



Experiment title:
Hierarchical Crystal Network of Triglycerides

Experiment number:
26-02-884

Beamline: BM26B	Date of experiment: from: 6/12/2018 to: 10/12/2018	Date of report: 14/03/2019
Shifts: 9	Local contact(s): Michela Brunelli	<i>Received at ESRF:</i>

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Report:

The objective of this experiment was to study the structural levels of different edible fat systems from a few nanometers to a few micrometers using microradian x-ray scattering setup. However, due to limited beam time and the absence of preliminary SAXS data, we decided to use the standard SAXS/WAXS configuration in this experiment. Instead, we performed additional analyses of the influence of shear on the crystallization of the edible fats.

Examples of 2D patterns for SAXS and WAXS from fully hydrogenated palm kernel oil (FHPKO), palm kernel oil (PKO), fully hydrogenated coconut oil (FHCNO) and coconut oil (CNO) are shown in figure 1. The obtained data suggested that different structures appeared in the different type of edible fat. The polymorphs of FHPKO and FHCNO appeared to be β' , however, both α and β' forms were observed in PKO and CNO from the WAXS patterns. From the SAXS pattern, it was obvious that the scattering peaks were changed after hydrogenation of PKO and CNO to be FHPKO and FHCNO, respectively. Moreover, the thickness of the fat nanocrystal decreased after hydrogenation. This might be due to more high melting point triglycerides were formed after hydrogenation, resulting in a rapid crystallization.

In addition, the shear rate also affected the structure of the fat crystal network. The small-angle X-ray scattering (SAXS) pattern of FHPKO with the shear rate of 20 s^{-1} at different time are depicted in figure 2. Here it can be clearly seen that the intensity of some peaks increased with the increase of shear time, which indicated that change of the structure of fats at the action of shear during the fat crystallization process.

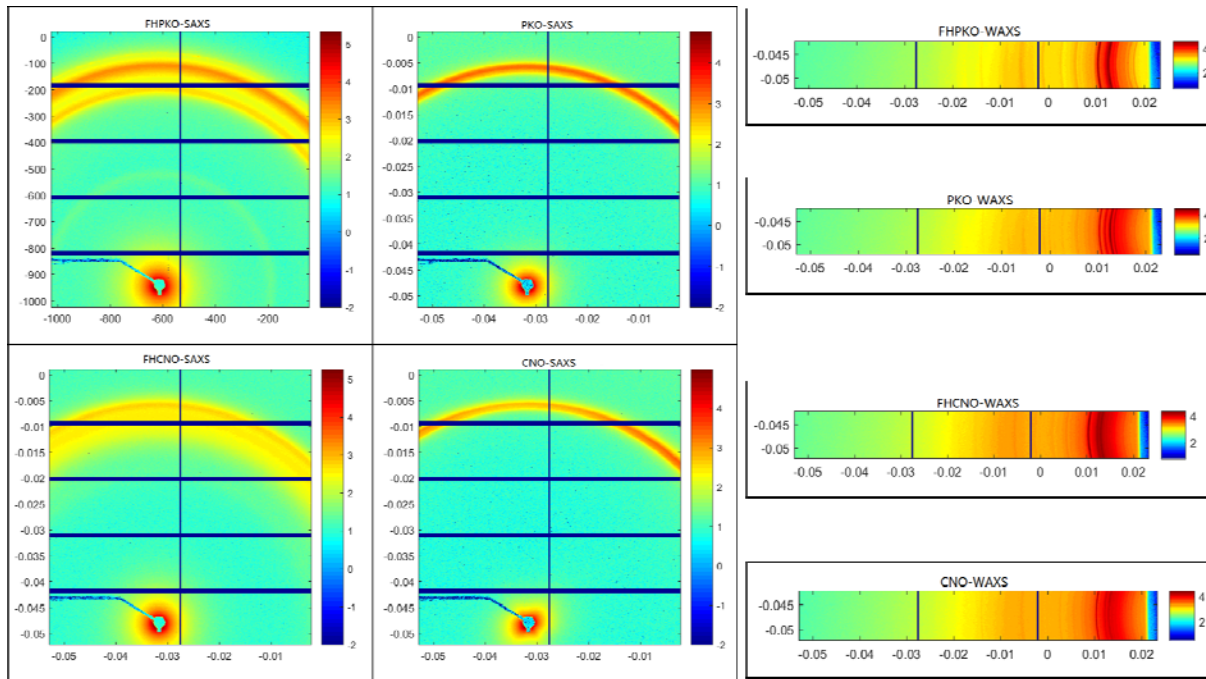


Figure 1: Examples of 2D patterns for SAXS and WAXS from different edible fats (FHPKO, PKO, FHCNO and CNO). Here, the background was subtracted and the data was plotted logarithmically.

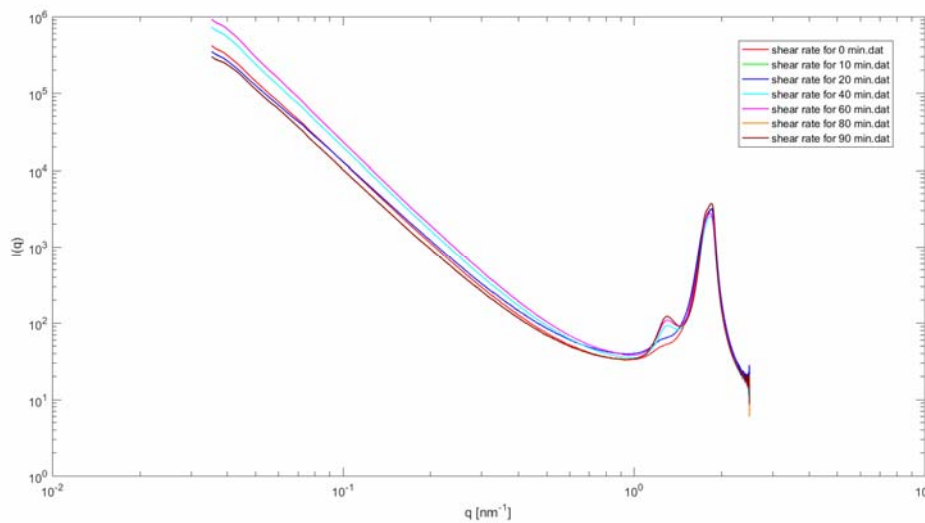


Figure 2: Small-angle X-ray scattering (SAXS) pattern of fully hydrogenated palm kernel oil (FHPKO) with the shear rate of 20s^{-1} at different time.

In addition, we have performed several test measurements of the pharmacologically-relevant ointments and cremes.

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