Effect of sterilization on chlorhexidine loaded soft contact lenses

Ana Topete[1,*], *Guilhermina M. Moutinho*[2], *Benilde Saramago*[1], *Ana Paula Serro*[1,2]

1. Centro de Química Estrutural, Instituto Superior Técnico, University of Lisbon, Lisbon, Portugal
2. Centro de Investigação Interdisciplinar Egas Moniz, Instituto Superior de Ciências da Saúde Egas Moniz, Monte da Caparica, Portugal
*anatopete@tecnico.ulisboa.pt

Introduction

The most prevalent disorders in the anterior segment of the eye (keratitis, conjunctivitis and post-surgery inflammations) are commonly treated with eye drops, which are extremely inefficient (bioavailability lower than 7%).

Drug-loaded soft contact lenses (SCLs) seem to be a promising drug delivery system to overcome these problems.

Microbiological safety requirements imply the use of a **terminal sterilization method** in the final product.

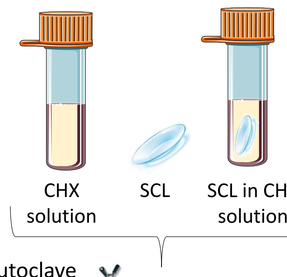
It is important to understand the **effect of sterilization procedures** on the eventual loss of activity or degradation of the drugs, changes in the intrinsic properties of SCLs and in the drug release behavior.

In this work, commercial silicone-based SCLs were loaded with **chlorhexidine** (antibacterial agent) and it is investigated the effect of two different methods of terminal sterilization, **gamma-ray irradiation** and **steam autoclaving**.

Methods

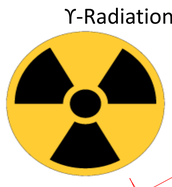
Materials:

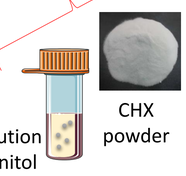
- Chlorhexidine (CHX)
- 2 commercial silicone based SCLs (Acuvue®Oasys® and 1-Day Acuvue®TruEye®)



Sterilization methods:

- Steam by autoclaving (1 hour, 121ºC and 1 bar)
  - CHX in solution (5 mg/mL)
  - SCLs
  - CHX loaded SCLs
- Gamma (ϒ) radiation (3 radiation doses: 5, 15 and 25 kGy)
  - CHX solution (5 mg/mL) with and without mannitol at 5%, CHX in powder
  - SCLs
  - CHX loaded SCLs





Drug studies:

- HPLC
- Antimicrobial assays

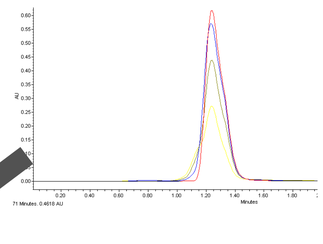
SCLs studies:

- Swelling behaviour
- Transmittance
- Wettability (captive bubble method)
- Surface morphology (SEM)

