

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

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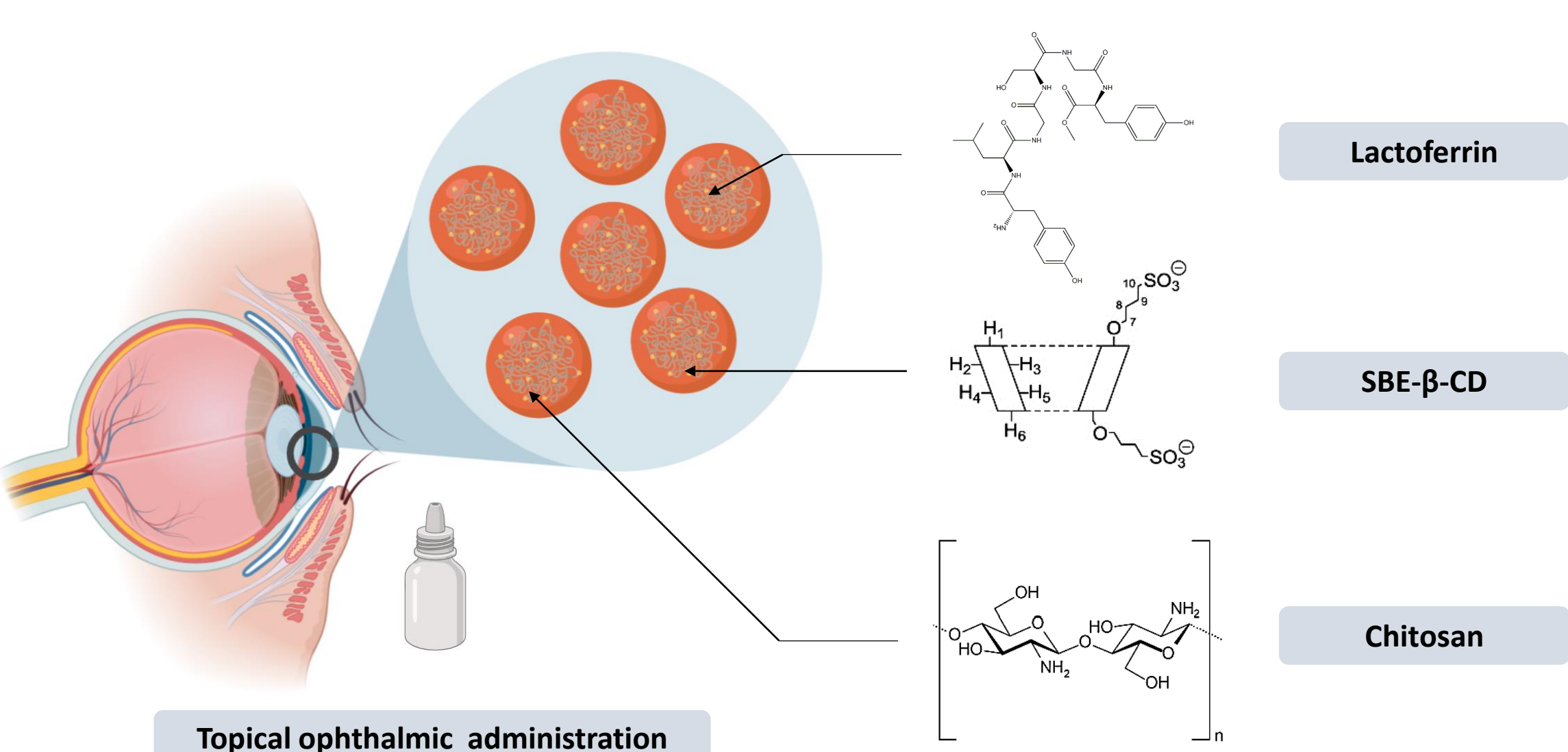
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Introduction and objectives

