

Rotational Viscosity Testing of Personal Care Products with ViscoQC

Perfectly adjusted viscosities of personal care products are guaranteed using the ViscoQC series. From quick single point measurements to easy and fast yield point determinations of gels and lotions, ViscoQC enables high quality end products.



1 Introduction

Investigating the flow behavior of personal care products is a major step in their quality control process. Certain products like gels or lotions need to have a specific viscosity to ensure smooth application and to meet customer expectations. A parameter of special interest is the yield stress, which defines the force needed at which a material starts to flow. It has an influence on how materials can be processed e.g. the pumping and mixing speed. Furthermore, it plays an important role during application of the end product e.g. squeeze lotions, gels or toothpastes out of the tube; or when applying lotions to the skin or when styling your hair with gel. A well-adjusted yield stress ensures easy application and therefore customer satisfaction.

The rotational viscometers ViscoQC 100/300 measure the dynamic viscosity of cosmetics to ensure a high-quality product. The touch viscometer ViscoQC 300 can additionally determine the yield point with the vane technique. These fast quality checks with a digital viscometer are described in the report.

2 Experiment

The viscosities of toothpaste and hair gel were determined using ViscoQC 100 and ViscoQC 300 with T-bar and vane spindles.

T-bar and vane spindles are in use for non-flowing, highly viscous samples. Vane spindles can be also

used for samples containing particles like toothpaste with granules in comparison to T-bars.

For quick single point checks a ViscoQC 100 - R is used with the Heli-Plus accessory. The motorized stand adapter Heli-Plus creates a helical movement of the T-bar spindle in the sample and eliminates the “channeling” problem. Any other spindle which rotates at the same height would create an air channel within such a sample. This will lead to meaningless viscosity values as only part of the sample is in contact with the spindle. The Heli-Plus with T-bar spindles ensures contact to the intact sample during the whole viscosity measurement. It can be used with ViscoQC 100/300.

For yield stress determination ViscoQC 300 - R with vane spindles is the configuration of choice. ViscoQC 300 needs to be upgraded with the software package V-Curve to unlock the static yield stress method with vane spindles.

Sample	Hair gel	Toothpaste
Instrument	ViscoQC 100 - R	ViscoQC 300 - R
Measurement type	Single point	Yield stress
Spindle	T-B	V75
Accessories	Heli-Plus	V-Curve
Speeds [rpm]	10 rpm	0.1 rpm
Temperature	~23 °C	

Table 1: Configurations and measurement conditions for viscosity tests of toothpaste and hair gel.

2.1 Test Procedure and Conditions

Both, the toothpaste and the hair gel were filled into 600 mL glass beakers. The beakers were centered using the Flexible Cup Holder.

Hair gel:

- Four measurement positions for the Heli-Plus were defined prior to the measurement.
- For single point measurements by the ViscoQC 100, a speed of 10 rpm was set in the Stop at Time (@t) mode with a target time of 2 minutes.

Toothpaste:

For yield stress measurements with the ViscoQC 300, a yield stress method (YiS) was programmed as described in the following:

- Zeroing: was set active with a Zero speed of 0.1 rpm. During Zeroing the torque is set to 0 %. This is important as during immersion of the vane spindle some torque has possibly been applied to the sample. This could already falsify the yield stress determination.
- The run speed was set to 0.1 rpm.
- The torque reduction is set to 100 %. This will cause the test to stop as soon as no torque increase is detectable anymore.
- The overtime was set to 30 s. An overtime enables monitoring of the flow behavior after the yield point.

3 Results and Discussion

The single-point viscosity value determined with ViscoQC 100 and Heli-Plus with a T-bar spindle for hair gel is given in Table 2. Internal viscosity limits ensure stiffness and a long holding power of the gel. On demand carbomers are added to the formulation as thickening agents.

A maximum speed of 12 rpm is recommended for rotational measurements with T-bar spindles. Preferably the viscosity measurement should only be performed during the first downwards movement. Otherwise already pre-sheared sample is measured which can lead to lower viscosity values.

Hair gel	
Speed [rpm]	10
Torque [%]	80.1
Viscosity [mPa·s]	32 024

Table 2: Single point viscosity measurement of hair gel with ViscoQC 100 – R and Heli-Plus.

For the yield stress determination with ViscoQC 300 the vane spindles are turned at a very low speed and the shear stress and the strain are monitored in an online graph during measurement, as a function of time (Figure 1). At the yield point, where the sample starts to flow, the shear stress stops increasing. The maximum shear stress identified over time is the yield stress (red line, Figure 1).

The yield stress and the corresponding parameters can be exported as graph from the data memory as PDF file (Figure 2). The average yield stress value for toothpaste was 273 N/m². The higher the yield stress is the more force is needed when squeezing the toothpaste out of the tube.

Alternatively, toothpaste without particles can also be measured with the Heli-Plus using T-bars and hair gel with vane spindles, respectively.

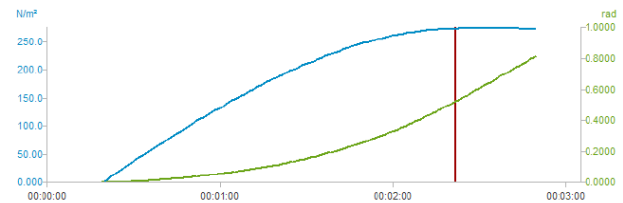


Figure 1: Online graph of a yield stress measurement of toothpaste using ViscoQC 300 with the software package V-Curve.

Yield Stress

► Yield Stress: 273.2 N/m²
 ► Torque: 68.3 %
 ► Apparent Strain: 0.5126 rad
 ► Runtime: 00:02:01.840 hh:mm:ss.000

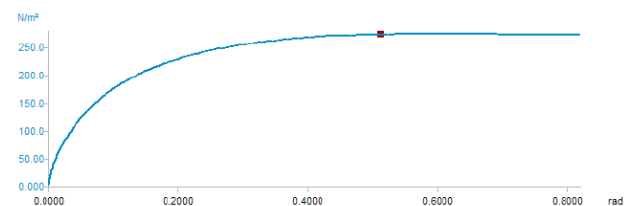


Figure 1: Result graph of the static yield stress measurement of toothpaste from the data memory of the ViscoQC 300. Available only with the software package V-Curve.

4 Summary

The ViscoQC 100/300 viscometers are well suited for the determination of the dynamic viscosity of personal care products. The Heli-Plus with T-bar spindles as well as vane spindles are suited for these kinds of samples. The ViscoQC 100 offers fast single point rotational viscosity checks. ViscoQC 300 upgraded with the software package V-Curve offers static yield stress determination with vane spindles, which is an important parameter in the quality control of personal care products.

If you have further questions regarding this application report, please contact your local Anton Paar representative.

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