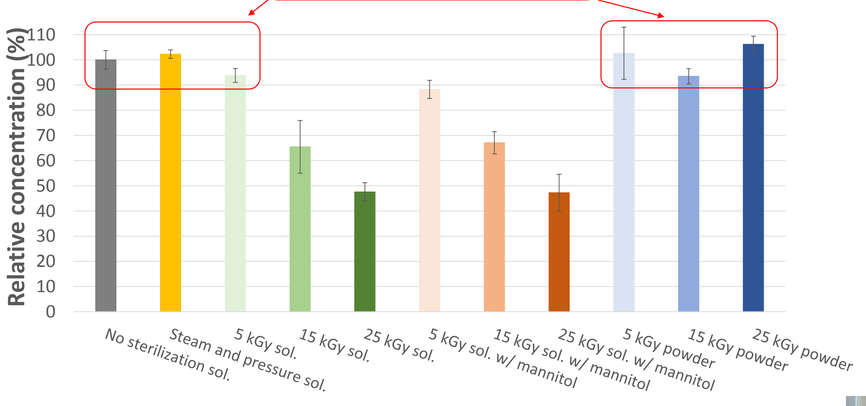
Results

Studies of CHX

HPLC

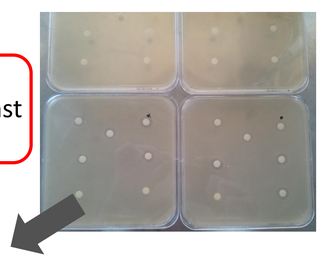


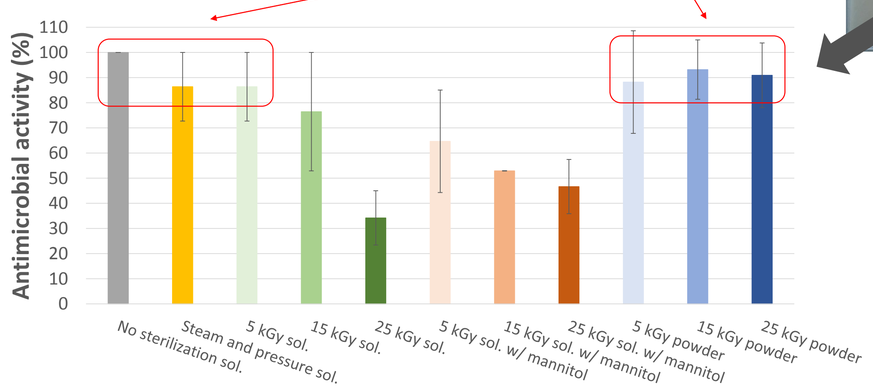
No signifficant degradation



Antimicrobial assays

No signifficant loss of antimicrobial activity against *Staphylococcus aureus*

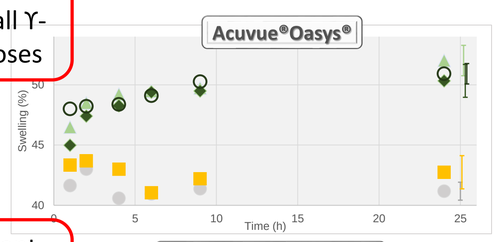




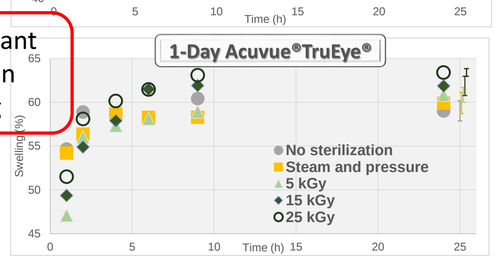
Studies of SCLs

Swelling

Increase of swelling at all ϒ-radiation doses

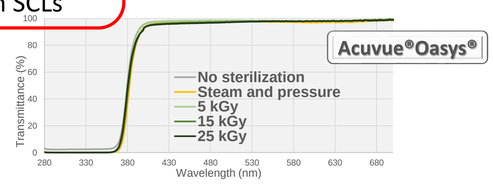


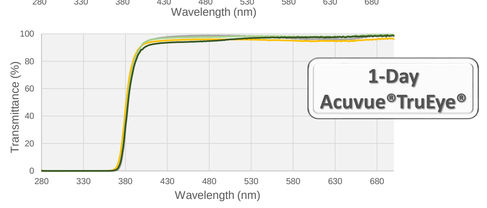
No signifficant changes in swelling



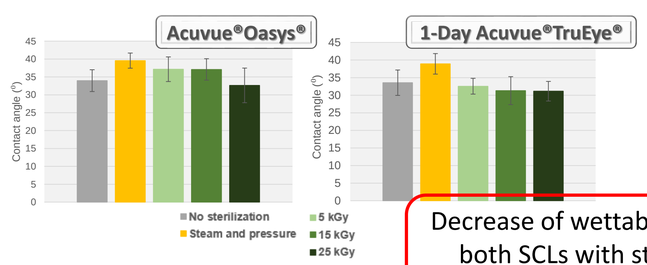
Transmittance

No signifficant changes in transmittance for both SCLs



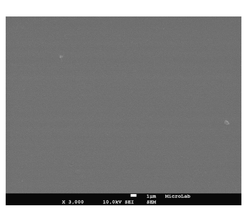


Wettability



