

Antibacterial Properties of Psychrophilic *Penicillium* sp. Extract from Arctic Soil towards *Pseudomonas aeruginosa* ATCC 9027 and *Bacillus cereus* ATCC 11778

Alif Khuzairie Ruslan^a, Siti Hajar Sadiran^{ab*}

Structured Abstract

Background: The emergence of pathogens which survive low-temperature conditions has heightened the concerns on the preservation of refrigerated and frozen products. *Pseudomonas aeruginosa* and *Bacillus cereus* are examples of such psychrotolerant and they show resistance towards preservation methods conventionally used and even at low temperatures. The study aimed at identifying the possibility of utilising psychrophilic fungi, namely *Penicillium* sp. that was isolated in Arctic soil (Svalbard Island) to acquire novel anti-bacterial compounds that have efficacy at low temperatures.

Methods: *Penicillium* sp. was fermented in potato dextrose broth (PDB) at 10°C over four weeks. The liquid-liquid extraction procedure was performed using ethyl acetate and the extract was concentrated by rotary evaporation. The crude extract obtained was tested for its antibacterial activity on *P. aeruginosa* ATCC 9027 and *B. cereus* ATCC 11778. This was carried out through disc diffusion, broth microdilution to identify minimum inhibitory concentration (MIC), and the dot plate method identifying minimum bactericidal concentration (MBC).

Results: In the disc diffusion assay, the extract showed significant antibacterial properties against both the bacteria with an inhibition diameters of 17.67 ± 1.15 mm and 20.33 ± 0.58 mm against *B. cereus* and *P. aeruginosa* respectively. The MIC of *B. cereus* and *P. aeruginosa* was 630 ± 0.00 µg/mL and 1670 ± 720 µg/mL respectively. Both strains showed an MBC value of 5000 µg/ml. These findings propose greater susceptibility of the Gram-positive strain to lower concentrations, and at the same time demonstrate the effectiveness of the extract as a broad-spectrum agent.

Conclusion: In conclusion, this study successfully demonstrated the cultivation of a psychrophilic *Penicillium* sp. and its antibacterial activity against *B. cereus* and *P. aeruginosa*. These findings suggest the potential application of cold-adapted *Penicillium* strains as natural antimicrobial agents to enhance food safety, particularly under refrigerated conditions.

Keywords: Antibacterial Activity, Arctic Fungi, Psychrophilic Fungi, *Penicillium* sp., Foodborne Pathogens

*Correspondence: hajarsadiran@uitm.edu.my

^a School of Biology, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia

^b Atta-ur-Rahman Institute for Natural Product Discovery, Universiti Teknologi MARA Selangor, Puncak Alam Campus, Bandar Puncak Alam, Selangor, Malaysia