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Design and optimization of dexamethasone containing *in situ* gelling mucoadhesive eye drops

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Eye drops are commonly used for the treatment of ocular diseases. The complex elimination mechanisms of the eye cause poor bioavailability of this route of administration. Dexamethasone is frequently used to treat non-infectious inflammatory ocular diseases. The low water-solubility and penetration ability of dexamethasone decrease its biological effectiveness. My PhD work aims to formulate in situ gel-forming mucoadhesive eye drops containing dexamethasone-cyclodextrin inclusion complex to improve the residence time and solubility of the active pharmaceutical ingredient.

During the preformulation studies, optimal cyclodextrin type and concentration were chosen based on the results of phase solubility tests and the stability constants of the complexes.

Poloxamer was used to form thermosensitive in situ gelling eye drops. To provide proper mucoadhesivity, two mucoadhesive polymers were combined with it. Rheological studies were carried out in order to investigate the gelation: gelation temperature, gelling time at body temperature and gel strength were measured. Mucoadhesivity of the eye drops were examined with a texture analyzer. A mucin covered surface was used to imitate the surface of the eye. Adhesive force and adhesive work were determined based on the force-distance curve.

The preliminary experiments helped to choose the optimal concentration range of the components to form mucoadhesive in situ gelling eye drops. 33 full factorial design was applied to evaluate the effect of the composition on the gelation and the mucoadhesivity.

The purpose of the factorial design is to find the ideal composition and to explore the correlation between the composition and the dissolution.