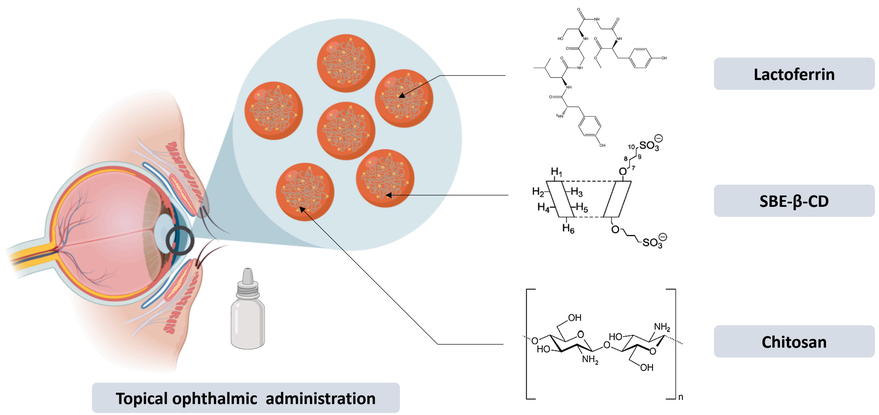
Design, preparation and characterization of lactoferrin-loaded sulfobutylether-β-cyclodextrin/chitosan nanoparticles as a therapeutic alternative for keratoconus treatment

R. Varela-Fernández[1,2], X. García-Otero[1], M. I. Lema-Gesto[2], M. González-Barcia[3], and F. J. Otero-Espinar[1]

1. Department of Pharmacology, Pharmacy and Pharmaceutical Technology. University of Santiago de Compostela (USC). Campus vida. Santiago de Compostela. Zip Code: 15782. Spain. francisco.otero@usc.es.
2. Clinical Neurosciences Group. University Clinical Hospital, Health Research Institute of Santiago de Compostela (IDIS). Travesía da Choupana s/n Santiago de Compostela. Zip Code: 15706. Spain. mariaisabel.lema@usc.es.
3. Molecular Imaging Group. University Clinical Hospital, Health Research Institute of Santiago de Compostela (IDIS). Travesía da Choupana s/n Santiago de Compostela. Zip Code: 15706. Spain.
4. Clinical Pharmacology Group. University Clinical Hospital, Health Research Institute of Santiago de Compostela (IDIS). Travesía da Choupana s/n Santiago de Compostela. Zip Code: 15706. Spain. miguel.gonzalez.barcia@sergas.es.

Introduction and objectives

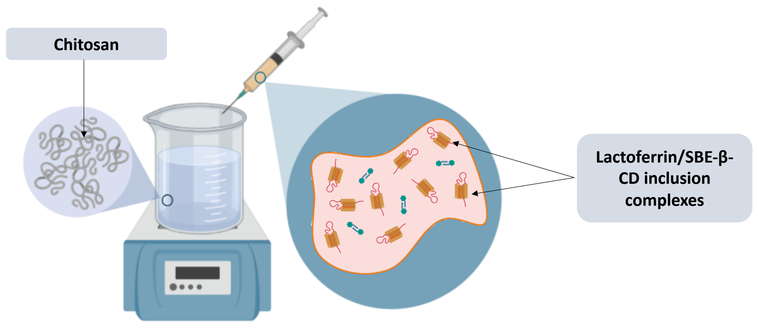
Lactoferrin has shown potential as a good therapeutic alternative in the treatment of Keratoconus [1]. Chitosan/Cyclodextrin nanoparticles as novel drug delivery systems (DDS) could successfully encapsulate hydrophobic drugs [2]. The aim of this work was based on the design, preparation, and characterization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



