Physicochemical characteristics of binary fat blends involved in the preparation of industrial shortenings.

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Introduction

The aim of this work was to evaluate some physical characteristics, such as texture (hardness) and SFC by nuclear magnetic resonance (NMR), of a number of binary lipids systems. Microscopic analyses were performed in order to explain variability in hardness for some blends having the same SFC values. Oils involved in this study are commonly used in industrial shortenings: hydrogenated palm oil (HPO), hydrogenated soybean oil (HSO), low erucic rapeseed oil (LERO), and hydrogenated low erucic rapeseed oil (HLERO).

Results

The blue curve in Figure 1a shows the result for 100% of HPO. The two other curves represent 100% of HLERO and HSO. The hardness of HLERO and HSO are similar. However, hardness of HSO diluted in LERO (56,55±3,3g) is significantly higher than HSO diluted in LERO (25±1,7g) (50/50-W/W) (Figure 1b).

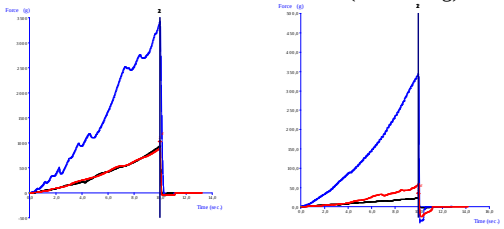

Figure 1a,b: Typical curves obtained by penetration test at 20°C (Texture measurements of the blends were carried out in a controlled temperature room (20±0.1°C) using a SMS TA.XT2i texturometer (Stable Micro Systems, Surrey, UK), after tempering the samples at 15°C).

Figure 2 (a,b,c) shows the relationship existing between logarithm SFC and logarithm penetration force. The regression obtained in the case of HSO-LERO (a) is linear however with a different slope in comparison to the other blend.

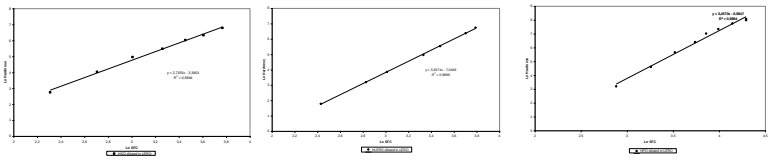

Figure 2 a,b,c: Linear relationship between the textural measurements (ln maximum penetration force (expressed in g)) and the ln SFC of the products tempered at 15°C (measurements done at 20°C).

Figure 3 illustrates microstructure of the three blends having SFC of 10% at 20°C. The crystals from HPO-LERO and HLERO-LERO blends were spherical (β', needle-like shaped crystals) and more individualized than crystals from HSO-LERO blends. The HSO-HLERO blends had more crystals, they were less dense than the other, closer to each other and overlapped.

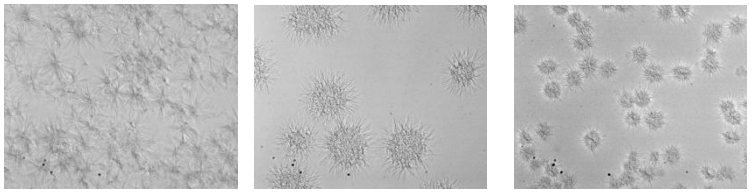

Figure 3 a,b,c : Microstructure of (a) HSO, (b) HLERO, (c) HPO diluted in LERO (10%SFC).

Discussions and conclusions

The variability in hardness for samples having same SFC values is due to various structures (various crystal types and/or network types) that are formed upon crystallization of the hard fats. Further researches are currently being performed in the Department on this topic.

This work demonstrates that for binary blends of studied oils, changes in the hardness are mostly controlled by the SFC but also by polymorphism and the material's microstructure.

•Danthine, S., & Deroanne, C. (2003a) Blending of hydrogenated low erucic rapessed oil, low erucic rapessed oil and hydrogenated palm oil or palm oil in the preparation of shorterings. *J.Am.Oil Chem.Soc.*, 80, 1069-1075.

•Danthine, S., & Deroanne, C. (2003b) Physical and Textural Characteristics of Hydrogenated Low-erucic acid Rapeseed oil and Low-erucic acid Rapeseed Oil Blends. *J.Am.Oil Chem.Soc.*, 80, 109-114.

•Braipson-Danthine S., Deroanne C. (2004) Influence of SFC, microstructure and polymorphism on texture (hardness) of binary blends of fats involved in the preparation of industrial shortenings. *Food Res. Int.*, in press.