken to secure legal protection for the research results.
14. The state council encourages the students/faculties, who want to protect the results/invention created out of the project by getting patents through its Patent Information Centre free of cost.
15. The knowledge generated from the project will be the property of TNSCST and must be appropriately acknowledged. Any transfer of technology developed through the project will be conducted in consultation with the Council.
16. The recipient organization shall comply, with such other conditions as may be suggested in the 'guidelines' issued in this regard from time to time.

MEMBER SECRETARY

TAMILNADU STATE COUNCIL FOR SCIENCE AND TECHNOLOGY
DOTE Campus, Chennai - 600 025

STUDENT PROJECT SCHEME 2023-2024
UTILIZATION CERTIFICATE

(TWO COPIES)

1. Name of the guide and address :

2. Name of the student(s) :

3. Title of the project :

4. Project code :

It is certified that a sum of Rs..... (Rupees)
Sanctioned by the council for carrying out above mentioned student project has been
utilized for the purpose for which it was sanctioned and sum of
Rs.remaining unutilized is refunded.

Signature of the Guide

Signature of the HOD

Signature of the
Registrar/Principal/Dean
with SEAL

Antibiofilm and Antiquorum Sensing Potential of Biosynthesized Silver Nanoparticles from Nutmeg against MDR *Salmonella enterica* Serovar Typhi

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Abstract

Globally, *Salmonella* infection poses a major public health problem. In this study, we report the antibiofilm activity and quorum sensing inhibition of an aqueous extract of nutmeg and biosynthesized silver nanoparticles (AgNPs) against multidrug-resistant (MDR) *Salmonella enterica* serovar Typhi (*S. Typhi*) isolated from typhoid patients and asymptomatic carriers. The inhibition of biofilm formation by MDR *S. Typhi* isolates and the suppression of pigment production in *Chromobacterium violaceum* demonstrated the quorum-sensing potential of nutmeg. The aqueous nutmeg extract exhibited 87% antibiofilm activity, while the biosynthesized AgNPs showed 99.1% antibiofilm activity. Molecular docking studies further revealed that the bioactive compounds in nutmeg possess anti-quorum sensing properties.

Introduction

Salmonella species are among the most important pathogens worldwide, exhibiting high morbidity and mortality rates. Following infection, *S. Typhi* colonizes the gallbladder and can remain there long after symptoms have subsided, serving as a reservoir for the further spread of the disease. However, a significant percentage of typhoid infections result in the asymptomatic carriage of *S. Typhi*. Clinical observations among typhoid carriers show that their resistance to antibiotic treatment and the extension of infection to the gallbladder are associated with the biofilm-producing potential of *S. Typhi*. In many typhoid cases, persistence can lead to the formation of biofilms on gallstones in both acute patients and chronic carriers. Typhoidal and non-typhoidal *Salmonella* biofilms represent a major health problem in industrial, veterinary, and medical settings, as they contribute to the failure of antibiotic treatments and facilitate the development and spread of antibiotic resistance.

Methodology

In this study, a nutmeg aqueous extract, biosynthesized AgNPs, and MDR *S. Typhi* isolates (NCBI accession numbers KT037135-38, KT037130-34, KT696507, KT696504-06) from asymptomatic typhoid carriers and typhoid patients were used. Potent biofilm-forming MDR *S. Typhi* isolates were evaluated using the Congo red agar, tube adherence, and tissue culture plate methods. The quorum sensing inhibition ability of the nutmeg aqueous extract and biosynthesized AgNPs was determined using a soft agar overlay protocol with *Chromobacterium violaceum* (ATCC 12472) as the indicator bacterium. Molecular docking studies of the bioactive compounds of nutmeg were performed against the transcriptional regulatory protein RcsB and the sensor kinase protein RcsC.

Results

S. Typhi isolates revealed a higher percentage (46%) of biofilm production when identified by the tissue culture plate method compared to the Congo red agar and tube adherence methods. The inhibition of biofilm formation by MDR *S. Typhi* isolates and the reduction in pigment production by *C. violaceum* (indicator bacteria) demonstrated the quorum-sensing potential of nutmeg. The aqueous nutmeg extract exhibited 87% antibiofilm activity, while the biosynthesized AgNPs showed 99.1% antibiofilm activity. Molecular docking studies of the bioactive compounds in nutmeg against the transcriptional regulatory protein RcsB and sensor kinase protein RcsC revealed interactions with these target proteins, indicating their anti-quorum sensing potential.

Conclusion

It is concluded that biosynthesized AgNPs could be used as an effective candidate for treating asymptomatic typhoid carriers or typhoid patients and for controlling the persistence of biofilm-producing *S. Typhi* strains or other pathogenic bacteria in environmental or industrial settings.

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