



Stability Testing of Low-Concentration Atropine Formulations for Ophthalmic Use

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Background and importance

Myopia causes blurred distance vision due to improper image focus. Low-dose atropine 0.1–0.5 mg/ml is widely used to prevent myopia progression in children with minimal side effects [1,2]. In Estonia, only 1 mg/ml drops are available, which must be diluted. This limits the shelf life to 7 days. A stability study was conducted to extend usability.

Aim and objectives

The aim of the study was to evaluate the physicochemical and microbiological stability of 0.1 mg/ml atropine eye drops prepared extemporaneously in a hospital pharmacy. The study included a 14-week closed-container stability assessment and a 4-week in-use stability evaluation.

Materials and methods

- Quantification of atropine sulfate and related impurities using the HPLC method (Ph. Eur 11.0)
- Sterility testing in accordance with Ph. Eur 11.0
- Visual evaluation of solution color and clarity, along with measurements of pH and osmolality (via the freezing point depression method)

Conclusion and relevance

Hospital pharmacy-prepared atropine sulfate 0.1 mg/ml eye drops remained sterile throughout a 14-week closed-container stability study and a 4-week in-use period. Stability data from the lowest tested concentration 0.1 mg/ml support extrapolation to 0.5 mg/ml, indicating that an extended shelf life may enhance patient convenience and cost-effectiveness.

References

¹ Pineles, S.L., et al., Atropine for the Prevention of Myopia Progression in Children: A Report by the American Academy of Ophthalmology. *Ophthalmology*, 2017. 124(12): p. 1857-1866

² Yam, J.C., et al., Low-Concentration Atropine for Myopia Progression (LAMP) Study: A Randomized, Double-Blinded, Placebo-Controlled Trial of 0.05%, 0.025%, and 0.01% Atropine Eye Drops in Myopia Control. *Ophthalmology*, 2019. 126(1): p. 113-124.

Results

Atropine sulfate 0.1 mg/ml eye drops remained sterile throughout both the 14-week stability study and the 4-week in-use study;

Table 1: Average Concentration of Atropine Sulfate (mg /ml)

Batch	4-week in use study		14-week stability study	
	Day 0	Day 28	Day 0	Day 98
I	0.102 ± 0.0013	0.098 ± 0.0009	0.101 ± 0.0002	0.105 ± 0.0033
II	0.102 ± 0.0006	0.098 ± 0.0008	0.101 ± 0.004	0.105 ± 0.0014

Table 2: Average pH of Atropine Sulfate Eye Drops During Stability Studies

Batch	4-week in use study		14-week stability study	
	Day 0	Day 28	Day 0	Day 98
I	5.44 ± 0.025	5.20 ± 0.010	5.47 ± 0.199	5.14 ± 0.038
II	5.38 ± 0.020	5.17 ± 0.021	5.57 ± 0.060	5.16 ± 0.012

Table 3: Average Osmolality of Atropine Sulfate Eye Drops (mosm/kgH₂O)

Batch	4-week in use study		14-week stability study	
	Day 0	Day 28	Day 0	Day 98
I	288 ± 0.00	287 ± 1.41	290 ± 0.00	291 ± 1.41
II	289 ± 1.41	289.5 ± 0.71	289 ± 2.83	289 ± 1.41

