

EVALUATION OF THE LIFE CYCLE OF PASTEURIZATION OF DAIRY DERIVATIVES - A STUDY OF THE ENVIRONMENTAL PROFILE OF THERMAL & CLEANING CYCLES AT THE LABORATORY SCALE

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Fouling of heat exchangers used in the dairy industry to ensure the pasteurization and texturing of dairy products is a recurring problem.

Technological levers are however regularly proposed by the scientific community to minimize or facilitate the elimination of this contamination: optimization of heat treatments (leading to aseptisation) with regard to the kinetics of deposit formation, re-engineering of cleaning sequences, evolution of the composition of the dairy derivatives, functionalization of the surfaces

However, there is some reluctance to put in place the proposed technological solutions. This is mainly due to the fact that the economic impacts of these innovations and their eco-efficiencies in a life-cycle approach (multi-step and multi-criteria) are far from clear.

Researchers from the University of Lille 1, the Ecole Nationale Supérieure de Chimie Lille and INRA institute (belonging to UMET Unit and laboratory of Mécanique de Lille) work together in the project framework entitled ECONETIAA (Environmental assessment to reason and argue the ECO-design of processing and cleaning processes in the Agro-Food Industry) in order to address this issue.

The main objective of the study is to carry out a Life Cycle Analysis (LCA) of the heat treatment / cleaning cycles of dairy products. LCA is a standardized and internationally recognized approach that assesses the potential environmental and human health impacts associated with products and services throughout their life cycle, from the extraction of raw materials, including transport, processing, use and end-of-life treatment.

The project was divided into 3 steps:

- 1) Establish a framework and baseline for (i) assessing the environmental impacts of the sanitation phase comparing to the cleaning phase; (ii) performing comparative environmental assessments and evaluating sensitivity and variability of the data used.
- 2) Identify innovations that could lead to improved system durability (physico-chemical parameters of dairy products, process parameters, properties of the surfaces constituting the wall of equipment).
- 3) Validate the reliability of the LCA prediction obtained at small scale with respect to higher scale

The work has so far enabled us to identify the environmental indicators relevant to this type of process, as well as the methods by which they can be evaluated. The collection of data for the first results was carried out on the basis of a pilot plant available at INRA. These results have highlighted the main contributors to the generation of the considered impacts, which will be exploited in the second phase of the project, to identify the innovations aimed at reducing the environmental footprint of the industrial process. Finally, the link between the LCA methodology and tools for modeling and optimization of process engineering will be developed.

The main challenge of the project is the development or re-engineering according to an ecodesign approach of the thermization processes used in the dairy industry.

Key words: pasteurization, eco-efficiencies, Life Cycle Analysis (LCA), dairy products