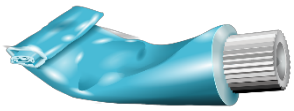
Low volume characterization of pharmaceutical gels

-Dermal and injectable samples-

PHARMACEUTICAL

Introduction

Determination of viscosity of gel product using conventional methods may be a challenging task. Air bubbles are often immobilized in the structure and a large quantity of sample may be required. In pharmaceuticals, products may contain active ingredients increasing product value therefore volume for analysis needs to be kept low.



Fluidicam^{RHEO} offers a rapid method to precisely characterize gels by using a very small amount of sample with no problems caused by air bubbles.

KEY BENEFITS

- LOW CONSUMPTION
- QUICK & SIMPLE
- VISUAL METHOD

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 150µm) with controlled flow rates. This results in a laminar flow where the interface position between sample and reference solution relates the viscosity ratio and flow rates.

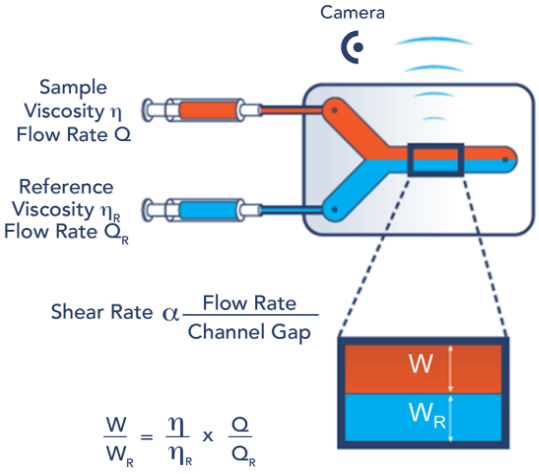
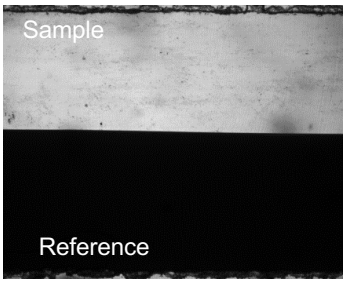


Fig. 1: Fluidicam measuring principle

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



Method

All tests were carried out using aqueous reference solutions (supplied by Formulaction). Gels were carefully loaded into a syringe and analyzed using following parameters:

Sample	Shear rate (s^{-1})	Chip	Temp (°C)
Injectable HEC gel	1 500 - 80 000	150 & 50µm	37°C
Psoriasis gel	50 - 2 500	150µm	25°C
Arnica gel	50 - 2 500	150µm	25°C

The injectable HEC gel was characterized over a wide range at 37°C to mimic body temperature and high shear on injecting. The psoriasis and arnica gels were measured at lower shear rate to mimic rubbing on the skin at 25°C.

Results

Full characterization of injectable HEC Hydrogel

The flow curve blow shows the characterization of the HEC hydrogel over a range of 1500-80,000s^{-1}. The lower shear rates were measured using the 150µm chip and the higher shear rates with the 50µm chip.

