# Preparation and characterization of NLC as ocular flurbiprofen delivery system

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## Introduction

The use of colloidal drug delivery systems, such as nanostructured lipid carriers (NLC), is considered nowadays a strategy to enhance the ocular bioavailability of topically administered drugs. NLC is a new generation of solid lipid carriers which overcome several limitations of others, due to their biocompatibility of lipid materials, modified release, avoidance of organic solvents during the production process and easy large scale production.
The main goal of this research was the development of nanoestructured lipid carriers loading flurbiprofen (FB) in order to improve the bioavailability of this drug used for the prevention of the inflammation caused by ocular surgery.

## Materials and Methods

FB and Tween® 80 (polyoxyethylene sorbitan monooleate) were purchased from Sigma Aldrich (St. Louis, MO), and Stearic acid (SA) from Merck-Schuchardt. Castor Oil was donated from Henry Lamotte GmbH, Germany. Double-distilled water was used after filtration in a Millipore® system.

Developed NLC formulations:
*Lipid screening* was performed to select the solid lipid and liquid lipid (oil) suitable to prepare FB-loaded NLC based on the required concentration (3% of FB with regard to the lipid matrix).
The presence of drug crystals was assessed by polarized light microscopy.
*Selection of solid lipid/liquid lipid ratio* was performed by differential scanning calorimetry (Mettler DSC 823e, Mettler Toledo, Switzerland), heating above the melting point of solid lipid and cooling down to the room temperature for 24 h.
*FB-loaded NLC* was produced by HPH (Microfluidizer, Microfluidics, Germany). Briefly, the lipid phase was melted in a water bath at 85ºC. The hot lipid phase was added to an aqueous solution of 1.6% Tween 80 heated at the same temperature and an emulsion was produced using an Ultra-Turrax T25 (IKA, Germany). This emulsion further processed by HPH. Morphometrical properties (average particle size, polydispersity index) and zeta potential (ZP) were assessed with a Malvern Zetasizer nano ZS; lipid crystallinity and polymorphism was performed by DSC, to optimise the formulation composition and the storage conditions.

## Results and Discussion

From the results obtained after the solubility screening tests, one solid lipid (stearic acid) and one liquid lipid (castor oil) were chosen to prepare FB-loaded NLC. Under DSC analysis of the solid (SL) and liquid (LL) lipid mixtures, the 80:20 and 60:40 SL:LL (w/w) ratios were selected.
Stability of FB-loaded NLC was dependent on the castor oil content and on the storage conditions. The obtained results suggest that the addition of oil to the formulation was favored to form more stable FB-NLC with more homogeneous size distributions due to the size reduction, suitable for ocular administration, and could also increase the loading capacity of NLC. Additionally, after 30 days of storage under cold conditions (4ºC) increased the stability of these colloidal dispersions remaining in the nanosize range.

## Acknowledgement

This work has been supported by DGI (CTQ2005 09063-C03-03/PPQ).

## References

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