

Use

Chocolate is used to make a wide variety of desserts and treats including; candies, icings, pastry fillings and desserts, to name a few.

Test Equipment

- **Torque Range:** HA
- **Spindle:** SC4-27 with SC4-13RPY Sample Chamber
- **Accessories:** Small Sample Adapter, TC-502P Programmable Temperature Bath
- **Speed:** 5, 10, 20, 50 and 100
- **Temperature:** 40°C



Test Method

The National Confectioners Association and Chocolate Manufacturers Association specify a chocolate test procedure using Brookfield equipment such as those listed above. The Small Sample Adapter may be used with various Brookfield Viscometers or Rheometers. We used a Brookfield HADV-III Ultra Rheometer with SC4-27 hanging link spindle for our example, however, many customers use the HADV-II+ Pro Viscometer instead. The SC4-13RPY sample chamber has an integral temperature probe that connects with its cable to the rheometer, to provide temperature readout. The test temperature of 40°C was maintained by connecting the Small Sample Adapter water jacket to a Brookfield TC-502P Programmable Refrigerated Bath.

Rheocalc software provides automated instrument control and data acquisition. It controls both the rheometer speeds and the bath temperature. Representative data from the analyses are shown in Figures 1 and 2.

Figure 1 demonstrates that the viscosity of the dark chocolate decreased as the speed increased. This behavior is known as "shear- thinning".

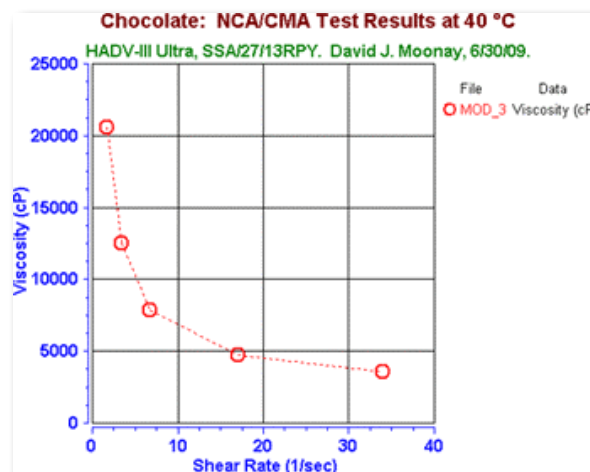


Figure 1
Chocolate Behavior at 40°C.

Figure 2, generated in the Rheocalc™ Analysis module, compares the calculated NCA/CMA Casson model values to the measured data. The Confidence of Fit (%) or "CoF" is nearly 100%, signifying an excellent fit of the model to the data. The Plastic Viscosity is 1241 cP and the Yield Stress is 129.2 Pa. These parameters provide important measures of how the molten chocolate will flow and enrobe, for example.

Figure 2, generated in the Rheocalc™ Analysis module, compares the calculated NCA/CMA Casson model values to the measured data. The Confidence of Fit (%) or "CoF" is nearly 100%, signifying an excellent fit of the model to the data. The Plastic Viscosity is 1241 cP and the Yield Stress is 129.2 Pa. These parameters provide important measures of how the molten chocolate will flow and enrobe, for example.

The viscosity value, cP, at 20 rpm, measured with HA-range viscometer and SC4-27 spindle, correlates with Degrees MacMichael or "deg. M": deg. M = [cP / 100]*3.40. Therefore, in our example, 7850 cP at 20 rpm corresponds to 266.9 deg. M.

Finally, it should be noted that chocolates are actually thixotropic - that is, shear-thinning over time at a constant shear rate. The advantage of the NCA/CMA method is that it provides a standardized test procedure - and thus better reproducibility. The test procedure is discussed in Article Reprints, particularly AR-99 and AR-79, available from Brookfield Engineering Labs., Inc. - please contact us if you want us to mail copies of these article reprints.

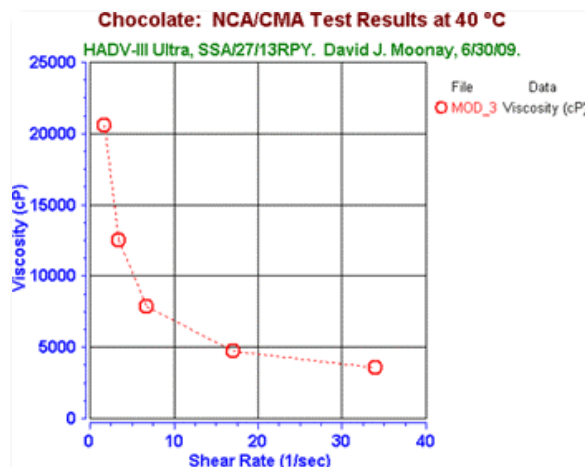


Figure II
NCA/CMA Casson Plot of Chocolate Rheology at 40°C.

Distributed by:

Lab Unlimited
CARL STUART GROUP

Tallaght Business Park
Whitestown, Dublin 24,
Ireland
D24 RFK3

Tel: (01) 4523432
Fax: (01) 4523967
E-mail: info@labunlimited.com
Web: www.labunlimited.com

Quatro House, Frimley Road,
Camberley,
United Kingdom
GU16 7ER

Tel: 08452 30 40 30
Fax: 08452 30 50 30
E-mail: info@labunlimited.co.uk
Web: www.labunlimited.co.uk