Development of Beeswax Oleogels and the Influence of Gelator Concentration and Oil Type on Their Final Properties

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Introduction:
Concerns regarding food nutritional value, sensory attributes, and consumer health urge to get a valid and feasible answer. The use of food-grade materials that guarantee gel-like behaviour and address consumer needs is currently essential in food industry. Structuring edible oils (i.e. oleogels) can be the response for such challenge, offering a healthier alternative (e.g. replacing saturated and trans fats) with tailored functionalities (e.g. different melting behaviour). This work focused on how different types of oil phase – medium chain triglycerides (MCT) and long chain triglycerides (LCT) – influence the gelation process of beeswax and the properties of the organogels produced thereof.

Method:
Oleogels were stabilized at different temperatures and qualitative phase diagrams were constructed to identify and classify the type of structure formed. The microstructure of gelator crystals was studied by polarized light microscopy. Melting and crystallization phenomena were evaluated by differential scanning calorimetry and rheology (flow and small amplitude oscillatory measurements) to understand organogels' behavior under different mechanical and thermal conditions.

Significance:
The structuring process supported by medium or long-chain triglycerides oils was an important exploit to apprehend the impact of different carbon chain-size on the gelation process.

Results:
Results showed that the increase of beeswax concentration leads to higher values of storage and loss moduli (G', G'') and complex modulus (G*) of oleogels, which is associated to the strong network formed between the crystalline gelator structure and the oil phase. Crystallization occurred in two steps (well evidenced for higher concentrations of gelator) during temperature decreasing. Thermal analysis showed the occurrence of hysteresis between melting and crystallization. Small angle X-ray scattering (SAXS) analysis allowed a better understanding in terms of how crystal conformations were disposed for each type of oleogel. LCT-based organogels presented different spacing and placement between crystals, in a lamellar and micellar conformation, while MCT-based organogels presented a more uniform structure. Nevertheless, no rheological differences were observed between oleogels produced using MCT and LCT.

Category:
Food Engineering