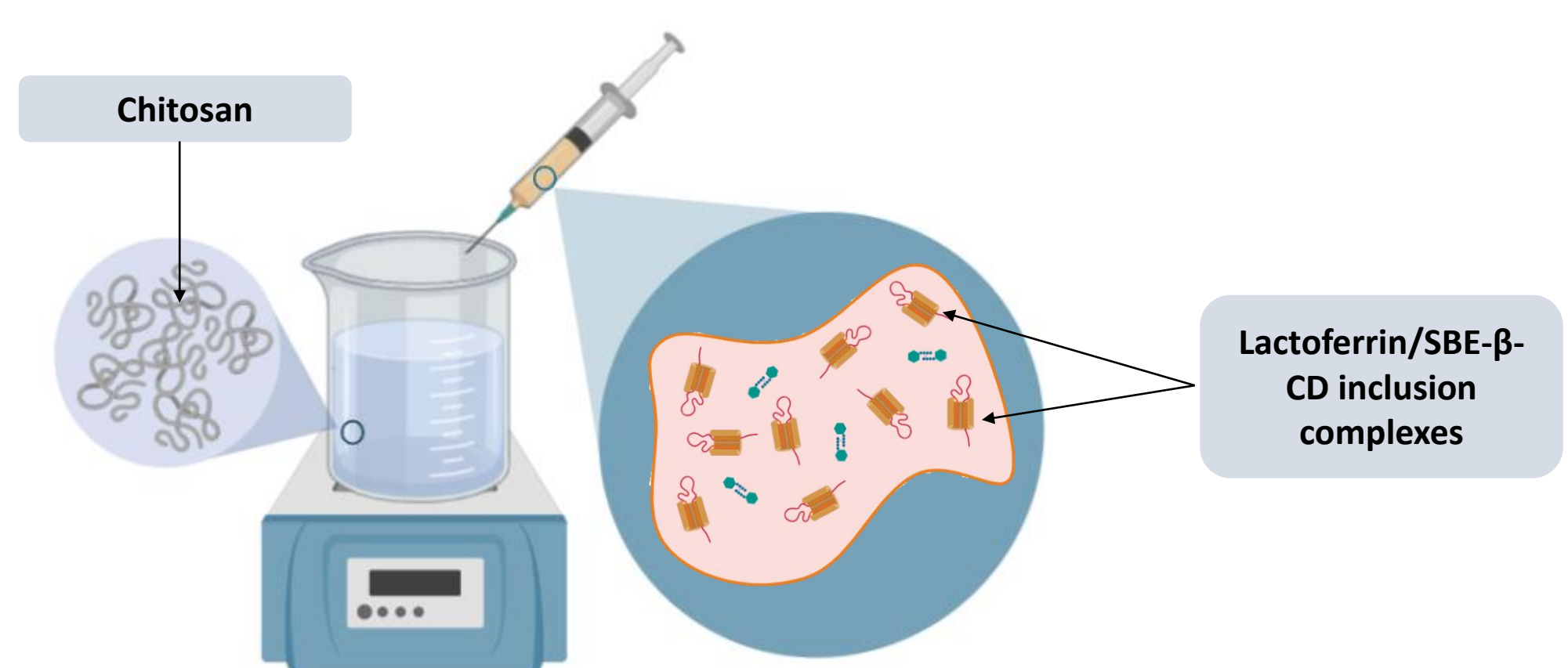
Lactoferrin has shown potential as a good therapeutic alternative in the treatment of Keratoconus [1]. Chitosan/Cyclodextrin nanoparticles as novel drug delivery systems (DDS) could successfully encapsulate hydrophobic drugs [2]. The aim of this work was based on the design, preparation, and characterization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



