Neutrons & Food Sydney, Australia

Contribution ID : **21** Type : **Oral**

Static and dynamic multiscale characterisation of micronized fat crystal network formation and disruption by USAXS and rheo-SAXS

Thursday, 18 October 2018 12:00 (20)

Micronization of fat crystals presents an appealing alternative for the conventional melt-cool routes for manufacturing fat based food products. By dispersing micronized fat crystals (MFC) in oil, fat crystallisation and network formation can be decoupled, which can bring significant process simplifications. In order to assess the industrial application scope of these dispersions we carried out a multiscale investigation on MFC network formation and disruption by means of USAXS, rheo-SAXS, confocal Raman imaging and rheo-MRI.

Rheo-SAXS and rheo-MRI showed that upon dispersion in oil, MFC network formation was concomitant with recrystallisation. Oil type, temperature and shear rate collectively determined MFC recrystallisation rate, which inversely correlated with the strength of the resulting weak-link network where crystal aggregates are embedded in a continuous net of crystalline nanoplatelets. USAXS revealed that the rough surface of MFC nanoplatelets hampers stacking into one-dimensional aggregates ('TAGwoods'), which explains the high mass fractal dimension of the networks formed in MFC dispersions as compared to those formed by melt-cooling.

Applying shear to matured MFC networks leads to a gradual and irreversible loss of yield stress, as shown by rheo-MRI. Shear did however not affect network fractal dimensions (USAXS) and also did not disrupt microscale MFC aggregates (confocal Raman imaging). Rheo-SAXS revealed that loss of network strength can be attributed to release of nanoplatelets from the weak-link network, which subsequently align in the shear field and undergo rapid recrystallisation. Our insights in the factors that govern MFC network formation and disruption bear relevance for simplified manufacturing of fat-based food products by effectively turning their design into a colloidal aggregation game.

Primary author(s) : NIKOLAEVA, Tatiana (Laboratory of Biophysics, Wageningen University); Dr VODA, Adrian (Unilever Discover Vlaardingen); Mr ADEL, Ruud den (Unilever Discover Vlaardingen); VELICHKO, Evgenii (TU Delft); Dr BOUWMAN, Wim (TU Delft); Dr VAN AS, Henk (Laboratory of Biophysics, Wageningen University); Prof. DUYNHOVEN, John van (Laboratory of Biophysics, Wageningen University)

Presenter(s) : NIKOLAEVA, Tatiana (Laboratory of Biophysics, Wageningen University)

Session Classification : Mid Morning

Track Classification : Lipids and Fats