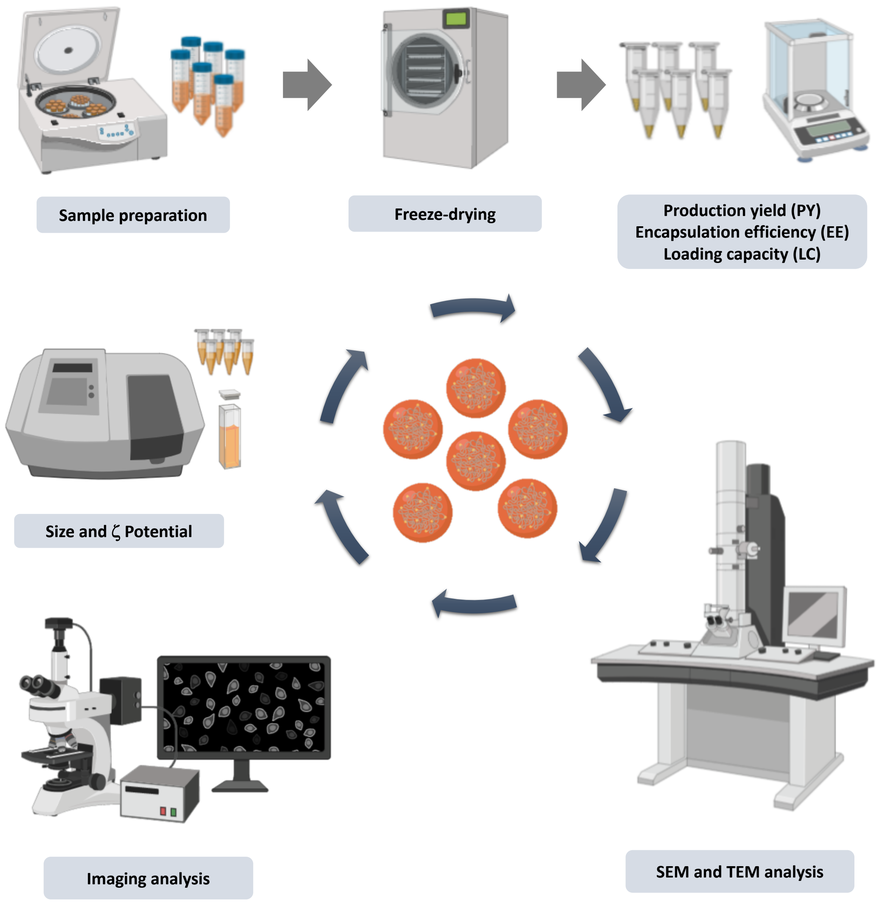
Methodology

Preparation of lactoferrin CS/SBE-β-CD NPs

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

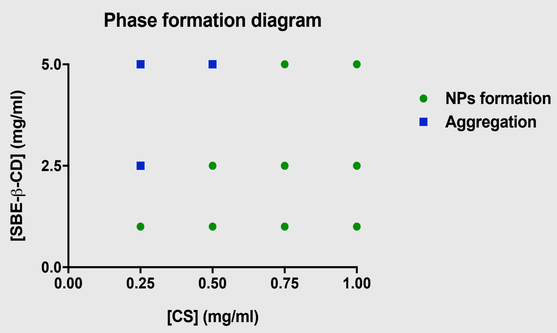


Characterisation of lactoferrin CS/SBE-β-CD NPs



Results

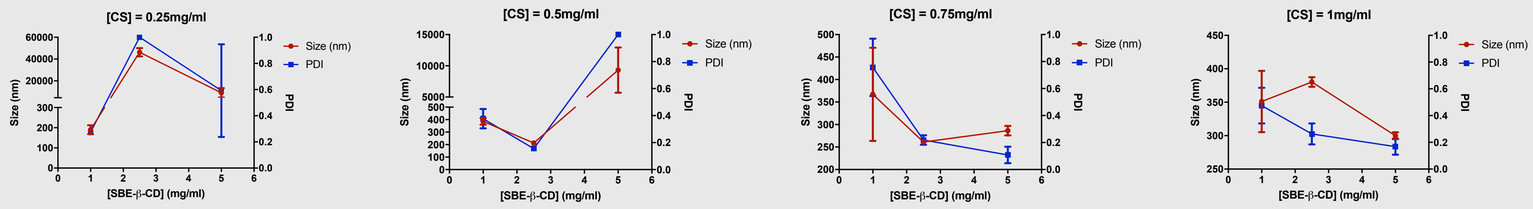
Phase diagram of nanoparticle's formation and physicochemical characterization



Phase diagram formation for lactoferrin-loaded CS/SBE-β-CD nanoparticle's formation.