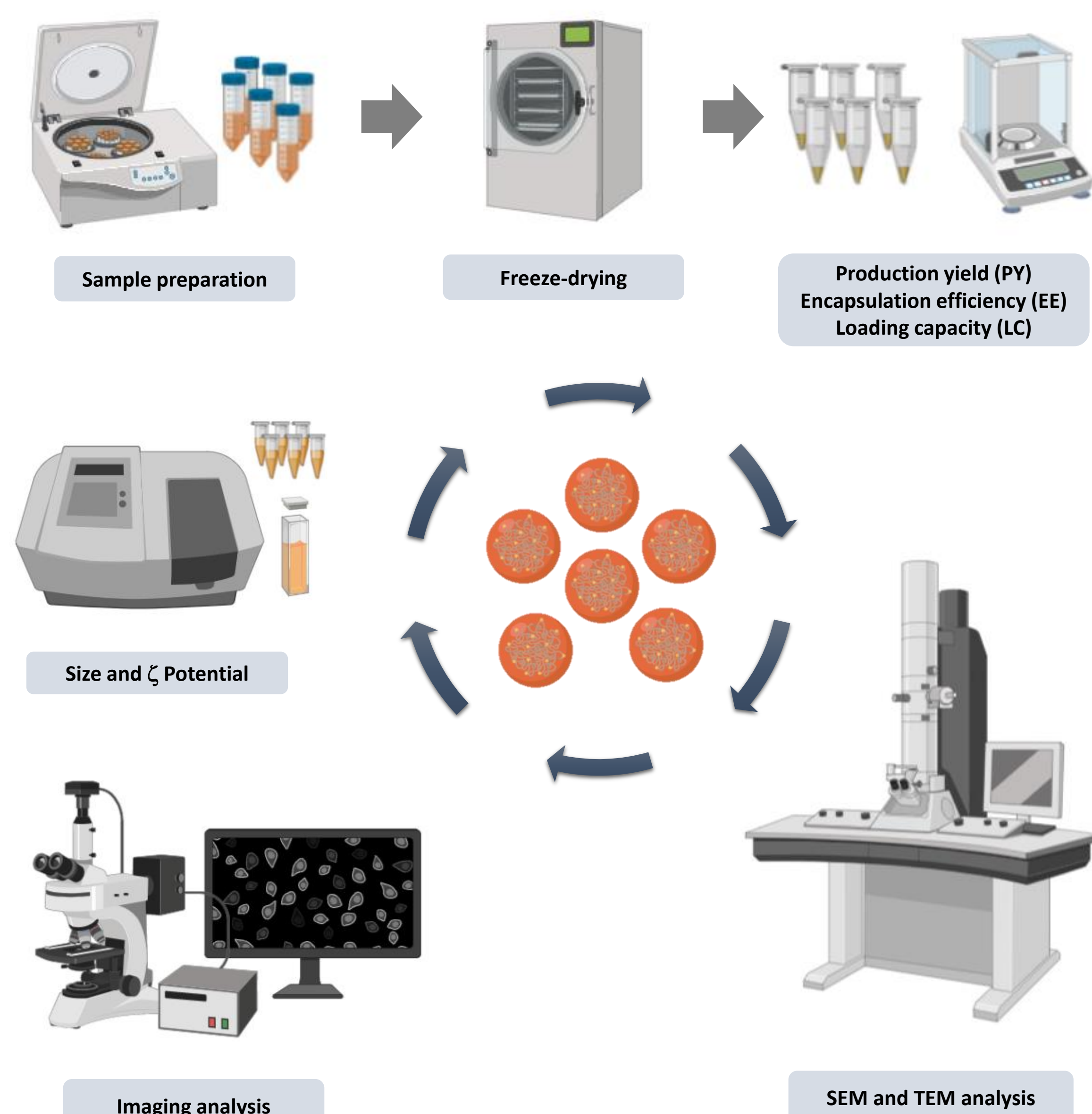
Methodology

Preparation of lactoferrin CS/SBE- β -CD NPs

Nanoparticles were spontaneously obtained via **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.