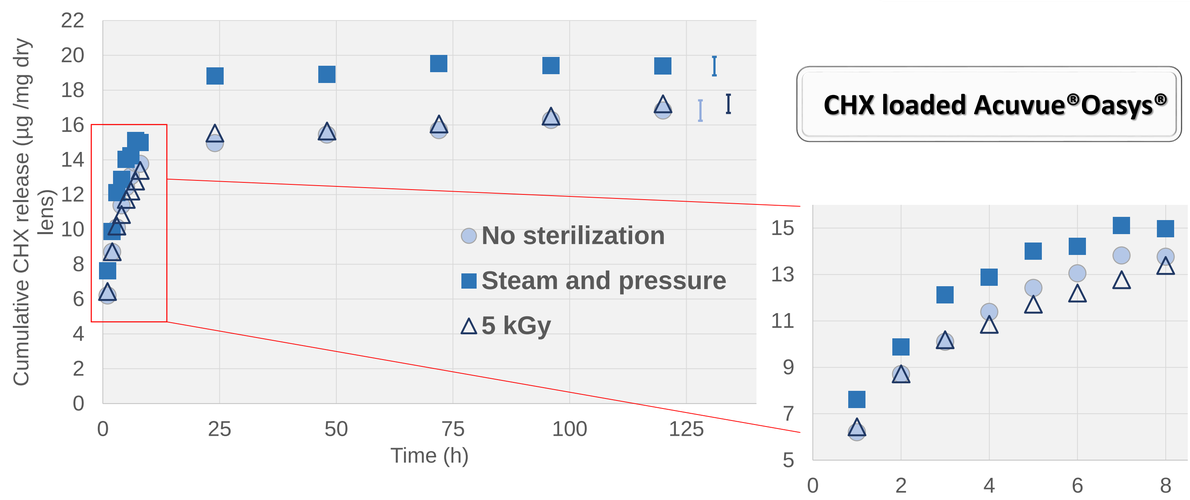
Decrease of wettability for both SCLs with steam sterilization

Morphology

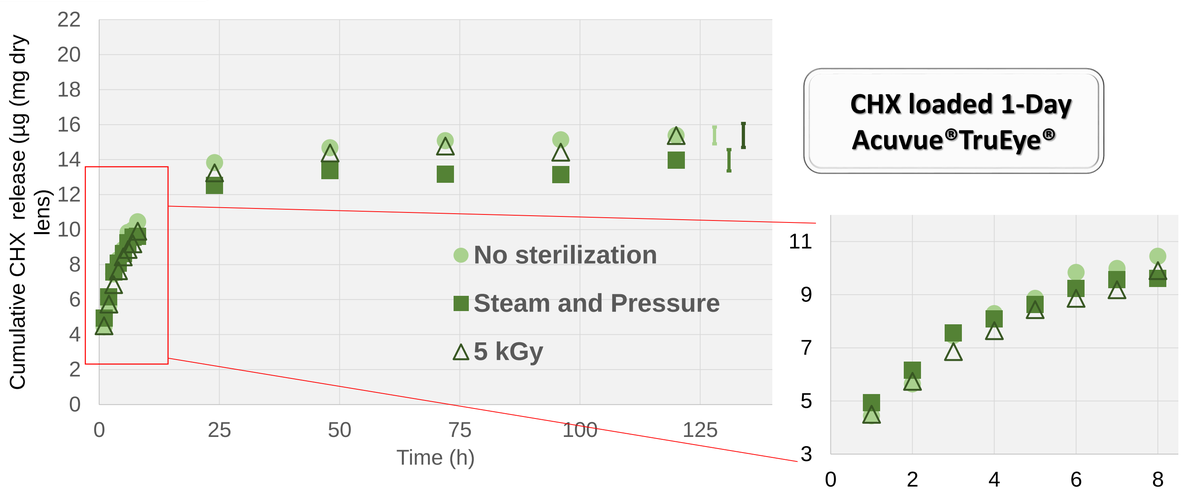


No irregularities on the surface of both SCLs at steam and 5 kGy ϒ-radiation

CHX release experiments



CHX loaded Acuvue®Oasys®



CHX loaded 1-Day Acuvue®TruEye®

Conclusions

Steam and **5 kGy gamma radiation** seem to be promising terminal sterilization methods for CHX, silicone-based SCLs and CHX-loaded SCLs. Furthermore, steam sterilization leads to a higher drug release efficiency in the case of Acuvue®Oasys®.

Acknowledgments

To Fundação para a Ciência e a Tecnologia for funding through projects UID/QUI/00100/2013 and M-ERA.NET/0005/2012 and to Eng. Paula Matos from CTN for the gamma irradiation.