CHEMICAL ENGINEERING

MUR DM 117/Nestlé - Modelling crystallization of complex mixtures of triacylglycerols

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019]- Société des Produits Nestlé SA [VAT no. CHE-116.281.710TVA]
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Context of the research activity	This combined experimental and modelling project aims to understand and control the crystallization behaviour of complex edible fats (e.g., cocoa butter, milk fat equivalents). The experimental work will involve the use of advanced characterization techniques such as X-ray scattering, Raman confocal microscopy and differential scanning calorimetry. Whereas both first principle and empirical (e.g., machine learning) models will be used for the computational part of the PhD. Progetto finanziato nell'ambito del PNRR - DM 117/2023 - CUP E14D23001980004
Objectives	Solid fats such as tallow or cocoa butter are an example of a multi-component crystalline system in the food sector, but they are also used in pharmaceutical and cosmetic formulations. Fats are one of the major macro-nutrients of the human diet and they comprise of mixtures of different triacylglycerides (TAGs), whose composition depends on the source (animal vs vegetal), origin (e.g., type of crop) and condition of development (e.g., geographical site of harvesting, seasonal changes). Due to this multi-component nature the crystallization of solid fats is very complex, also with the formation of immiscible phases and several polymorphs often appearing concomitantly for these solid solution materials. These phases and polymorphs can have very different thermal, mechanical, or rheological properties, which can dramatically affect the functionality of the finished fat-based product (e.g., mouthfeel, digestibility). The objective of this project is to develop a workflow to effectively control the crystallization of edible fats of different nature, with a particular focus on understanding how the type and number of different TAGs within the mixture affect thermodynamic and kinetics aspects of crystallization processes, as well as the functional properties of the resulting crystalline materials (e.g., rheology, thermal behavior).

Skills and competencies for the development of the activity	MSc degree in Chemical or Process Engineering, Chemistry or other relevant subjects.