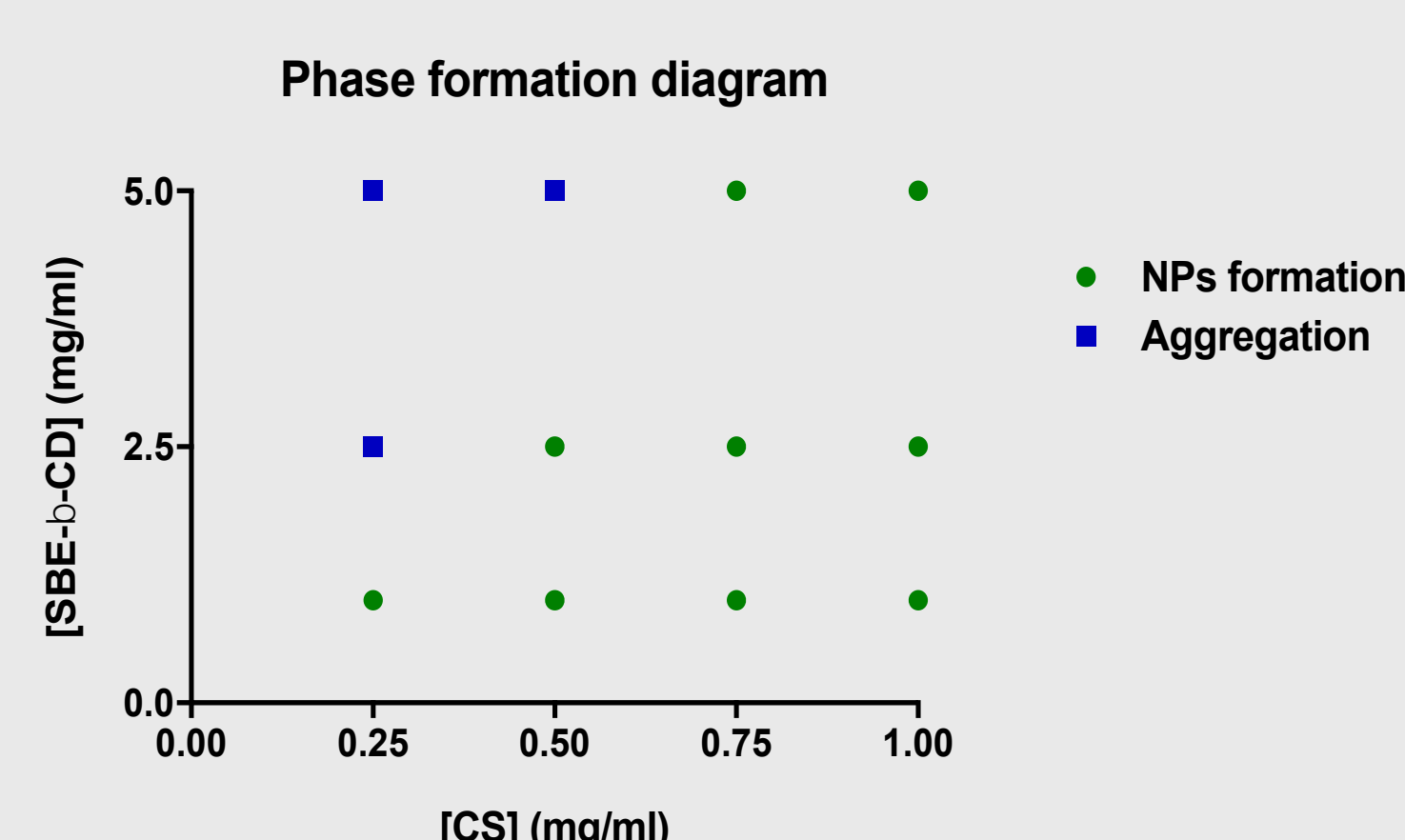


Characterisation of lactoferrin CS/SBE- β -CD NPs



Results

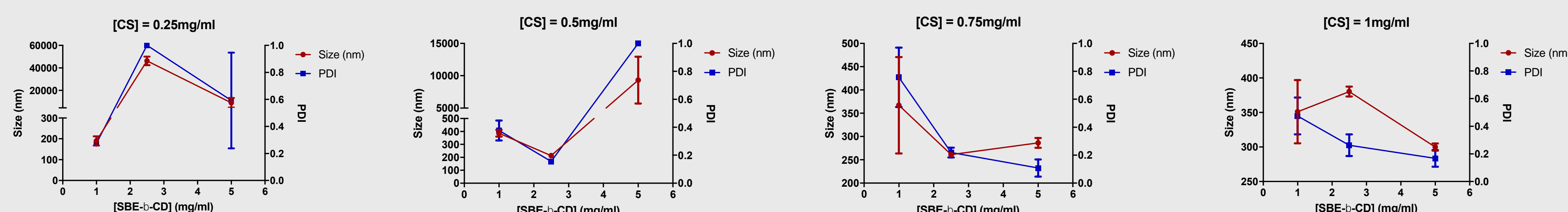
Phase diagram of nanoparticle's formation and physicochemical characterization



Phase diagram 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.

