Cleaning and disinfection operations and the European Reference Documents on BATs

Public report
The Ozonecip Project is a demonstration project that aims to contribute to the achievement of a reduction in the environmental impact of the sanitation operations carried out in the food industry through an innovative sanitation technique based on the use of ozone as an alternative sanitizing agent to other sanitation products commonly used. The demonstration activities will focus on clean in place (CIP) protocols. The potential environmental benefits will be tested in three sectors: brewery, winery and dairy. Three European centres will implement the project: Ainia (Spain) as coordinator, Bionord (Germany) and Gdansk University of Technology (Poland). Three companies will provide their industrial point of view: Allied domecq bodegas (winery), Becks (brewery) and Meiere-Genossenschaft e.G. Langernhorn (dairy).

This document is an output of the Task A Action A.1 consisting on an analysis of BAT reference documents in food industries in order to obtain information about what is already accepted as BAT concerning cleaning and disinfection in this sector. This document is a Public Report that shows some of the main information extracted from the corresponding full reports submitted to the European Commission (Deliverables of the Project).

Acknowledgements

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Reference documents identified and analysed

✓ 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)

✓ Spain- Ministerio de Medio Ambiente- “Guía de Mejores Técnicas disponibles en España del Sector Cervecería” (2005)

✓ Environment Agency for England and Wales with the Scottish Environment Protection Agency (SEPA) and the Northern Ireland Environment and Heritage Service (EHS) “General Guidance for the food and drink sector- Sector Guidance Note IPPC S6.10.” (March 2003)

✓ Food and Drink industry CBMC - The Brewers of Europe- “Guidance Note for establishing BAT in the brewing industry” (October 2002)

✓ FAO (Food and Agriculture Organisation of the united Nations) and WHO (World Health Organisation) “Recommended International Code of Practice. General Principles of food hygiene” “General Requirements (Food Hygiene). Codex Alimentarius” (Supplement to Volume 1B) Food and Agriculture (1997)

✓ Guidelines for the application of Best Available Techniques (BATs) and Best Environmental Practices (BEPs) in industrial sources of BOD, nutrients and suspended solids for the Mediterranean region. United Nations Environmental Programme (UNEP). 2004

✓ Producción respetuosa con el medio ambiente en vinicultura” (Environmental friendly production in winemaking). La Rioja Government. Project LIFE Sinergia (03/ENV/E/000085)

✓ BATs national document for Polish dairy industry was edited by the Ministry of Environmental Protection and published in April 2005
COVERED ISSUES

The different issues covered in the full reports are the following:

- Cleaning and disinfection within the related European BATs reference books
  - General information on cleaning and disinfection in the subsector under analysis
  - Available techniques for cleaning and disinfection (equipment, automation, chemicals)
  - Environmental data on water consumption, wastewater production, energy consumption, other
  - Emerging techniques for cleaning and disinfection

- Cleaning and disinfection within the related national BATs reference books
- Review of other BATs reference books (non-European, other industrial sectors) with potential usefulness for the project implementation or objectives.

In the following pages some of the most interesting information area shown. Extended Reports delivered to the Commission.
In all FDM installations, **BAT** is to do the following:

- Fit cleaning hoses used for manual cleaning with hand operated triggers
- Supply pressure-controlled water and do this via nozzles
- Select and use cleaning and disinfection agents which cause minimum harm to the environment and provide effective hygiene control
- Operate a clean-in-place (CIP) of closed equipment and ensure that it is used in an optimal way by, e.g. measuring turbidity, conductivity or pH and automatically dosing chemicals at the correct concentrations.
- Use single-use systems for small or rarely used plants or where the cleaning solution becomes highly polluted, such as UHT plants, membrane separation plants, and the preliminary cleaning of evaporators and spray driers
- Where there are suitable variations in the pHs of the waste water streams from CIP and other sources, apply self neutralisation of alkaline and acidic waste water streams in a neutralisation tank
- Minimise the use of EDTA, by only using it where it is required, with the frequency required and by minimising the quantity used, e.g. by recycling cleaning solutions
- Avoid the use of halogenated biocides, except where the alternatives are not effective
Maximise the recovery of diluted product from CIP initial rinses, HTST start-up, shut down and change-over and from the rinsing of other equipment and pipework by online detection of transition points between the product and the water phase. This can be done by, e.g. measuring the volume using flow or density transmitters; measuring the density using conductivity transmitters and using scattered light turbidity sensors to differentiate water from product.

For large dairies with highly branched tubing, use several small CIP systems instead of a centralised CIP system.

