Characterization of Palm Oils at different temperature scanning rates by MICROCALVET

INTRODUCTION

Palm oil is mainly constituted of esters of glycerol and fatty acids named glycerides. The composition of glycerides in oil is an important characteristic to control its quality. This composition can be determined following the specific phase transitions between polymorphic forms and solid-liquid phases of the constituents. It is shown that MICROCALVET is an equipment perfectly designed to characterize palm oil.

Palm tree fruits constituted by the flesh (1) and the kernel (2) from which are extracted PO and PKO

EXPERIMENT

Samples:
Refined Palm Oil (PO)
Refined Palm Kernel Oil (PKO)

MICROCALVET experimental conditions:
Atmosphere: air, atmospheric pressure
Sample mass: about 500 mg in a standard cell

Experimental procedure:
- +80 to -40°C at different temperature scanning rates
- Isotherm at -40°C during 30 minutes
- -40 to +80°C at the same scanning rate

RESULTS AND CONCLUSION

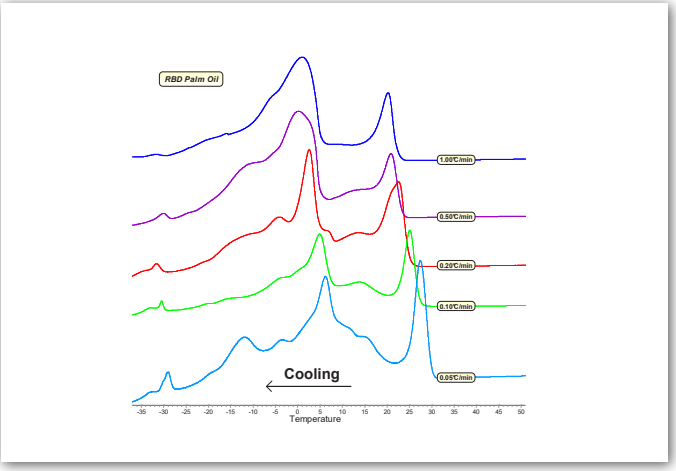


Figure 1 : Cooling thermograms of PO

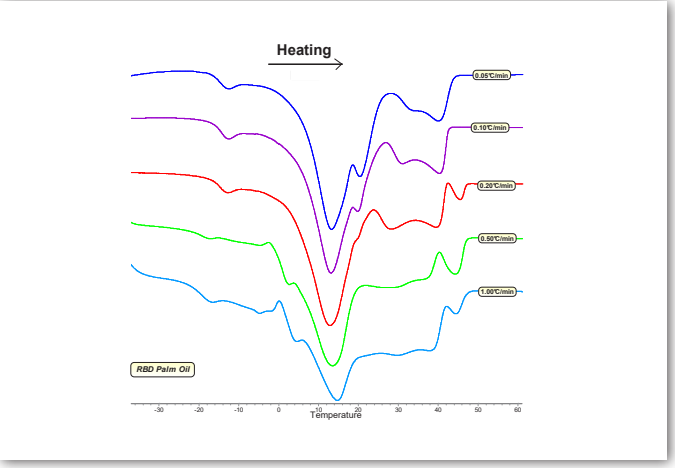


Figure 2 : Heating thermograms of PO

PO is constituted of different types of glycerides (saturated and unsaturated) which may have different crystal forms (polymorphism). That is the reason why on the corresponding thermograms, several peaks are observed. Figures 1 and 2 present the cooling and heating curves obtained using MICROCALVET at different temperature scanning rates. When the rate decreases, the resolution of peaks increases and allows for a better separation of the different glycerides. Despite the very slow rates (down to 0.05°C/min), the heat flow remains very easily measurable and allows for a better identification of the different fractions.

