

1. General remarks

Title

Industrial validation of an ozone based Clean in Place (CIP) system for dairy industries (ECO3CIP).

Partnership

The project consortium is composed by the following partners:

- o AINIA (Ainia Centro Tecnológico): **Project coordinator**. Food safety and environmental consultancy and facilities for microbiology and chemical analysis
- o ESNELAT (ESNELAT S.A.): end user representative of the dairy sector.
- o GRAU (Instalaciones Grau): experts on CIP technologies and specific equipments for food sector.
- o ITT (ITT Water & Wastewater España S.A.): experts on ozone based technologies.

The logo for ainia, with the word 'ainia' in a bold, orange, lowercase sans-serif font.The logo for xylem, with the word 'xylem' in a blue, lowercase sans-serif font, and the tagline 'Let's Solve Water' in a smaller blue font below it.

Founded by

- o The first "Application and market replication projects"
- o Agreement number: ECO/09/256045/SI2.564671
- o www.eco3cip.eu



2. Project summary

Background

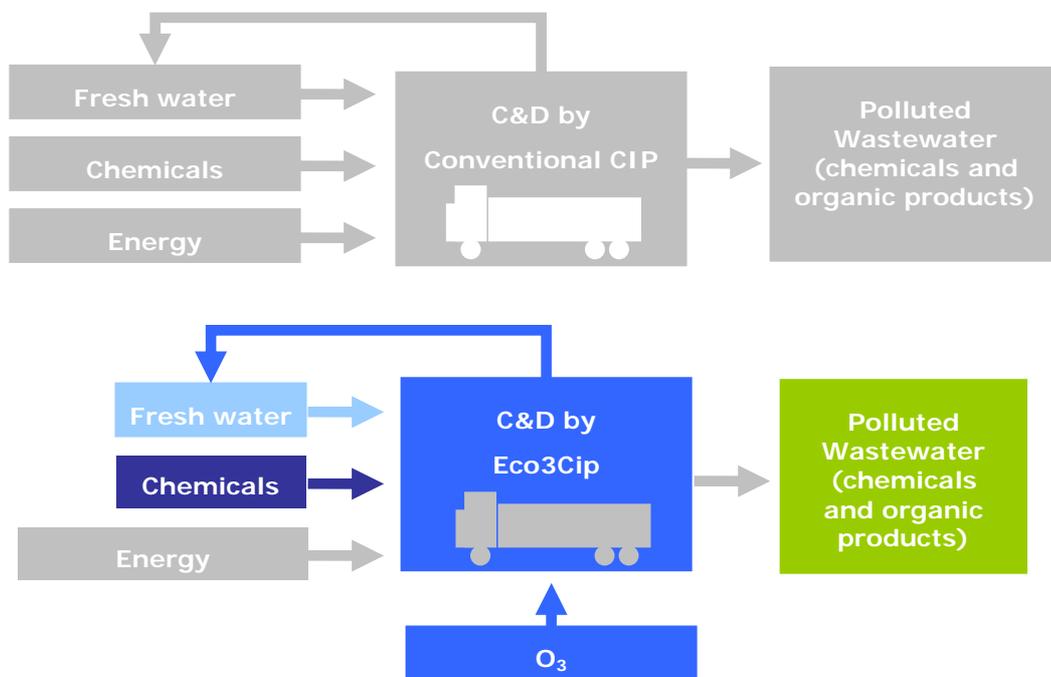
Cleaning and disinfection (C&D) are some of the main concerns of Food Drink industries which nowadays use clean in place (CIP) technologies as one of the main developed for reducing water and disposals. Nevertheless such operations produce a significant environmental impact in terms of water consumption and wastewaters



load. (EUROPEAN COMMISSION- Directorate-General JRC Joint Research Centre – Institute for Prospective Technological Studies-“Reference Document on Best Available Techniques in the Food, Drink and Milk Industries”, January 2006).

However, the organic load and the amount of chemicals can be significantly reduced by incorporating ozone based technologies. On a previous OZONECIP Life project (“Ozonecip” project: LIFE05 ENV/E/000251, awarded as one of the best 2009-2010) has been proven that the incorporation ozone as cleaning agent allows same C&D efficiency but reducing the environmental impact of such processes. Additionally and despite ozone technologies investment cost are somehow higher than current CIP systems, the running costs and the environmental impact are lower. This advantages justifies the evaluation of the technology at industrial scale including also a business plan aimed to promote the implementation of it on the EU dairy sector.

Based on this, a general scheme proposed by Eco3Cip in which conventional vs. ozone based technology are compared, is shown below.



The project has been developed over a three year period (2011-2013) and the proposed system lies on the knowledge gained on the previous OZONECIP project in which the ozone based technology and its environmental advantages have been demonstrated at pilot plant scale.

Eco3Cip aims to integrate an ozone based technology into an industrial CIP scenario (dairy industry) for providing a new C&D system more efficient and environmentally friendly than current practise.

Eco3Cip obtained results have been used to conduct costs an analysis under real conditions and to defining a business plan among the partners for commercializing the system in the close future.



