Application Report

Datum und Messplatz:
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Anton Paar Graz

Company Data:

Sales Contact:

Application:
Chemical Filler at 15, 25 und 35°C

Tests carried out by:
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Table of Contents

1 Introduction and Specs

One sample named FAB 01 was sent in without any specs.

Figure 1: Sample

Description of the application:
The production step is the mixing of the powder with some substances. Then passing it through the grinding process and finally pump it into a storage tank. The location of inline viscometer is suitable placed at the storage tank on the pipe which can continuous monitor the viscosity whether in the range of the specification although consists of many different new batch for every day

2 Goal of the measurement

Rheological qualification of the sample with a laboratory rheometer at 15, 25 and 35°C.

Feasibility of the viscosity measurement at room temperature with the inline viscometer L-Vis 510.

3 Description of the measurement

A Rheolab-QC measurement is done with the CC39 S/N23094 measuring system (Cup/Cone DN39 mm) at 15°C, 25°C and 35°C, at shear rates between 1 s^{-1} and 500 s^{-1}. This measuring system is used, because it is similar to the L-Vis. The measuring procedure is done in three sections:

1. temperature conditioning at 50 s^{-1}
2. increase of the shear rate from 10 to 500 s^{-1} and
3. decrease from 500 back to 10s^{-1}

With the section 2 and 3, the time-dependency of the flow behavior, which is important for process steps like stirring or pumping, can be determined.

Figure 2: Rheolab QC

To check the feasibility of a L-Vis measurement, the sample is measured with a L-VIS 510 Configuration 6 in a temperature controlled beaker. The temperature is set around room temperature.

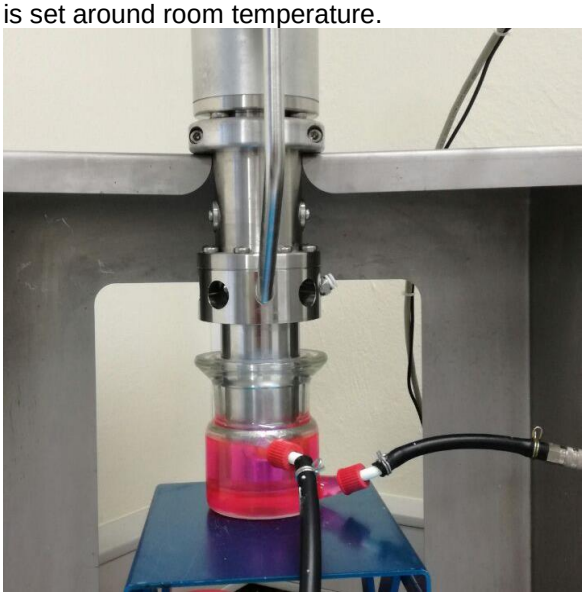

Figure 3: L-Vis 510 with a temperature controlled beaker

4 Measuring Data

4.1 Sample Preparation

The sample is measured without any preparation. A slow filling should avoid bubbles.

4.2 Rheometer-Data

The following graph contains the flow curves of the sample at three different temperatures 15, 25 and 35°C. Showed is only the flow curve from the highest to the lowest shear rate. A time-independency was determined.

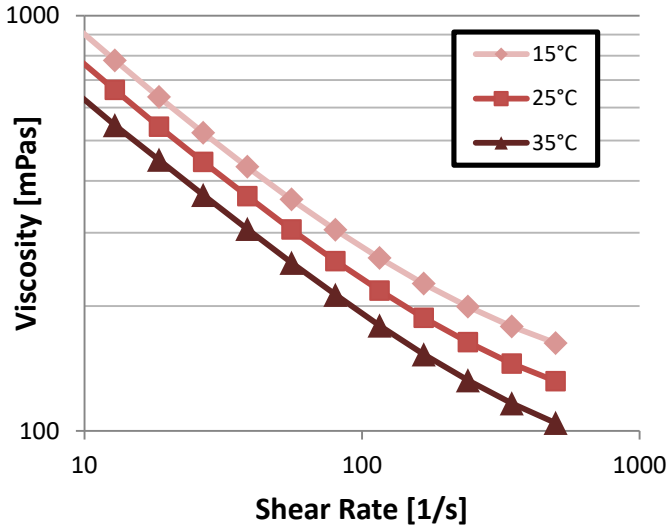

Figure 4: Flow curves at different temperatures

Table 1: Rheolab QC results at certain shear rates

Temp. / °C	Rheolab QC: Viscosity at different shear rates / mPa.s		
	71 s^{-1}	**178 s^{-1}**	**284 s^{-1}**
15	325.9	221.9	173.7
25	274.8	183.5	152.5
35	228.3	149.8	134.1

The average decrease of the viscosity is 1.8% per °C temperature increase.