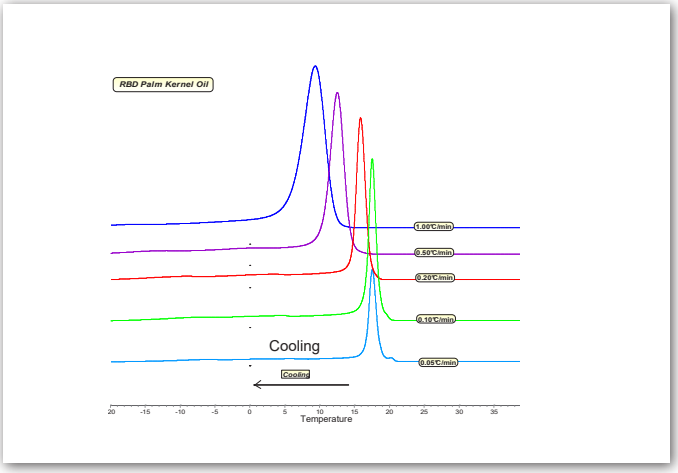


Figure 3 : Cooling thermograms of PKO

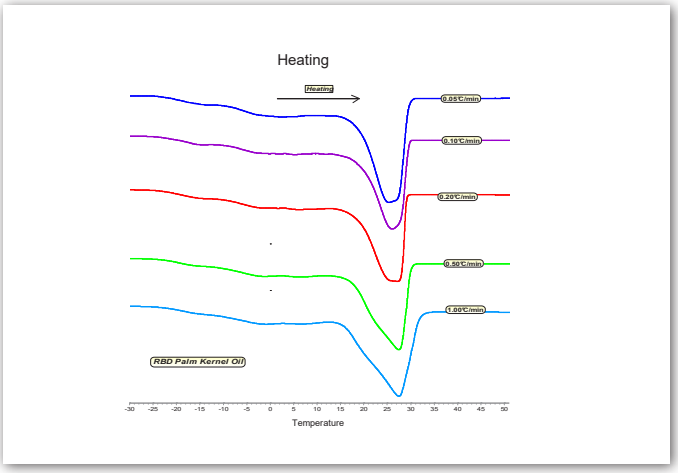


Figure 4 : Heating thermograms of PKO

On the contrary, PKO thermograms have very few peaks even when applying a slow rate. One main peak is observable since PKO is particularly concentrated in saturated triglycerides. (Figures 3 and 4).

As the melting and cooling are very complex to analyze due to the several peaks, the Calisto software with its deconvolution function is used to extract from the thermogram the different peaks associated to each glycerides and to enable a better identification of the spectrum (Figures 5 and 6).

