
Development of eco-design tools for wastewater reuse or recycling in the food processing industries: the MINIMEAU ANR project Application to a dairy case study

DELOCHE Y. (1), FARGUES C. (2), ROMDHANA H. (2), GUIGA W. (3), ROUX P. (4), MAESELEE C. (4), GARNIER C. (2), NEMATI-AMIRKOLAI K. (2)

1 CRITT Agroalimentaire SUD , Avignon, France

2 AgroParisTech, Palaiseau, France

3 Le CNAM, Paris, France

4 INRAE, Montpellier, France

In the context of strong and increasing pressure on water uses and punctual water shortage, the food industry currently faces challenges regarding water supply. Most food industry sectors are already engaged in water sparing by implementing good practices or common-sense actions.

The adoption of "good practices" generally results in a 15-20% reduction in water consumption. To go further, it is necessary to modify technological choices, but it is often difficult to find alternatives to water use. Thus, water recycling seems to be a necessary solution to water savings, and in particular the development of short recycling loops within the production line, before effluents mixing and any wastewater treatment plant. Given the complexity of industrial water networks, but also the strict requirements for food product quality and safety issues, implementing appropriate recycling or reuse processes requires well-adapted engineering tools to design and simulate them.

In this context, the French ANR MINIMEAU project (ANR-17-CE10-0015 MINIMEAU, 2018-2021, <https://minimeau.fr>) which associates academic partners (AgroParisTech/UMR SayFood ; INRAE/UMR ITAP), industry (ProSim), food institutes (CTCPA, ITERG, ACTALIA, IFV) and a transfer center (CRITT Agroalimentaire Sud), developed a method summarized as a flowchart, and several eco-design tools. Amongst the tools, one can find:

- a water pinch analysis to identify the major wastewater fluxes to be recycled or reused in order to optimize the water network;
 - an inventory of the main pollutants or "key parameters" encountered, to be monitored or eliminated in the effluents (depending on the food sector);
 - a new simulation module in a commercial software tool (ProSimPlus) to describe membrane processes, the reliability of which was validated thanks to experimental tests at a pilot scale;
 - a water footprint and life cycle assessment (LCA) calculator to ensure that technical solutions implemented for reusing water flows do not result in pollution transfers that exceed the water savings benefits (due to needed energy and infrastructures).
- Scenario propositions were tested in 10 companies with or without treatment (including membrane processes) and a case study on representative, although fictitious, data in the dairy industry showed up to 40 % of freshwater savings.