# Effect of sterilization on drugs and lenses for ophthalmic applications


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## INTRODUCTION

The most dramatic complication of **intraocular lenses (IOLs)** implantation is endophthalmitis, an infection caused by bacteria that may occur in the post-surgical period. The use of **drug-loaded IOLs** to prevent this problem has been regarded with great interest. **Drug-loaded soft contact lenses (SCLs)** also seem to constitute a promising vehicle for drug delivery that can be used in the treatment of a vast number of pathologies of the anterior part of the eye. However, these devices still do not exist in the market.

IOLs and SCLs sterilization is mandatory to fulfill strict microbiological safety requirements. However, the **effects of sterilization** procedures on drug-loaded hydrogels, including changes on the **intrinsic properties of the materials**, on the **drug activity** and **drug release behavior**, are mostly unknown.

This work aims to contribute for the clarification of the **effects of different methods of sterilization on drugs and lenses for ophthalmic applications.**

## METHODS

**Sterilization conditions**

| | | | Steam Pressure (60 min, 121ºC and 1 bar) | Gamma radiation (3 doses: 5, 15 and 25 kGy) |
|---|---|---|---|---|
| DRUGS | Diclofenac | | • Aqueous solution (NaCl 0.9%) | • Powder<br>• Aqueous solutions (NaCl 0.9%)<br>• Aqueous solutions (NaCl 0.9%) + 5% mannitol |
| | Ketorolac | | | |
| | Moxifloxacin | | | |
| | Levofloxacin | | | |
| LENS | SCL | Acuvue®Oasys® | • Samples in aqueous solution (NaCl 0.9%) | |
| | | 1-Day Acuvue®TruEye® | | |
| | IOL | Poly(meth)acrylic hydrogel | | |
| | | Hydrophilic acrylate (26% water uptake) | | |

**1st step** Effect of sterilization on drugs → Drug degradation (HPLC)

**2nd step** Effect of sterilization on lenses → Transmittance (UV-Vis spectroscopy); Swelling ratio (36ºC); Wettability (captive bubble method)

## RESULTS

### 1. Effect of sterilization on the drugs

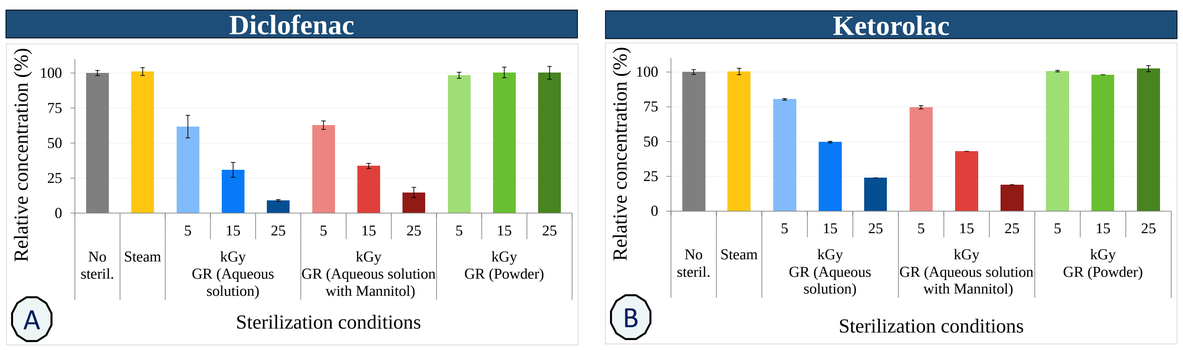


**Figure 1.** Relative concentration of Diclofenac (A), Ketorolac (B), Moxifloxacin (C) and Levofloxacin (D), before and after sterilization, determined by HPLC.

- The drugs sterilized with **steam did not suffer degradation**.
- The **γ-radiation** led to different results **depending on the form** of presentation of the drugs:
  - **Powders did not degrade** at any dose;
  - **Mannitol at 5% did not prevent the degradation** of drugs as was suggested by the literature [1].
  - The **γ-radiation doses of 15 kGy and 25 kGy degraded all drugs**. So, these doses were abandoned.
  - At **5 kGy, the antibiotics did not present significant degradation** in solution, while the anti-inflammatories suffered degradation at both doses, being diclofenac the most affected.