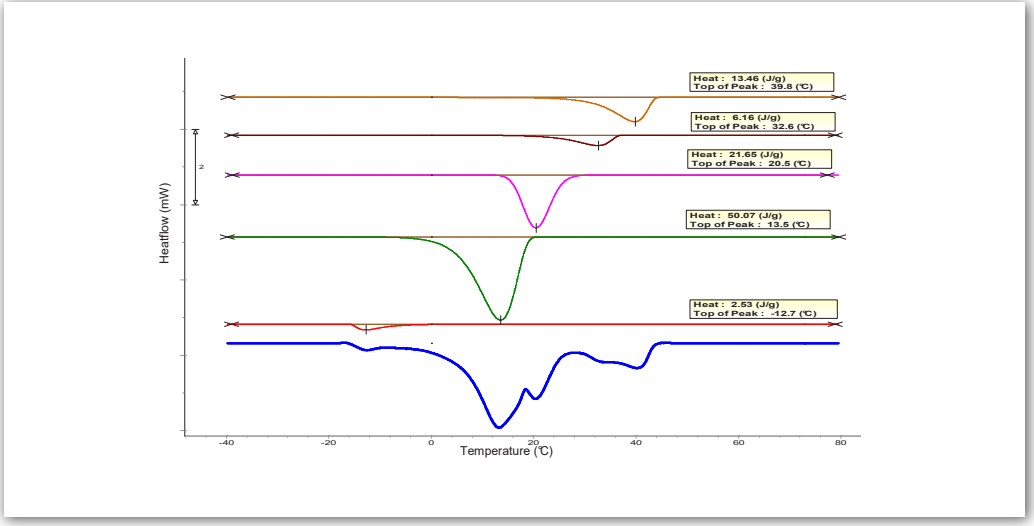


Figure 5 : Deconvolution of PO cooling thermogram at 0.05°C/min

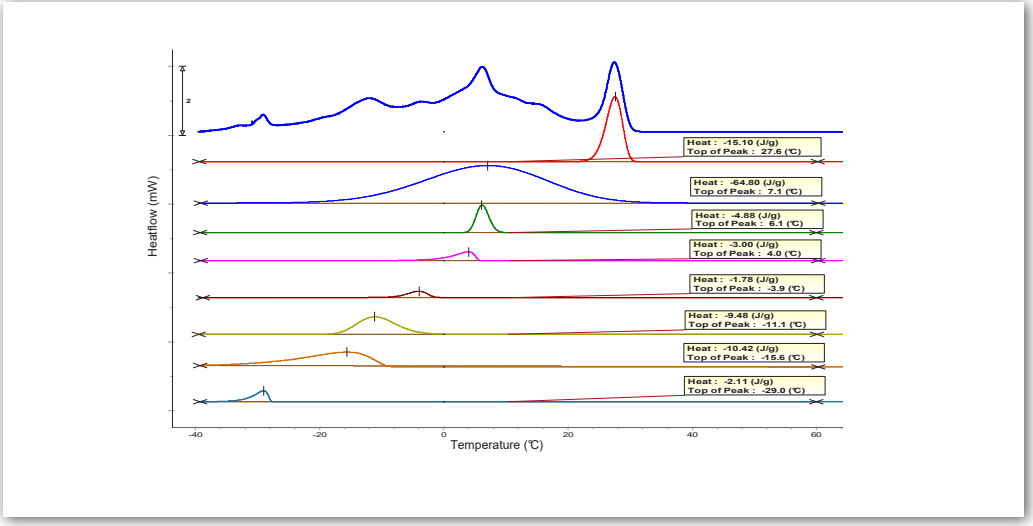


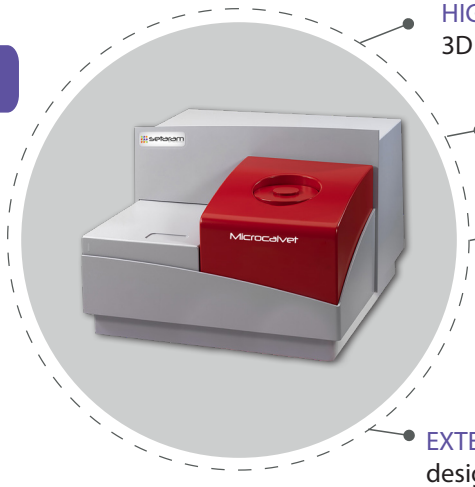
Figure 6 : Deconvolution of PO heating thermogram at 0.05°C/min

The MICROCALVET with its large sample volume combined with a high sensitivity, is ideal to characterize very accurately the different transitions in palm oil and access to the glycerides' composition and polymorphic forms of their crystals. Associated with the Calisto software a separation of the different peaks is made available for a better identification of the composition.

INSTRUMENT

MICROCALVET

-45°C to 120°C



HIGHEST HEAT MEASUREMENT ACCURACY
3D sensor based on Peltier elements with Joule effect calibration.

MODIFIABLE TEMPERATURE CONDITIONS
for increased flexibility and replication of real life conditions.

CONVENIENT INTERCHANGEABLE CRUCIBLES AND CELLS
to perform even the most demanding experiments using one instrument :
- high pressure (1000bar) and high vacuum
- pressure measurement and control
- mixing experiment

EXTERNAL COUPLING CAPABILITY
designed to increase your research options including manometry, BET instrumentation, gas analyzers, humidity controllers and gas panels