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Research Article

Antibacterial potential of bacterial cellulose composite with levofloxacin against pathogens from wounds and burns infections in Basrah, Iraq

Fatima Salem Al-halfi
Department of Biology, College of Science, University of Basrah, Basrah, Iraq
Wijdan Hussein Al-Tamimi *
Department of Biology, College of Science, University of Basrah, Basrah, Iraq

*Corresponding author. E-mail: wijdan.abdulsahib@uobasrah.edu.iq

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Abstract
Bacterial cellulose (BC) has attracted attention as a drug delivery platform due to its structural strength and biocompatibility. In the present study, BC produced by *Bacillus licheniformis* was tested against bacteria isolated from wound and burn infections. BC was fabricated in situ with gellan and whey Bacterial cellulose/gellan gum (BC/GW) and ex situ with sodium alginate and levofloxacin at different concentrations Bacterial cellulose/gellan gum/ levofloxacin (BC/GW/SA/LEV) to improve its antibacterial efficacy. Molecular detection using the *16S rRNA* gene was employed to identify 31 bacterial isolates. The BC films were characterized by measuring water-holding capacity (WHC), Fourier transform infrared (FTIR), Scanning electron microscopy (SEM), and Thermal gravimetric analysis (TGA). The results indicated that the most prevalent genera were *Staphylococcus* sp. 13 (52%) and *Escherichia* sp. 4 (16%). In terms of frequency, *Staphylococcus aureus* was the most common species, found in 6 isolates (20%). The isolate of *Bacillus licheniformis* demonstrated a high BC yield of 188 g/l, which increased to 289 g/l after in situ fabrication. The BC/GW film exhibited the highest WHC improvement at 96.03%, compared to the BC film at 93.93%. FTIR confirmed successful bonding between the BC/GW/SA/LEV film and levofloxacin. TGA analysis showed moderate thermal stability for the BC film and BC/GW, whereas BC/GW/SA exhibited significantly enhanced thermal stability. SEM revealed a three-dimensional porous fibrous network of BC. The BC/GW film appeared denser and more compact. The BC/GW/SA film appeared more homogeneous, with filled voids, and the BC/GW/SA/LEV surface exhibited branched crystalline domains, indicating successful incorporation of levofloxacin. The composites exhibited strong antibacterial activity, with a maximum inhibition zone of 35 mm for *Bacillus bacterium* strain ZHCPRcN32 at a concentration of 7.5 mg, and the lowest was against *Escherichia coli* at 11 mm at the same concentration. The BC composite films may play a promising role in treating multidrug-resistant wound infections by serving as carriers for antibiotics targeting these bacteria.

Keywords: Antibacterial activity ,Bacterial cellulose, Composite fabrication, , Levofloxacin, Wound infections

INTRODUCTION

Chronic wounds are ulcers that do not heal and are often associated with bacterial infections. Because of compromised cellular responses and increased inflammation, which are probably brought on by bacterial infection and biofilm formation, these wounds evade the natural healing process (Chamoun and Matheus, 2025). Wound infections remain an interprofessional and interdisciplinary challenge, particularly in patients with chronic wounds (Dissemond *et al*., 2025). In daily clinical practice, multidrug-resistant organisms (MDROs) present a significant challenge. This term describes a group of bacteria that exhibit strong antibiotic resistance. Approximately 1.2 million individuals worldwide die each year as a result of antibiotic resistance (Murray *et al*., 2022). Gram-positive cocci (*Staphylococcus aureus* and *Enterococcus faecalis*) and gram-negative bacilli (*Pseudomonas aeruginosa* and *Klebsiella pneumoniae*) dominate wound infections (Bhujugade *et al*., 2024). Even though there are numerous therapeutic approaches for treating wounds and burns, and significant advancements have been made in this field, there is still an opportunity for improvement because better ways to hasten wound healing and recovery are desperately needed, particularly for patients

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