Wax and fatty compounds: various applications about crystallization

Introduction

Waxes are group of solids at room temperature, which are composed of different types of compounds, such as fatty esters (beewax), fatty alcohols and triglycerides, long chain hydrocarbons (paraffin wax). They are lipids and share some characteristics with them: they are not soluble in water, but well soluble in organic solvents. Moreover, crystallization of waxes is similar to fat crystallization as observed in chocolate or butter.
Waxes are used in cosmetics, food and pharmaceutical industry to texturize and thicken creams, to form water-resistant films and to form so-called oleogels. However, in some application, the presence of waxes can be a disadvantage, such as the crystallization of paraffin waxes in mineral oil as it can plug the filters in engines (low temperature diesel).
This document gives a rapid overview of different applications related to waxes.

A) Food application

Genarally speaking, natural waxes are used for film formation (glazing on chocolated peanuts or chewing gums). Waxes can also be used for gelation of olive oil or other vegetable oils to give edible oleogels. Carnauba, sunflower or candelilla wax may be used in substitutes of margarines and give new & healthier alternatives for butter. The melting point of these products depends on the wax concentration. Especially candelilla wax shows an excellent oil retention capacity.
Palm oil is also used in various food applications. Palm oil quality can differ significantly due to different triglyceride compositions (particularly tristearine and trioleine, this last one increasing the fusion temperature), which have an impact on crystallization points of the palm oil.

The figure below shows a heating and cooling cycle of two different palm oils. Palm oil I (red) crystallizes at 30°C, whereas Palm oil II (dark blue) crystallizes at 27.3°C. During heating, the Palm oil II (clear blue) melts at 48°C and Palm oil I (orange) at 51.5°C. This behavior seems to indicate that Palm oil I contains more trioleine than Palm oil II.

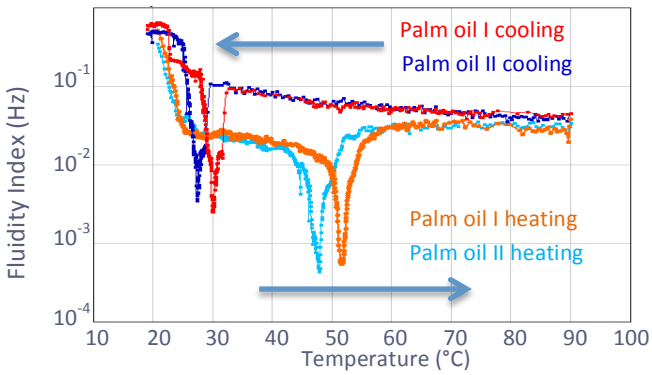

Figure 1. Schematical signatures of MSD curves.

Fat crystallization is similar to wax crystallization. It is also important for butter and butter-like products. Butter is a water-in-oil emulsions stabilized by milk proteins. According to the triglyceride composition, different butters melt at different temperatures.

In the example below, a standard butter shows a peak at higher temperatures (22°C), which is consistent with a hard aspect of the butter at room temperature, whereas an easy spreadable butter shows an important melting peak at 19°C and a smaller one at 22°C, indicating a lower mass fraction of high melting triglycerides. At room temperature, this butter can then be spread easily.