**Introduction**

Studies of phase behavior help to provide a better understanding of the ways in which fat blends interact, an important aspect since the large-scale industrial production of shortenings and other fat-containing products often requires blending of lipids from many different sources. Palm oil is without doubt the most fractionated oil. Multi-step dry fractionation gives rise to soft fractions (Olein, Superolein and Topolein) that are used as salad, cooking and frying oils, and to harder fractions (Stearins and Palm Mid Fractions) finding applications in frying fats, margarines, shortenings and specialty fats. Anydrous milk fat (AMF) is also widely fractionated. This is why those oils and their fractions have been selected as model fats for this basic study.

**Methods:**

- **DSC**: Melting, Cooling, Heating 5 C/min.
- **NMR**: ADICS Method
  - IUPAC Method
  - Particular method after tempering
- **Powder X-ray diffraction**:

**Palm oil and HLERO**: Dynamic conditions (48h at 15°C)

- Isosolid diagrams at 15 and 20°C after a tempering procedure of 48h at 15°C:
  - (a) blends involving palm oil
  - (b) blends involving a liquid lab fraction of palm oil
  - (c) blends involving a solid lab fraction of palm oil

Arens indicate enantiotropic interactions.

**Palm oil or some of its fractions and HLERO**: Tempered conditions (48h at 15°C)

- After the tempering procedure, the minimum of SFC is observed for higher HLERO content in the case of blends involving a solid fraction and for lower HLERO content in the case of blends involving a liquid fraction compared to blend made of full palm oil.

**Palm oil or some of its fractions blended with HLERO and LERO**: Dynamic conditions (ADICS method)

- Isosolid diagrams at 15, 20 and 30°C (ADICS method):

**Conclusions**

Molecular interactions have been observed for all the studied blends. Compositions at which molecular interactions are detected are dependent on TAG compositions of the fat fractions involved in the blends.

Further studies are being conducted in our lab on this topic, with trans-free fats.

**Objectives**

**GOAL**: The objective of this work is to study physical characteristics and interactions that occur in binary systems made of oils and fats commonly used in European shortenings (for ex. palm oil). Physical properties such as solid fat content (SFC) by pulsed nuclear magnetic resonance (pNMR), melting profile by differential scanning calorimetry (DSC) and polymorphism by powder X-ray diffraction analysis (XRD) under dynamic conditions and after a tempering procedure are studied. Isosolid diagrams are drawn based on pNMR data. Dynamic phase behavior diagrams of the binary systems are established from DSC and XRD data.

**Methods**

- **DSC**: Melting, Cooling, Heating 5 C/min.
- **NMR**: ADICS Method
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  - Particular method after tempering
- **Powder X-ray diffraction**:

**Palm oil and HLERO**: Dynamic conditions

This figure illustrates the correspondence between DSC melting profiles and polymorphic behavior of the extreme samples.

**Palm oil blended with AMF or AMF fractions**: Dynamic conditions (IUPAC method)

**Palm oil blended with AMF or AMF fractions**: Dynamic conditions (IUPAC method)

Under dynamic conditions, a minimum is observed (enantiotropic interactions) within the SFC lines as a function of composition, for all the blends.

This minimum is shifted to higher Palm oil contents for blends made of AMF fractions with high DP and to lower Palm oil content for blends made of AMF fractions with low DP.

Regarding blends made of AMF and a solid fraction of palm oil, the minimum is shifted to higher AMF contents.