

Vegetable oil modeling applied for the formulation of structured lipids

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Vegetable oils are complex mixtures composed mainly by triglycerides, which in turn are made of three fatty acids esterified on a glycerol backbone. They display both physical and nutritional properties that make them appealing for the food industry and the human consumption.

Concerning nutrition and health issues, vegetable oils can bear polyunsaturated fatty acids (PUFA) in sn-2 position of the glycerol, and such triglycerides are reputed healthier than animal fat, cold water fish's ones excepted. Food engineers seek vegetable oils formulations that have fatty acids with enhanced nutritional profile while keeping physical properties within the desired range. Besides, special fatty acids, like omega 3,6 and 9 are looked at in sn-2 position and can add value to food products based on vegetable oils.

Concerning consumers' desired attributes in fat-foods like hardness, texture, graininess and spreadability, they are strongly related to the distribution of the triglycerides between the solid and liquid phases (solid fat content).

As physical and nutritional properties are both related to the oil composition and physical state, we model the solid – liquid equilibrium of vegetable oils by using up-to-date thermodynamic concepts and show how this can be used to evaluate in a pre-experimental step how composition impacts the melting profile. The model is predictive and uses triglycerides or fatty acid composition, the last one being easier to measure. Computing solid fat content curves and DSC curves, allows us to predict the outcome of vegetable oil mixtures, the impact of introducing omega fatty acids on oil, but also the result of chemical interesterification of a vegetable oil mixture.