

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; 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.

1.1 Keywords

viscometer personal care, viscometer cosmetics, hair gel, toothpaste, yield stress, yield point, viscosity quality control, touch viscometer, rotational viscometer, dynamic viscosity, digital viscometer, determination of viscosity

2 Experiment

The viscosities of toothpaste and hair gel were determined using ViscoQC series with Vane spindles. For quick single point checks a ViscoQC 100 - R is

used. For yield stress determination ViscoQC 300 - R is the model of choice. For that reason ViscoQC 300 needs to be upgraded with the software package V-Curve to unlock the static yield stress method with Vane spindles.

	Toothpaste and hair gel	
Instrument	ViscoQC 100 - R	ViscoQC 300 - R
Measurement type	Single point	Yield stress
Spindle	V75 and V73*	V75 and V72
Immersion depth	Only "Full" possible for all vane spindles	V75: Full, V72: Half
Speeds [rpm]	5 and 1 rpm**	0.1 rpm
Temperature	Ambient conditions	
Accessories	Flexible Cup Holder	

Table 1: Configurations and measurement conditions for viscosity tests of toothpaste and hair gel.*V73/V72 were used for hair gel, V75 was used for toothpaste. **5 rpm were used for hair gel measurements, 1 rpm for toothpaste measurements.

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.

- For single point measurements by the ViscoQC 100, a speed of 5 rpm (hair gel) and 1 rpm (toothpaste) was set in the Stop at Time (@t) mode with a target time of 1 min.
- 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 for both samples.

- 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

To measure the flow behavior of toothpaste and hair gel vane spindles were used: Vane spindles do not destroy the sample's structure of paste-like materials when immersed, which is a big advantage over e.g. cylindrical measuring systems.

The single-point viscosity values determined with ViscoQC 100 for toothpaste and hair gel are given in Table 2. A maximum speed of 10 rpm is recommended when rotational measurements with vane spindles are performed.

	Toothpaste	Hair gel
Speed [rpm]	1	5
Torque [%]	92	62
Viscosity [Pa.s]	1968	66.3

Table 2: Average viscosity values of toothpaste and hair gel measured with a ViscoQC 100-R at 1 and 5 rpm, respectively.

Toothpaste shows a higher viscosity than hair gel. Both samples show shear thinning behavior.

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).

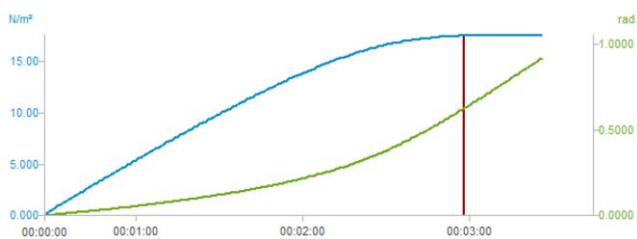


Figure 1: Online graph of a yield stress measurement of hair gel using ViscoQC 300 with the software package V-Curve.

The yield stress and the corresponding parameters can be exported as graph from the data memory viewer as PDF file (Figure 2).

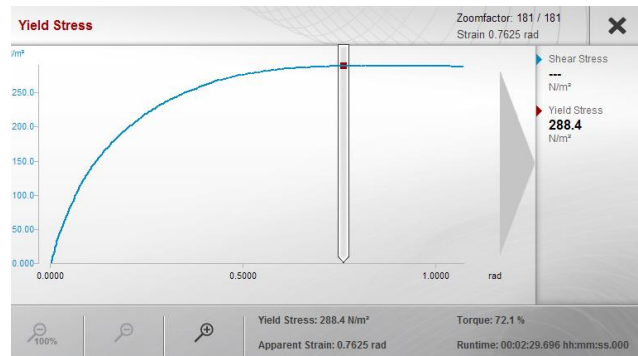


Figure 2: Result graph of the static yield stress measurement of toothpaste from the data memory of the ViscoQC 300. Available only with the software package V-Curve.

The average yield stress values for toothpaste and hair gel were 288 N/m² and 18.7 N/m², respectively. This means that more force is needed for the toothpaste in contrast to hair gel when squeezing the samples out of their tubes.

4 Summary

The ViscoQC series with vane spindles is well suited for the determination of the flow behavior of personal care products. The vane spindles provide a good transfer of movement into the sample and do not destroy the sample's structure when immersed.

The ViscoQC 100 offers fast single point rotational viscosity checks with vane spindles.

ViscoQC 300 upgraded with the software package V-Curve offers static yield stress determination, which is one of the most important parameters in the quality control of personal care products. For low sample volumes only half of the spindle body of the spindles V71 to V73 can be immersed (additional immersion mark). V74 and V75 are intended for full immersion only. The immersion depths of the spindle can be set inside of the measuring method for ViscoQC 300 and are automatically considered in the calculation by the software.

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

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