# High shear microfluidic rheometer
# Rheology optimization of ophthalmic eye drops

**Roland Ramsch, Hubert Ranchon, Thanina Amiar, Giovanni Brambilla, Gérard Meunier**

*Formulaction, SAS, 3-5 rue Paule Raymondis, 31200 Toulouse, France*

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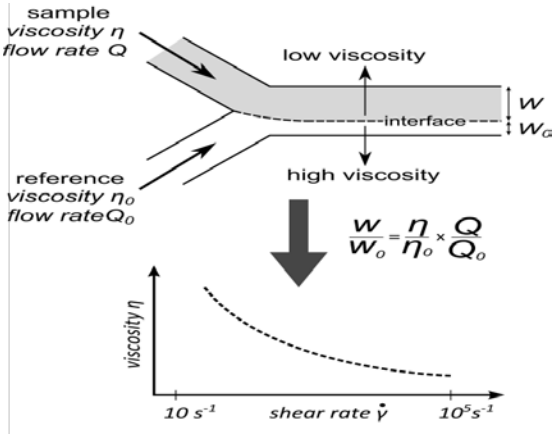
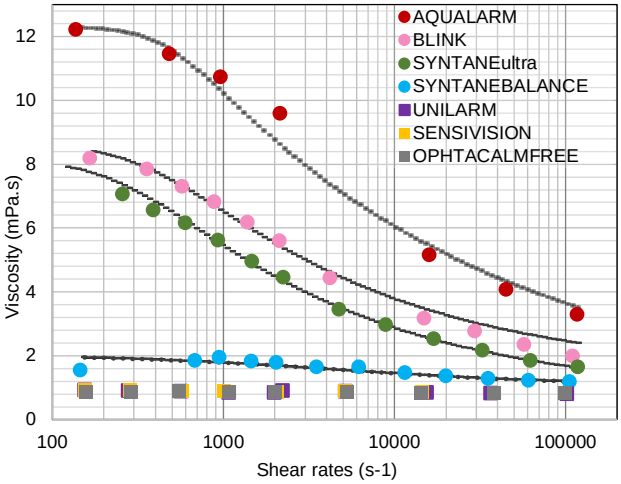
## Abstract

Topical application represents the main route of drug administration for eye disorders. It is recognized that the ophthalmic formulations efficiency relies on their rheology. blinking phenomena submits eyedrop to high shear rate ranges estimated between 4,000 $s^{-1}$ and 30,000 $s^{-1}$ according to literature. Formulations must be carefully optimized to respect patient compliance and the adequate retention time.

Fluidicam$^{RHEO}$, a microfluidic based instrument, allows viscosity measurement as a function of shear rate (up to $10^5$ $s^{-1}$) in a single experiment set-up. During the measurement, a sample and a viscosity standard are pushed together through a microfluidic chip (Y-junction) at controlled flow rates. Images of the resulting laminar co-flow are acquired by a camera used to measure the interface position. The latter is related to the ratio of flow rates between the sample and the reference allowing to determine the viscosity. In this work different formulations of eye drops were analyzed with Fluidicam$^{RHEO}$ over shear rates ranging from 150 – 180 000 $s^{-1}$ at 34 °C (corneal surface temperature) in order to identify their rheological behavior.




Depending on the formulation application, the physical properties and the rheological behaviour vary. Newtonian formulations (purple, grey and yellow squares) are used for cleaning reasons with viscosity values around tears viscosities, providing a short retention time to clean the corneal surface.
Whereas Non-Newtonian formulations (red, pink, green and blue dots) can reach high viscosities at low shear rates providing a higher retention time for therapeutic treatment and comfort at higher shear rate thanks to the shear thinning profile.




FLUIDICAM$^{RHEO}$ allows accurate viscosity measurement at shear rate representative of the blinking stress. Thus, the instrument provides relevant information required to formulate eyedrop with optimum physical properties. The use of microfluidic device allows precise viscosity characterization with minimum sample requirements and in a short amount of time.

## References.

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