APPLICATION NOTE

Spreadability of cream cheese - Influence of temperature and fat content

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Rheology, Yield stress, Dairy products, Cream cheese

Introduction
Soft, spreadable foods such as cream cheese are viscoplastic materials. Consumer acceptance of these foods depends on their textural characteristics such as spreadability – a measure of how easily and uniformly they can be deformed and spread at end-use temperatures. It also determines if a given substrate like soft white bread will be able to withstand the spreading force.

The rheological properties correlating with spreadability of food products have been studied by a variety of methods. Breidinger and Steffe [1] for instance used yield stress and yield strain data from vane measurements to construct texture maps of spreadable foods. In a rotational rheometer, semi-solid spreadable foods are often difficult to test with conventional parallel plate or coaxial cylinder geometries. This is because of wall slip that might occur during testing and an excessive sample disruption during loading into measuring geometries with a narrow shear gap. The use of vane geometries is an established alternative for measuring the yield stress of semi-solid materials such as highly concentrated dispersions or emulsions.

When the vane rotor is fully immersed in the sample, the yield stress itself can then be calculated according to Boger [2]:

$$\sigma = \frac{T}{K} \qquad [a]$$

With T being the torque and K the vane parameter that depends on the height (H) and the diameter (D) of the paddle according to:

Figure 1: The HAAKE Viscotester iQ Rheometer with universal container holder and vane rotors for relative measurements.

$$K = \frac{\pi \cdot D^3}{2}\left[\frac{H}{D} + \frac{1}{3}\right] \qquad [b]$$

Materials and methods
The Thermo Scientific™ HAAKE™ Viscotester™ iQ Rheometer equipped with a 4-blade vane rotor FL22 (vane diameter 22 mm, height 16mm) and a universal container holder (Figure 1) was used for all tests described below.

Two cream cheese products with varying fat content (10 % versus 50 %) have been studied at room temperature (25 °C) as well as at refrigerator temperature (8 °C).

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After the vane rotor was postioned correctly inside the sample, with the blades fully immersed, a constant rotational speed of ω = 0.05 rpm was applied for 120 s. The resulting shear stress was then monitored as a function of measuring time and the maximum value was determined as a measure for the yield stress of the sample. After an initial purely elastic response in the sample the structure.

Results and discussion

Figure 2 shows the results of the yield measurements for the two cream cheese products at room temperature. It can be seen, that the yield stress for the high fat content product is 1000 Pa versus 200 Pa for the low fat product. In comparison, Figure 3 shows the test results for the same products at precooled in a refrigerator at 8°C.

As can be seen from Figure, 3 the yield stresses for the cream cheese products rise considerably at 8 °C to 1500 Pa for the high fat product and 370 Pa respectively for the low fat product. Let us now consider that we want to spread these products on soft white bread. Some soft white breads may only withstand shear stresses of around 1200 Pa before they fracture.

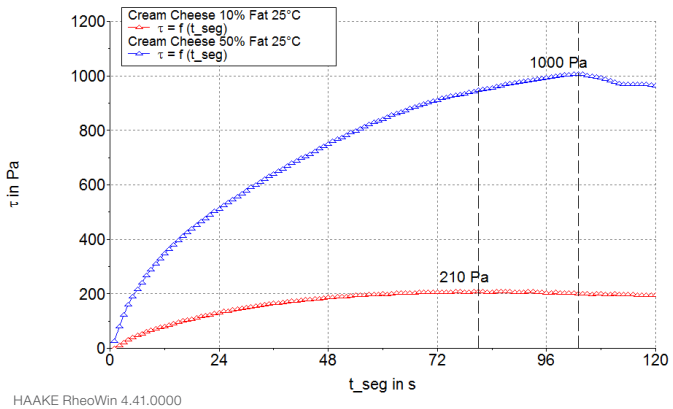

Figure 2: Shear stress versus time for the two different cream cheese products at 25 °C.

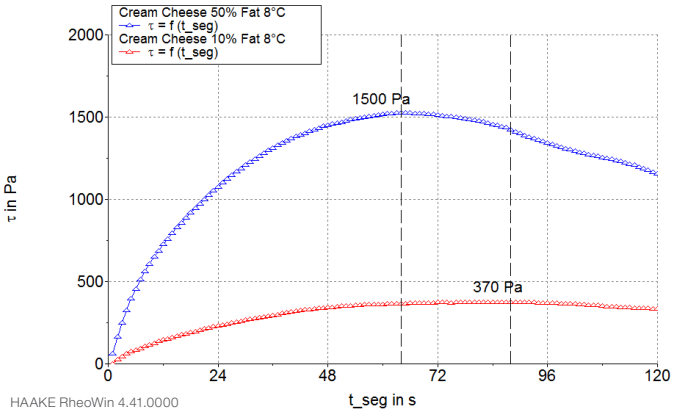

Figure 3: Shear stress versus time for the two different cream cheese products at 8 °C.

From the results presented above, one can conclude that problems will arise when trying to spread the refrigerated high fat content product on soft white bread as the yield stress of the cream cheese is higher than the maximum stress that can be supported by the bread structure.

Conclusion

Performing yield stress tests with a vane rotor on the HAAKE Viscotester iQ Rheometer is a quick, simple and accurate method for the determination of spreadability and customer acceptance of semi-solid foods like cream cheese.

Reference

1. C. Breidinger, S. L. and Steffe, J. F. 2001. Texture map of cream cheese. J. Food Sci. 66, 453-456 of cream cheese. J. Food Sci. 66, 453-456
2. Dzuy NQ, Boger DV. 1985. Direct yield stress masurement with the vane method. J Rheol 29:335-47

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