Lysozyme Responsive Prolonged Dual Anti-glaucoma Drug Deliverable Nanocomposite to Manage Intraocular Pressure

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Abstract: The designing of highly efficient and biocompatible nanocomposites with multifunctional delivery and tracking characteristics is noteworthy for clinical and therapeutic applications. Herein, we report the delivery of anti-glaucoma drugs, latanoprost (LP) and Timolol (TM) under an enzymatic stimulus, lysozyme (Lyz) with novel chitosan (CS) - graphene quantum dots (GQD) nanocomposite. The LP-TM caged CS-GQDs nanocomposite was well characterized through extensive spectral, morphological, particle size, and zeta potential studies along with cytotoxicity assays against human corneal epithelial (HCE) cells. The prolonged delivery of the drug was observed for 72 hours in the presence of lysozyme. Further, AO/EB staining and biocompatibility assays further proved excellent cell viability of >80%. ^{1}H-NMR spectral studies confirm the release of drugs through the hydrolysis of 1,4-glycosidic bonds of chitosan, and mucoadhesive investigations confirm the prolonged residence feature of composite. Besides, an *ex-vivo* test, HET-CAM assay, and histopathological studies prove the non-irritancy of the as-prepared dual drug-loaded nanocomposite upon the exposure of 5 minutes. These findings justify the further utility of novel CS-GQDs caged drug nanocomposite for preclinical investigations and for fabricating medicated soft contact lenses to treat glaucoma.

Keywords: Chitosan, Drug delivery, Graphene quantum dot, Lysozyme, Latanoprost, Timolol