Objectives

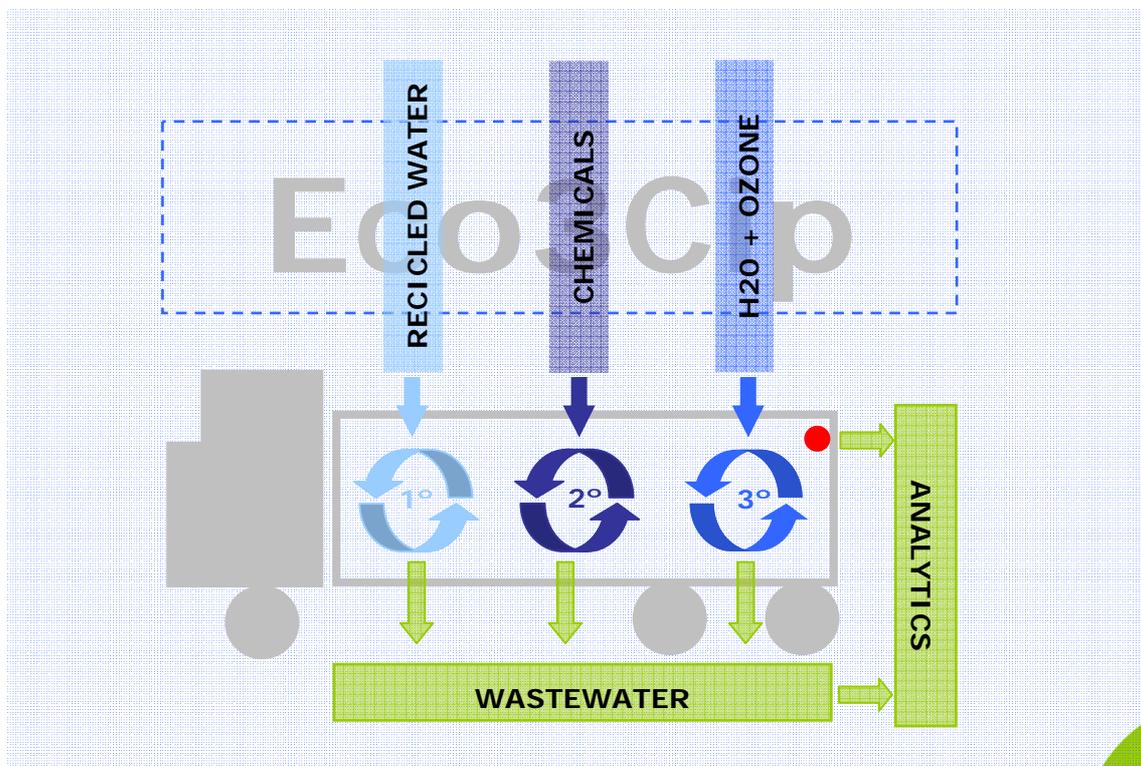
Considering the benefits of ozone (high oxidative capacity, no residue after action) ECO3CIP project aims the following objectives:

- o To validate at industrial scale a significant reduction of water consumption, chemicals, wastewater volume and organic load by keeping same C&D efficiency on dairy installations.
- o To set the basis for commercialisation of the ECO3CIP system.
- o To conduct a broad dissemination of the technology among dairy industries and other related stakeholders.
- o To validate ECO3CIP system as a Best Available Technique candidate among other CIP systems.

3. Methodology & Results

Project methodology

Existing CIP industrial installations of Esnelat have been adapted in order to operate them under ozone based protocols. By using this adapted installations, several C&D cycles have been conducted on milk transportable tankers in order to obtain quantitative data from conventional and Eco3Cip system as well.



From each "run", samples of wastewater (punctual and integrated), last rinse water samples and also from the tankers inner surface, have been taken for quantitative evaluation of several parameters for environmental monitoring (pH, water volume,

chemical organic demand (COD), conductivity, ecotoxicity, etc.) and parameters for hygienic monitoring (residual adenosine tri phosphate (ATP), aerobic mesophilic counts, enterobacteriaceae).

The evaluation of the system has also considered economical aspects related with the implementation of the technology at industrial scale on the dairy sector as: installation costs, economical savings, payback time, etc. aiming to define a business plan for commercialisation of the system in the close future.

Results

After achieving all industrial trials with the ozone based system Eco3Cip and comparing it with conventional CIP systems the following results have been obtained:

- o Significant reduction on the wastewaters organic load due that C&D product remnants (organics and chemicals) are less and better recycled.
- o Significant reduction of the wastewater toxicity.
- o Significant reduction of the water consumption related with C&D processes.
- o Significant reduction of the wastewater generation.
- o Significant reduction of the required chemicals for the C&D processes.
- o Maintenance same hygienic efficiency than conventional.

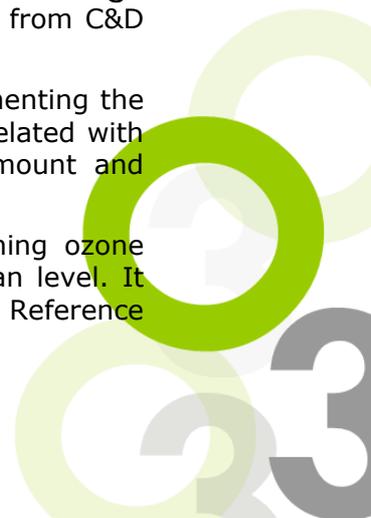
Performance of Eco3Cip vs. conventional CIP	
Environmental indicator	Reduction (%)
Water consumption and wastewater generation	~19
Wastewater COD (mgO ₂ /L)	≥80
Chemicals consumption	~25
Wastewater toxicity	≥70

4. Benefits of the project subject at European level

Ozone use in the European dairy industry may suppose a **competitive advantage** by diminishing **production and environmental related costs** derived from C&D operations.

Is important to highlight that an important economical benefit of implementing the ECO₃CIP technology” derives from savings on the corresponding taxes related with the wastewater disposal which can be reduced by minimising the amount and organic load of those streams.

Additionally ECO₃CIP project provides valuable information for positioning ozone based technologies as C&D Best Available Technology (BAT) at European level. It potential recognition as BAT in future revisions of the European Reference



Documents would significantly help for the broad implementation of more environmental friendly technologies on EU food industry.

The reduction in the environmental impact of C&D activities along with the competitiveness considerations of implementing this ozone based technology may help **to improve the sustainability of the dairy industry in Europe.**

