

# DETERMINATION OF VISCOELASTICITY IN SEMI-SOLID FATS BY THE RS600 RHEOMETER

by: ZALIHA OMAR; CHONG, C L; ZUKARINAH KAMARUDIN; ROZIYAH AHMAD; JORIAH PUTEH; MOHAMED KHAIRUL NIZAM MOHD NASIR; MD NIZAM ABD RAHIMAN and WAN ALIAS WAMN NGAH

442

MPOB INFORMATION SERIES • ISSN 1511-7871 • JUNE 2008

MPOB TS No. 45

**R**heology is the science of flow and deformation of materials under stress and strain. The study of rheological properties is an important area in food product development. Viscoelasticity is one of the rheological properties of materials. A viscoelastic sample behaves like an elastic solid or a viscous liquid under different conditions. Rheological testing is a sensitive technique for evaluating the texture of fat crystal networks especially in food products. In the food industry, rheological data are needed for determining the functionality of ingredients in product development, determination of food texture by correlation to sensory data, immediate or final product control and process engineering calculation for equipment such as pumps, heat exchangers, extruders and mixers.

The behaviour of a semi-solid fat can be determined by measuring its viscoelasticity using a rheometer. In oscillation tests, the elasticity part is defined as storage modulus ( $G'$ ) and the viscosity part as loss modulus ( $G''$ ). In viscosity measurements, the shear viscosity is defined as  $\eta$ . The SI unit for  $G'$  and  $G''$  is Pascal (Pa) while that for  $\eta$  is pascal second (Pas).

According to Tadros (2004), in any flow process, whether during manufacturing masticating of the food product, the flow stress affects the 'structure' of the system, which, in turn, affects its rheological characteristics.

## INSTRUMENT

The rheological properties of food samples are determined using a Rheostress RS600 Rheometer (Figure 1: Thermo Haake Karlsruhe, Germany using a stabilized low-inertia air bearing and a Peltier element for temperature control). A 35.0

cm serrated parallel measuring plate and a special mould (Figure 2) are used for sample tempering prior to the measurement.

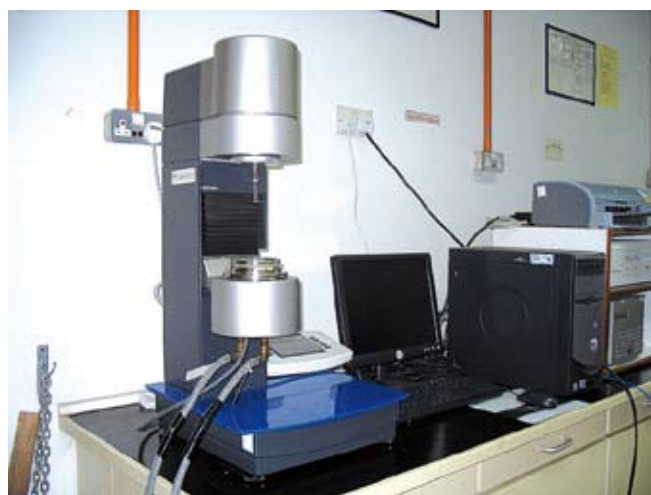
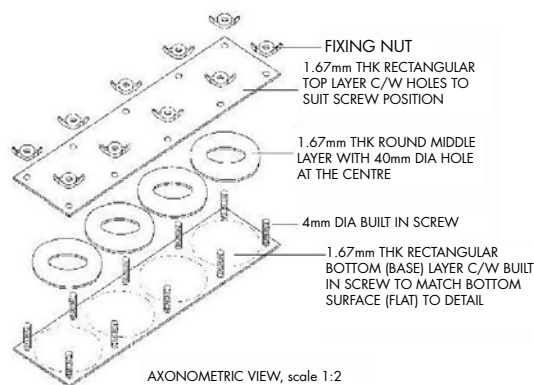


Figure 1. RS600 Rheometer.

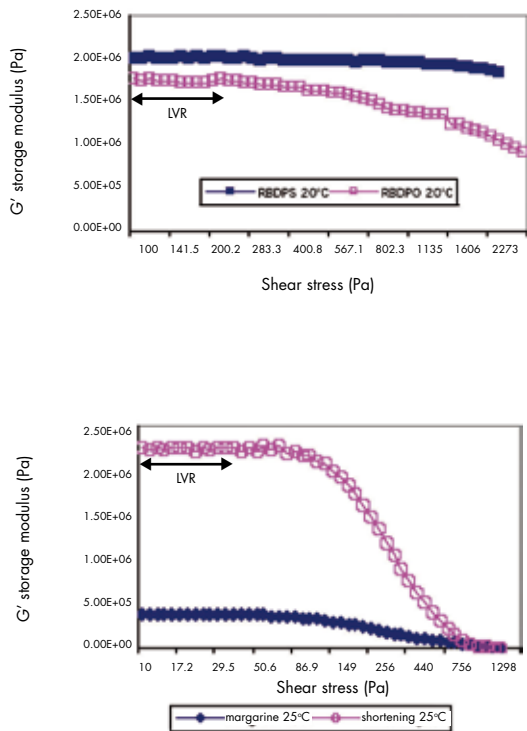


Source: Zaliha (2006).

Figure 2. Special mould for sample tempering.



## RESULTS



Figures 3. Storage modulus ( $G'$ ) and viscosity ( $\eta$ ) of commercial margarine, shortening and palm oil products.

## SERVICE OFFERED

An oscillatory stress sweep test to determine the linear viscoelastic region (LVR) at a frequency of 1 Hz, followed by frequency sweep tests from 1 to 20 Hz at constant stress (in the LVR) to evaluate the storage modulus ( $G'$ ), loss modulus ( $G''$ ) and viscosity ( $\eta$ ) for:

- foods including fats and fat-structured products at different temperatures; and
- palm oil products such as CPO, RBDPO and palm mid-fractions.

## TARGET CLIENTS

- Food and palm oil industries;
- MPOB researchers; and
- Universities (national and international), other research organizations and laboratories.

## REFERENCES

TADROS, T H (2004). Food colloids, rheology and texture. Lecture note from seminar, 2004.

ZALIHA OMAR (2006). Crystallization behaviour of palm oil: application of fractal analysis on crystal network of palm oil products.

For more information kindly contact:

Director-General  
MPOB  
P. O. Box 10620  
50720 Kuala Lumpur, Malaysia.  
Tel: 03-87694400  
Website: [www.mpob.gov.my](http://www.mpob.gov.my)  
Telefax: 03-89259446