

Formulation and In Vitro Assessment of a Hybrid Gel-Microparticle Composite for Ocular Delivery of Dual-Antiglaucoma Drugs

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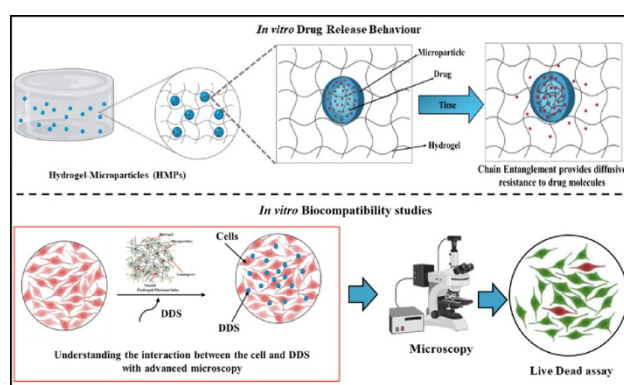
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Glaucoma, a major global health issue, is the second leading cause of blindness. Topical eye drops are commonly used due to their simplicity, but the eye's protective barriers hinder optimal drug concentration at the target site. This study addresses these challenges by developing a novel dual-drug delivery system, integrating polycaprolactone microparticles loaded with latanoprost (hydrophobic) and timolol maleate (hydrophilic) antiglaucoma drugs into a gelatin-alginate hydrogel matrix. There is a fundamental challenge to combine both drugs in the same delivery system with a controlled release profile. Hydrogel-microparticles (HMPs) were assessed via in vitro drug release and cell culture for biocompatibility, with Raman analysis for chemical compatibility and drug diffusivity. Results showed that the HMPs system has prolonged drug release for up to 32 days. Raman analysis confirmed the chemical compatibility of the formulation components, and in vitro biocompatibility studies demonstrate that the HMPs system is biocompatible and exhibits minimal cytotoxicity. This novel HMPs system can serve as a flexible, controlled-release platform that modulates the release profile. Our study highlights that the polymer and drug properties, along with the external matrix, were key factors influencing the drug release behavior of the formulations, and the proposed HMPs system can potentially be considered for glaucoma therapy.

Keywords:

Hydrogel-microparticles (HMPs), Drug release, Latanoprost, Timolol maleate, Raman analysis, Biocompatibility studies



Graphical Abstract

References:

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