### 2. Effect of sterilization on lenses

#### 2.1. Transmittance

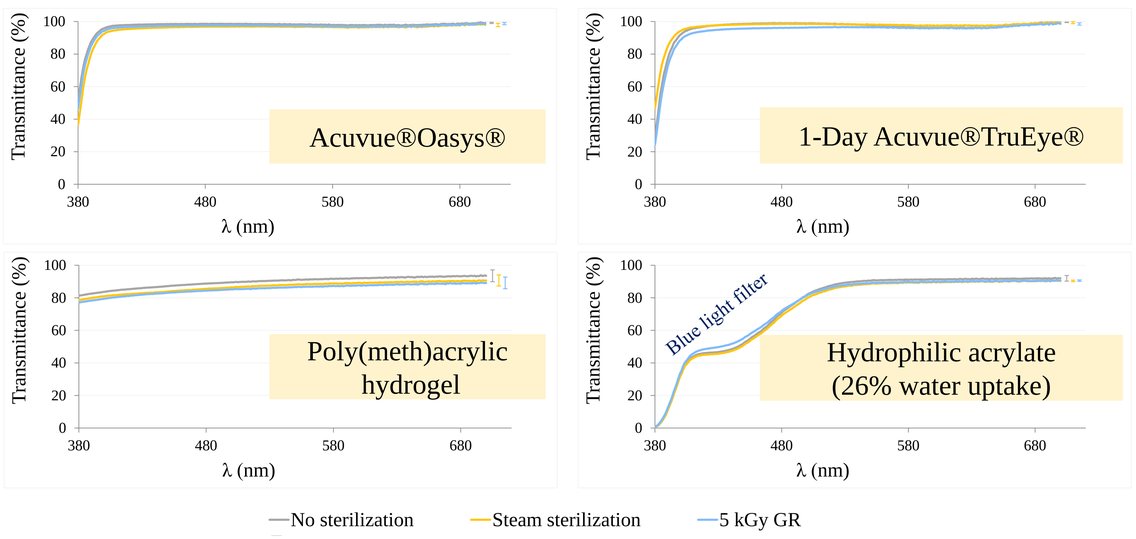


**Figure 2.** Transmittance (UV-Vis spectroscopy) before and after sterilization.

- **Steam sterilization did not affect** significantly the materials transmittance.
- **γ-radiation sterilization** led to a **small decrease** in transmittance of **poly(meth)acrylic hydrogel**.

#### 2.2. Swelling

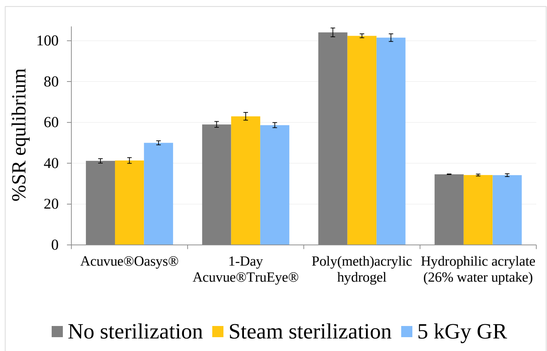


**Figure 3.** Swelling ratio at 36ºC, before and after sterilization.

- **Steam sterilization did not affect** significantly the swelling behavior of the materials.
- The **γ-radiation sterilization enhanced** the swelling behaviour of **Acuvue®Oasys®.**

#### 2.3. Wettability

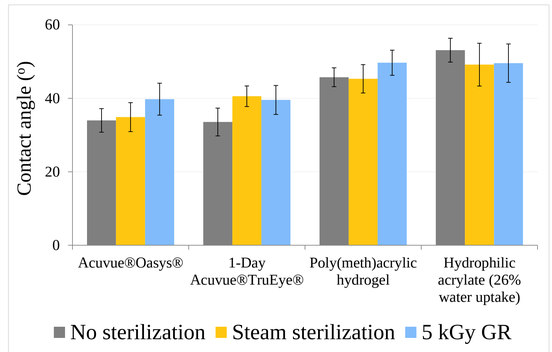


**Figure 4.** Wettability before and after sterilization.

- **Steam sterilization slightly decreased** the wettability of **both commercial SCLs** and **increased that of hydrophilic acrylate** (26% water uptake).
- **γ-radiation sterilization decrease**d the wettability of all materials with the exception of **hydrophilic acrylate** (26% water uptake), where a slight increase was observed.

## CONCLUSIONS

**Steam** and **γ-radiation at 5 kGy** seem to be **promising methods for terminal sterilization of drugs and lenses**. Next stage of this work is to study the drug release behavior before and after sterilization.

## REFERENCES


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