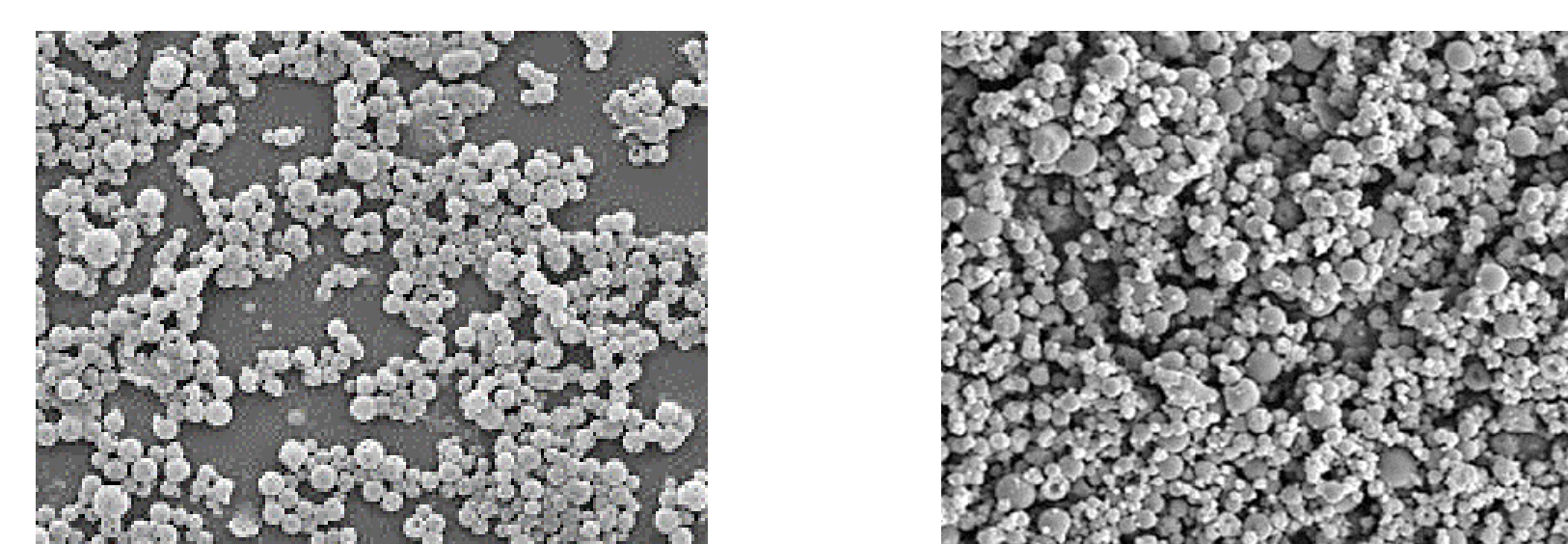
Phase diagram formation for lactoferrin-loaded CS/SBE- β -CD nanoparticle's formation.



