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Synthesis and Characterization of Polycaprolactone for the Delivery of Rifampicin

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Abstract : Bacterial infections have been a challenge both in the public and private sectors. The colonization of bacteria often occurs in medical devices such as catheters, heart valves, respirators, and orthopaedic implants. When biomedical devices are inserted into patients, the deposition of macromolecules such as fibrinogen and immunoglobin on their surfaces makes it easier for them to be prone to bacteria colonization leading to the formation of biofilms. The formation of biofilms on medical devices has led to a series of device-related infections which are usually difficult to eradicate and sometimes cause the death of patients. These infections require surgical replacements along with prolonged antibiotic therapy, which would incur additional health costs. It is, therefore, necessary to prevent device-related infections by inhibiting the formation of biofilms using intelligent technology. Antibiotic resistance of bacteria is also a major threat due to overuse. Different antimicrobial agents have been applied to microbial infections. They include conventional antibiotics like rifampicin. The use of conventional antibiotics like rifampicin has raised concerns as some have been found to have hepatic and nephrotoxic effects due to overuse. Hence, there is also a need for proper delivery of these antibiotics. Different techniques have been developed to encapsulate and slowly release antimicrobial agents, thus reducing host cytotoxicity. Examples of delivery systems are solid lipid nanoparticles, hydrogels, micelles, and polymeric nanoparticles. The different ways by which drugs are released from polymeric nanoparticles include diffusion-based release, elution-based release, and chemical/stimuli-responsive release. Polymeric nanoparticles have gained a lot of research interest as they are basically made from biodegradable polymers. An example of such a biodegradable polymer is polycaprolactone (PCL). PCL degrades slowly by hydrolysis but is often sensitive and responsive to stimuli like enzymes to release encapsulants for antimicrobial therapy. This study presents the synthesis of PCL nanoparticles loaded with rifampicin and the on-demand release of rifampicin for treating staphylococcus aureus infections.

Keywords : enzyme, Staphylococcus aureus, PCL, rifampicin
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