

DESCRIPTION FOR THE GENERAL PUBLIC

The main aim of the proposed project is to describe fundamental processes that occur during a hydrofluidisation (HF) impingement method of food freezing by means of advanced mathematical models and series of experiments. The motivation to work on this still emerging method are potential advantages, i.e. a short freezing time, low exploitation cost in the whole process and the resulting good quality and attractive appearance of a food product.

In the advanced mathematical description is necessary to take into consideration all the physical phenomena responsible for the freezing process. For this reason, the developed algorithm will consider highly turbulent flow of the refrigerant jet on the surface of a single of a few fixed or moving food products. A separately formulated model, coupled with the main one, will describe the heat and mass transfer processes within the food product.

The developed coupled model accuracy will be verified at each stage of its development using advanced experimental techniques. For this reason, a dedicated test rig will be designed to analyse effectiveness of the considered freezing method for small food products, mainly vegetables and fruits, e.g. vegetables mixes, mushrooms, strawberries. On the test rig, the products will be horizontally moving to imitate a product motion in the industrial food processing. During the experiments, the spatial velocity field of the refrigerant in the vicinity of the food products and the point temperatures within the product will be determined.

As a result of the interdisciplinary approach of the mathematical modelling and experimental tests, the effective heat and mass transfer in the HF impingement method will be characterised. Various food products in terms of type, size and shape and also flow operating conditions will be considered. Such a scope and the expected results of the project will lead to a better comprehension and further development of the considered method. The results of such complex research on the freezing method are not available in the scientific literature.

In addition, the planned heat transfer conditions will be closely related to those potentially applied in the industrial installations. In the future, consumers will be offered food products of better quality. In addition, such an effect will be obtained using the proposed method at low exploitation cost and high process efficiency provided that more research is carried out.