Design, preparation and characterization of lactoferrin-loaded sulfobutylether-β-cyclodextrin/chitosan nanoparticles as a therapeutic alternative for keratoconus treatment

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Introduction and objectives
Lactoferrin has shown potential as a good therapeutic alternative in the treatment of Keratoconus [1]. Chitosan/Cyclodextrin nanoparticles as novel drug delivery systems (DDS) could successfully encapsulate hydrophobic drugs [2]. The aim of this work was based on the design, preparation, and characterization of lactoferrin-loaded CS/SBE-β-CD nanoparticles as topical ophthalmic DDS for the keratoconus treatment.

Methodology
Preparation of lactoferrin CS/SBE-β-CD NPs
Nanoparticles were spontaneously obtained via isometric gelation. 1 ml lactoferrin/SBE-β-CD aqueous solution was added to 3 ml CS acidic aqueous solution under magnetic stirring at room temperature.

Characterisation of lactoferrin CS/SBE-β-CD NPs

Results
Phase diagram of nanoparticle’s formation and physicochemical characterization
Phase diagram reveals that only CS/SBE-β-CD specific ratios lead to nanoparticle’s formation. The appearance of opalescence was used as an indicator of nanoparticle formation, also confirmed by Dynamic Light Scattering (DLS).

Morphological characterisation of nanoparticles
Scanning electron microscopy (SEM)
Transmission electron microscopy (TEM)

Long-term stability to storage study
Lactoferrin-loaded CS/SBE-β-CD nanoparticles were proposed as a new ocular drug delivery system with the virtue of easy administration, prolonged drug release time, improved ocular bioavailability and reduced dosing frequency. Lactoferrin CS/SBE-β-CD nanoparticles show considerable potential as hydrophilic drug carrier and have the capacity to deliver drugs to specific target sites, possibly revolutionizing the Keratoconus therapy.

Conclusion
Lactoferrin-loaded CS/SBE-β-CD nanoparticles were prepared as a new ocular drug delivery system with the virtue of easy administration, prolonged drug release time, improved ocular bioavailability and reduced dosing frequency. Lactoferrin CS/SBE-β-CD nanoparticles show considerable potential as hydrophilic drug carrier and have the capacity to deliver drugs to specific target sites, possibly revolutionizing the Keratoconus therapy.

References