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

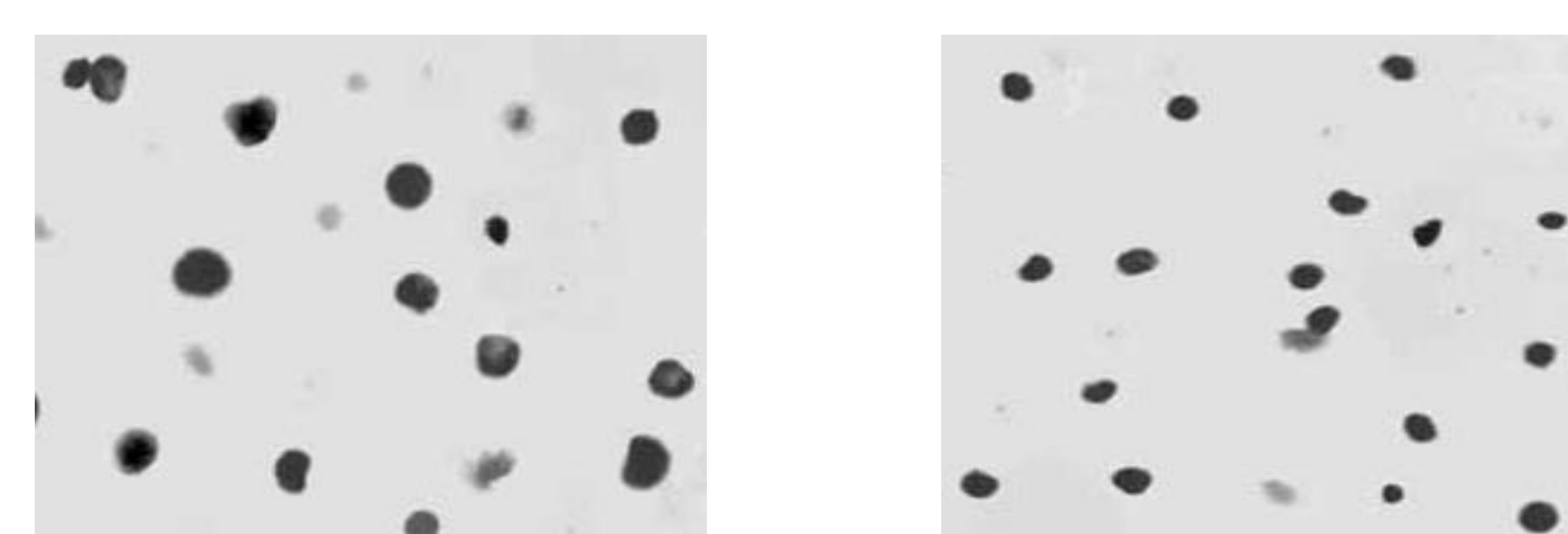
Morphological characterisation of nanoparticles

Scanning Electron Microscopy (SEM)



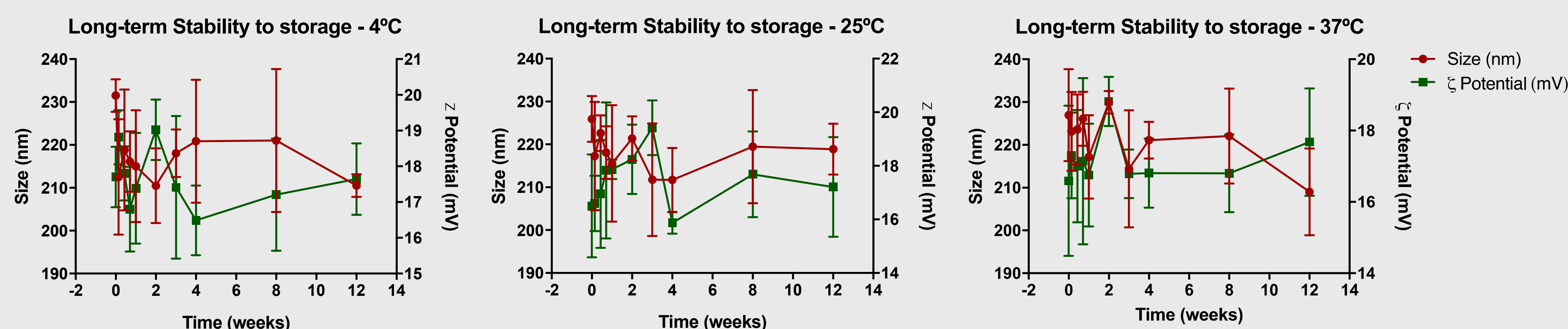
Scanning electron micrographs show that **lactoferrin-loaded CS/SBE- β -CD nanoparticles were predominantly spherical in shape**.

Transmission Electron Microscopy (TEM)



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

- [1] Mas Tur V, MacGregor C, Jayaswal R, O'Brart D, Maycock N. A review of keratoconus: Diagnosis, pathophysiology, and genetics. *Surv Ophthalmol*. 2017 Dec;62(6):770-83.
[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.