4.3 Inline-Viscometer-Data

Viscometer setup: L-Vis 510 (Config 6)

The inline viscometer operates at 3 different speeds which – as in our case – are mainly used to gain a proper deflection and measurement. Generally, the higher the speed the more the raw signal we will get. In mathematical terms, this three velocities correlate to the shear rates 71,178 and 284s^{-1} (not exactly, because of a wedge shaped gap and not a parallel gap). Because of the shear thinning behavior of the sample, also different viscosity values are expected at different speeds.

In normal operation, the instrument measures at the lowest shear rate, to measure a high viscosity. The following graph shows a measurement with all three velocities over a time period of 800 second and detailed for 1 cycle.

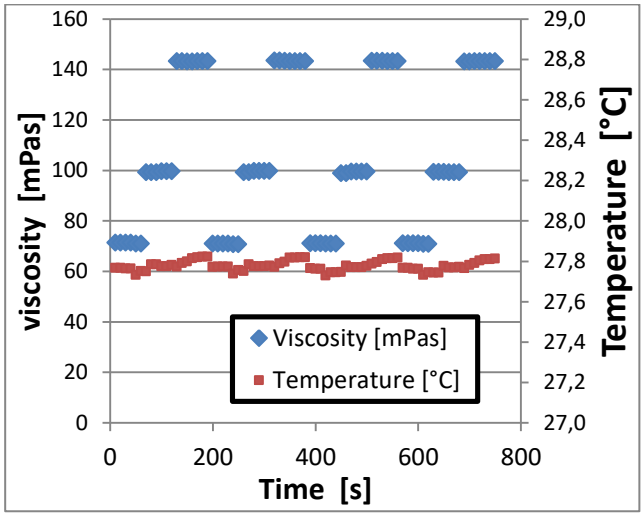

Figure 5at stable temperature: L-Vis measurement over 800 seconds

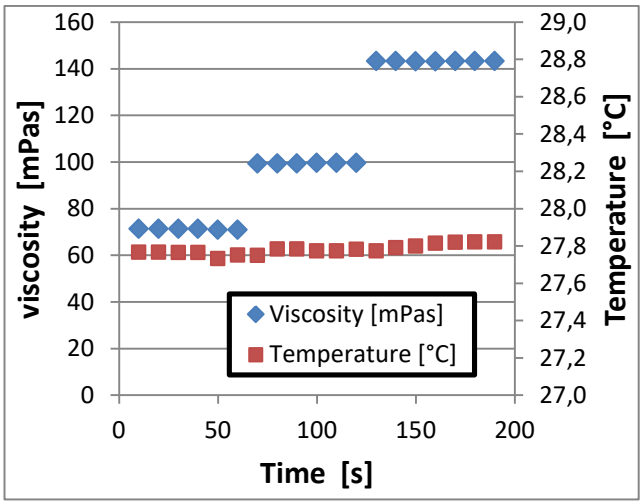

Figure 6: One cycle of the L-Vis measurement at a stable temperature

Table 2: L-Vis 510 results at one temperature

Temp. / °C	L-Vis 510: Viscosity at different shear rates / mPa.s		
	71 s^{-1}	**178 s^{-1}**	**284 s^{-1}**
27.8	143.3	99.5	71.3

5 Conclusion

With the flow curves at different temperatures, configuration 6 is choosen. The L-Vis measurement at a single temperature is very stable. Therefore, a correlation between inline measurement and laboratory measurement should be possible.

If the instrument is mounted at the pipework, the sensor head must be totally in the product stream. Also a drying of the process liquid at the sensor head can influence the measurement.

6 Table of Figures

This is a web link: www.anton-paar.com