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# Chitosan based positively charged mucoadhesive nanocarriers for ocular drug delivery

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Cornea and conjunctiva carry a negative charge upon their surface, due to the presence of negatively charged mucus residues on the outer side of their membranes, and to selective active ion pumps. Ocular surface should thus be selective to positively charged delivery systems that interact with cells, leading to increased drug permeability and prolonging the pharmacological effect. Chitosan (CS), as a unique positively charged polysaccharide, has been one of the most popular biopolymers for development of drug delivery systems for various applications, due to its promising properties, including high biocompatibility, excellent biodegradability, low toxicity, as well as abundant availability and low production cost. In fact, an ionic interaction between the positively charged amino groups of CS and negatively charged sialic acid residues in mucus has been proposed as the mucoadhesion mechanism. Since last decade, increasing attention has been attracted by delivery systems fabricated from natural biopolymer-based polyelectrolyte complexes (PEC), formed by electrostatic interactions between two oppositely charged biopolymers. The preparation of nanocapsule via complex coacervation method is based on the PEC through the electrostatic interactions between cationic and anionic polymers, resulting in the formulation of insoluble spherical beads or capsules. Due to the protonation of amino groups on the backbone, CS becomes a cationic polyelectrolyte in acidic medium, which could form PEC with negatively charged polyelectrolytes, resulting in various applications. In recent years, positively charged liposomes and nanoemulsions have been used as drug carriers. CS is suitable for formulation of mucoadhesive cationic nanoemulsion because it is positively charged, making it able to adhere to the negatively charged oil globules in nanoemulsion and is soluble in diverse acids and able to interact with polyanions to form complex and nanogel. This is an effort to summarize the recent developments in the area of CS based cationic mucoadhesive nanocarriers for ocular drug delivery.

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