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Nanoencapsulation of amoxicillin in chitosan-tripolyphosphate nanoparticles for enhanced gastric retention time

K. R. Hulugalla, K. M. N. De Silva*, W. R. M. De Silva and V. U. Godakanda

Department of Chemistry, University of Colombo, Colombo 03, Sri Lanka

Over the past few decades, the field of medicine has progressed at a breakneck pace, and recent advancements in drug delivery have provided promising solutions to the persisting problems of limited efficacy and low site-specificity of many drugs. Nanosized drug carriers have increased in popularity because of the tuneable chemical and physical properties that allow for selective accumulation in the affected region. The use of polymeric nanoparticles for the oral drug delivery route shows great promise due to their ability to protect the drug from the harsh environment of the gastric tract as well as allowing for controlled release of the drug. This work aims to provide a foundation for the development of a more effective, sustained oral drug delivery platform, to prolong dosing intervals for the antibiotic Amoxicillin, which is a cornerstone in the treatment of peptic ulcers caused by the bacteria *Helicobacter pylori*. Chitosan is a biodegradable, natural polymer with inherent antibacterial activity, which served as reason for its selection as the encapsulating polymer for the nanoparticles. The particles were fabricated by the ionic gelation technique which uses the positive charge of the chitosan molecule to form a complex with tripolyphosphate (TPP), a negatively charged crosslinker. The optimum concentration of chitosan was 2.0 mg/mL, and the formulation showed encapsulation and loading efficiencies of 96.23% and 58.94%, respectively as determined by UV-Vis spectrophotometry. The nanoparticles were characterized using FT-IR, SEM and XRD. The SEM images showed that the size range of the nanoparticles was 100 nm to 1 µm, and the drug was found to lose its crystallinity and exist in the amorphous form upon encapsulation according to the XRD and FT-IR spectra. Drug release kinetics were fitted to the Korsmeyer-Peppas model and showed a sustained release profile with a non-Fickian release mechanism. All analysis experiments were conducted in triplicate. According to the results, our developed formulation shows promise as a controlled release vehicle for the oral delivery of Amoxicillin and can be used as a framework to develop more effective oral drug delivery platforms in the future.

Keywords: Nanoencapsulation, chitosan, amoxicillin, sustained release

E-mail: kmnd@chem.cmb.ac.lk