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).

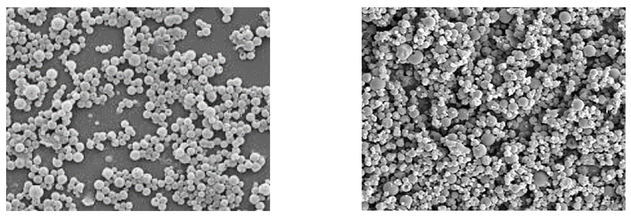
Low amounts of initial CS/SBE-β-CD give rise to no nanoparticle's formation, while precipitation occurred when high amounts of initial compounds were used.



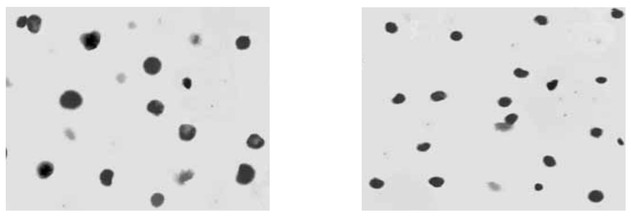
Changes in size and PDI values during the optimization procedure of CS/SBE-β-CD nanoparticles.

Morphological characterisation of nanoparticles

Scanning Electron Microscopy (SEM)



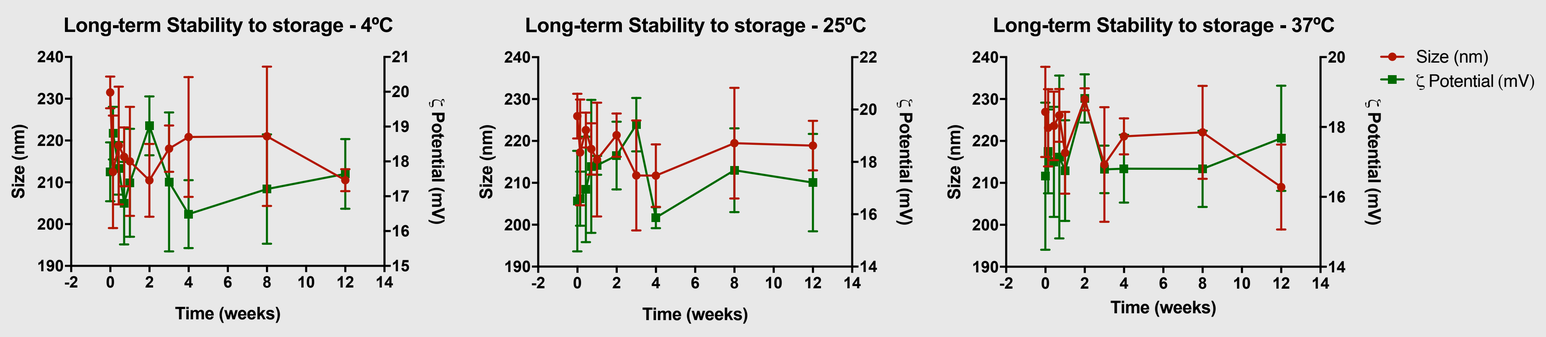
Transmission Electron Microscopy (TEM)



Scanning electron micrographs show that **lactoferrin-loaded CS/SBE-β-CD nanoparticles were predominantly spherical in shape**.

Transmission electron microscopy images indicate that **these nanosystems may have an irregular surface.**

Long-term stability to storage study



Conclusion

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.

Bibliography

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[2] Jingou J, Shilei H, Weiqi L, Danjun W, Tengfei W, Yi X. Preparation, characterization of hydrophilic and hydrophobic drug in combine loaded chitosan/cyclodextrin nanoparticles and in vitro release study. Colloids Surf B Biointerfaces. 2011;83(1):103-7.