After the cold stabilisation of wine, re-use the alkaline cleaning solution and when the spent alkaline solution can no longer be re-used and the pH is still high enough to disrupt the operation of the WWTP, apply self-neutralisation or if the pH levels and the flow rate will not disrupt the operation of the WWTP, gradually release the cleaning solution to the WWTP.
in the FDM-BREF it is recognised the importance of food safety in FDM processing. Thus, as well as environmental considerations all FDM production installations must comply with the required food safety standards. These may have an influence on environmental considerations, e.g. frequent cleaning is required and this uses heated water and detergents. This means that cleaning and disinfection is a must within food industries and that will cause an environmental impact, at least in terms of water consumption, waste water generation and, depending on the industry, energy consumption.

2. Key environmental aspects clearly identified and explicitly linked to cleaning operations

The key environmental issues in the FDM industry included in the Reference Document on Best Available Techniques in the Food, Drink and Milk Industry (FDM-BREF) are: “water consumption and waste water production, air pollution related to VOCs and odour, noise, solid output, and energy consumption”.

As far as water consumption is concerned FDM-BREF already says that: “most of the water which is not used as an ingredient ultimately appears in the waste water stream”. (This is the case for cleaning and disinfection waters).

In relation to the use of water for cleaning and disinfection the FDM-BREF states that: “large quantities of water are required for cleaning and disinfection. In many installations this is the main consumer of water, with the amount depending on the type and size of equipment to be cleaned and the materials processed. Cleaning and disinfection produces waste water. In principle, the cleaning and disinfection agents that are used are discharged via the waste water, either in their original state or as reaction products. Also, when cleaning is carried out at elevated temperatures there will be a high consumption of energy to heat water and produce steam”.

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As far as the reference environmental data reported at the FDM-BREF it is admitted that **strong information imbalances and gaps exist**. In general, at the BREF, “the current consumption and emission level data provided were not linked with process descriptions, operating conditions, installation capacity, sampling and analytical methods and statistical presentations”.

Different amount of process and environmental information is already available at the FDM-BREF for brewery, winery and dairy sub-sectors, with the data related to wineries almost inexistent. For the three sub-sectors, almost no environmental data is given in relation to in-process operations and no quantitative data is given in relation to cleaning and disinfection operations in terms of energy, water consumption and waste water production.
4. CIP is considered BAT. Ozonecip should improve the performance of such.

The statement in the BREF in relation to Best Available Techniques (BAT) about cleaning and disinfection, in particular with Clean In Place (CIP) systems, is resumed in the following table in which it is discussed why the “Ozone CIP” technique could be considered more advanced than BAT described in this BREF:

<table>
<thead>
<tr>
<th>BREF</th>
<th>Comparative Ozone CIP potential advantages</th>
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<tbody>
<tr>
<td>5.1.3.9 “select and use cleaning and disinfection agents which cause minimum harm to the environment and provide effective hygiene control” (1)</td>
<td>• because as ozone does not leave any residue since it breaks down into oxygen after its disinfection action:</td>
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<tr>
<td></td>
<td>- Ozone CIP systems allow significant water saving because not final rinse is needed</td>
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<td>- Ozone CIP systems improves final wastewater quality (lower chloride content, it does not generate unhealthy organo-halogen compounds)</td>
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<td>- Ozone CIP could allow to re-used disinfection water flow for the initial cleaning stages, either directly or after re-ozonating it to attain the required quality.</td>
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<td>5.1.3.10 “operate a cleaning-in-place (CIP) of closed equipment and ensure that it is used in an optimal way” (2)</td>
<td>• provides energy savings in CIP systems as it is normally used at low temperatures</td>
</tr>
<tr>
<td>5.1.3.14. “avoid the use of halogenated oxidising biocides, except when the alternatives are not effective” (3)</td>
<td>• as ozone is generated on site as needed, eliminating the need for chemical storage and the risk of accidents.</td>
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<td>• reduce the risk of accidents in the preparation of disinfection solutions.</td>
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<td></td>
<td>• after ozone conversion back into oxygen, an extra concentration of the last is in the wastewater reducing odours and facilitating the biological treatment at the sewer</td>
</tr>
</tbody>
</table>

(1) There are not a explicit mention in section 4.3.8.1 refereed in this BAT to ozone. However, there is a reference to section 4.5.4.8.1 where ozone is considered as an oxidising biocide that “dissipates rapidly after generation, so no chemical residual persist in the treated waste water but its dissolved oxygen content is high. No halogenated compounds are produced. Ozone is also used as an oxidising agent”
(2) So CIP technique is considered as a BAT.
(3) This BAT again refers sections 4.3.8.1 and 4.5.4.8.1 previously described.