Biointerface Research in Applied Chemistry
Platinum Open Access Journal (ISSN: 2069-5837)

Article
Volume 12, Issue 6, 2022, 8105 - 8116
https://doi.org/10.33263/BRIAC126.81058116

Antibacterial Studies of Penicillin G Loaded Carboxylic Cellulose Acetate Nanoparticles

Boon-Kui Ho [1], Suk-Fun Chin [1,*], Samuel Lihan [2]

1 Faculty of Resource Science and Technology, Universiti Malaysia Sarawak 94300, Kota Samarahan, Sarawak, Malaysia;
2 Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak 94300, Kota Samarahan, Sarawak Malaysia
* Correspondence: sfchin@unimas.my (S.F.C);

Scopus Author ID 16644797900

Received: 5.10.2021; Revised: 15.11.2021; Accepted: 19.11.2021; Published: 9.12.2021

Abstract: Cellulose acetate nanoparticles (CCA NPs) with mean particles sizes of 97 nm were synthesized via the nanoprecipitation process. The antibacterial properties of these CCA NPs were evaluated against Gram (+) and Gram (-) bacteria, respectively. The CCA NPs exhibited good antibacterial activity against Methicillin-resistant Staphylococcus aureus (MRSA) (+), Staphylococcus epidermis (+), Escherichia coli (-), Bacillus cereus (+), and Salmonella typhimurium (-) in range of MIC of 2.5×102 to 5.0×102 µg.mL-1 and MBC of 5.0×102 to 1.0×103 µg.mL-1. Penicillin G (PenG)-loaded CCA NPs demonstrated synergistic antibacterial activities against Gram (+) and Gram (-) bacteria. PenG-loaded CCA NPs also exhibited promising antimicrobial activity against the Methicillin-resistant staphylococcus aureus (MRSA) superbug, which is resistant to penicillin G. These promising antibacterial properties suggested that CCA NPs could potentially serve as an alternative potent antimicrobial agent for both Gram (+) and Gram (-) bacteria as well as the superbug MRSA.

Keywords: cellulose nanoparticles; penicillin-loaded cellulose nanoparticles; antibacterial activity; Methicillin-resistant *staphylococcus aureus* (MRSA); superbug.

1. Introduction

Even though there are many types of antibiotics available in the market for the treatment of bacterial infections, however, most of the bacteria tend to evolve into mutated antibacterial-resistant bacteria. For instance, *Staphylococcus aureus* evolved and mutated into MRSA superbugs. Furthermore, misuse and overdosage of antibiotics may lead to bacteria resistance towards antibiotics, reduce the effectiveness, and ultimately lead to the emergence of new infections. Therefore, the search for a potential cure for MRSA infection is still a big challenge, and the development of new antibacterial agents has become an urgent need to treat infectious diseases.

Recently, polysaccharide-based nanoparticles have been studied extensively for biological applications due to their non-toxic, low cost, good biocompatibility, renewable and biodegradable [1,2]. Also, antimicrobial studies of polysaccharide-based nanoparticles were widely reported. For instance, Ismail and Gopinath [3] reported that starch nanoparticles loaded with penicillin and streptomycin were fabricated *via* the microemulsion method and evaluated for their antimicrobial activity against *Streptococcus pyogenes* and *Escherichia coli*. The result displayed an inhibition zone of 17 mm at the concentration of 1 mg/mL. Another similar study was also reported by Gopinath *et al*. [4] on the preparation of ampicillin-loaded cellulose