

High shear microfluidic rheometer

- Rheology optimization of ophthalmic eye drops -



Introduction

Topical application represents the main route for administration of drugs to treat eye disorders. It is widely recognized that efficiency of ophthalmic formulations highly relies on their rheology. As blinking phenomena submits eyelid to a wide range of shear rates, the rheology of formulations must be carefully optimized. Its full knowledge allows for residence time to be increased while keeping a maximal patient compliance.

KEY BENEFITS

- HIGH SHEAR RATE
- FAST ANALYSIS
- SMALL SAMPLE VOLUME



According to literature the shear rates during blinking are estimated between $4000s^{-1}$ and $30\,000s^{-1}$.

Viscosity measurement using conventional rheometers remains challenging regarding the low viscosity of the eye drops solutions. The microfluidic system of Fluidicam^{RHEO} allows accurate characterization of viscosity among representative shear values, in one single experiment.

Reminder of the technique

Fluidicam^{RHEO} uses a co-flow microfluidic principle to measure viscosity. The sample and a reference solution are simultaneously introduced into the microfluidic channel (typically 2.2mm X 150 μ m) with controlled flow rates. This results in a laminar flow where the interface position between sample and reference relates the viscosity ratio and flow rates.

Images acquired during the measurement allow the software to calculate the position of the interface and directly plot an interactive flow curve.

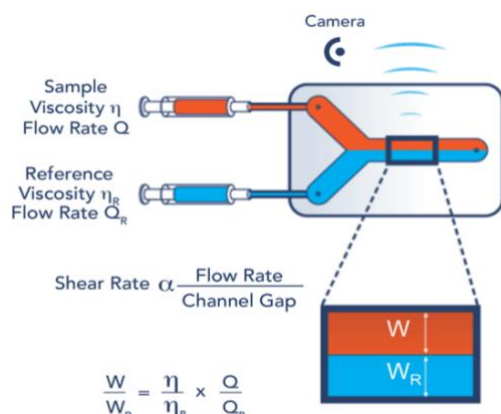
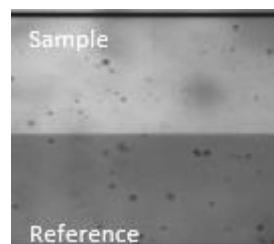


Figure 1: Fluidicam measuring principle



Method

A variety of commercialized eye drops formulations listed in the table (1) were analyzed with Fluidicam^{RHEO} over a large range of shear rates at 34°C, temperature of the corneal surface.

Shear rates from $150s^{-1}$ to $100\,000s^{-1}$ were applied using two microfluidic chips with 150 μ m and 50 μ m channel gap.