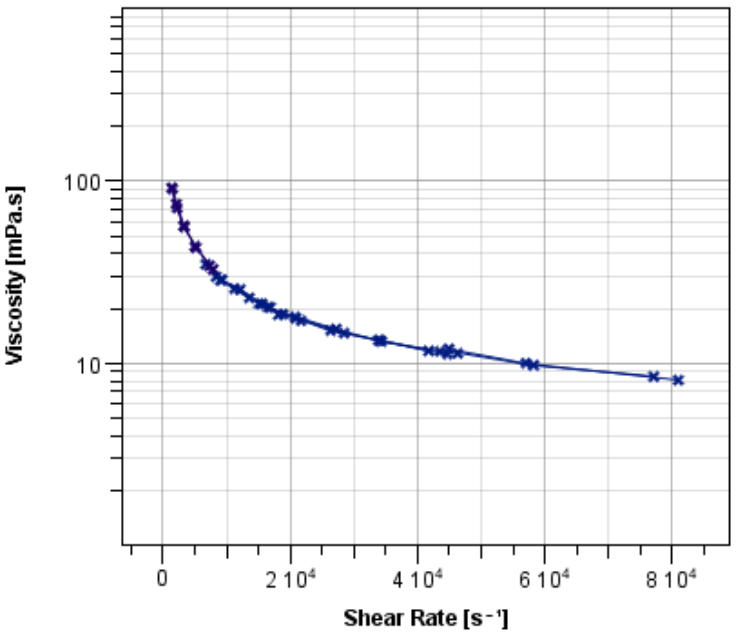


Fig 2. Flow curve for HEC injectable gel at 37°C.

The hydrogel is highly shear thinning which is a critical property for injectable samples in order to reduce possible injection pain. The viscosity ranges from approximately 100mPa.s at low shear to below 10mPa.s at high shear.

Fluidicam^{RHEO} can be used quickly and easily to cover this whole range of shear rates in just **10 minutes** using only 5ml of sample in this test.

Characterization with low consumption

Figure 3 shows results for 2 different pharmaceutical gels; 3 repetitions were done for each gel over a shear rate range of 50s^{-1}- 3000s^{-1}.

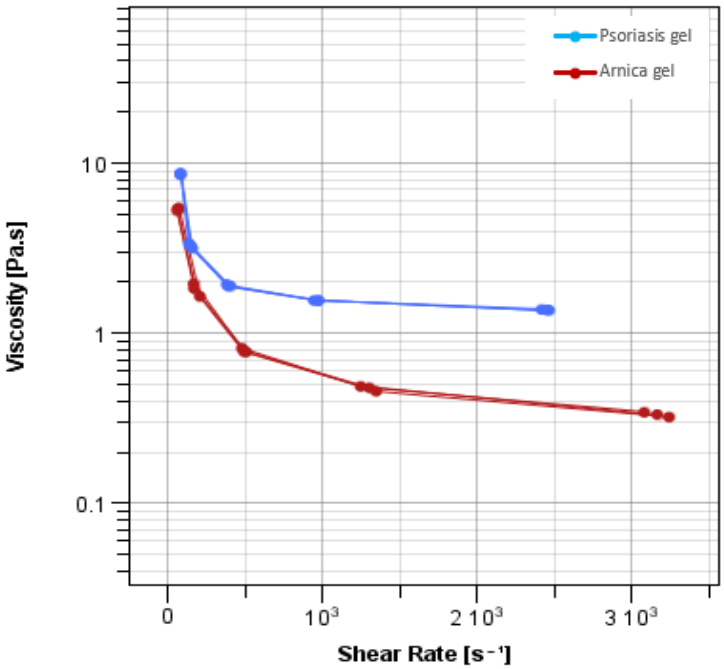


Fig 3. Flow curve for arnica gel and psoriasis gel

Both gels show clear shear thinning behaviour. Arnica gel presents more significant decrease of viscosity. At low show rate both samples have relatively close viscosity, at high sher rates Arnica gel's viscosity continues to decrease. Psoriasis gel however reaches a plateau around 1000 s^{-1}.
The table below shows the sample consumption and the time taken to do the analysis for the arnica gel and the psoriasis gel.

Sample	Sample Consumption	Time required (for 3 repetitions)
Arnica Gel	1.6ml	11 minutes
Psoriasis Gel	1.2ml	12 minutes

CONCLUSION

Fluidicam^{RHEO} can effectively characterize different gels at the actual conditions of their use. In only couple of minutes, the wide range of shear rates mimics real-life conditions providing fast and precise analysis of shear viscosity. The sample consumption is as low as **0.4ml to plot 1 flow curve.** Multiple repetitions can be done rapidly: **4 minutes to plot 1 flow curve** using a single experiment set up.