



# BACTERIOPHAGES COLLECTED BY CORIOLIS® COMPACT AIR SAMPLER: OZONE DECONTAMINATION EFFICACY OF LACTIC BACTERIOPHAGES IN A DAIRY PLANT

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## / CONTEXT

Bacteriophages or phages are viruses that can infect bacteria. These viruses are present in ecosystems where bacteria can be found. A wide range of food products needs the use of large-scale fermentation process. The manufacture of products such as cheese, sour cream, and buttermilk requires the use of lactic acid bacteria at large concentrations, Lacto-coccus lactis being one of the most important used species.

Lactococcal cultures are susceptible to be infected by lactococcal lytic phages. Mainly three species of these phages are encountered in dairy plants, SK1 (formerly 936-type), C2, and P335. These phages species possess a high tolerance to sanitation treatments and display an aggressive infective nature; they are often responsible for fermentation process issues such as low, delayed or incomplete process and variations in taste and texture of products.

In order to avoid lactococcal infection, it is important to determine the phage concentration in the environment and implement measures to control their levels. The use of ozone as a decontaminating agent has been introduced to the market. Ozone is an unstable gas. Its penetrability, high reactivity, and natural decomposition make ozone the ideal disinfectant to ensure the microbiological safety of elements and equipment, without leaving chemical residues. Ozone is 52% stronger than chlorine, and it has been proven to be more effective on a much larger set of microorganisms than all other disinfectants. In the present study, we report the impact of ozone treatment on the bacteriophages present in the air in a dairy factory.

## / MATERIALS

- Alphatech Mobile disinfection unit C28 N°439
- Coriolis® Compact, Bertin Technologies
- Coriolis® Compact cones and caps, Bertin Technologies

## / PROTOCOL

The volume of the treatment zone was about 1500 m<sup>3</sup>.

The ozone concentration targeted 2ppm/2h during 8h in the absence of workers.

Air samples were obtained by Coriolis® Compact 50L/min flow rate, during 5 hours at indicated times and conditions.

Samples were submitted to DNA extraction and PCR simplex with specific primers against C2, SK1 and P335 phages performed.

## / CONCLUSION

The Coriolis® Compact air sampler can be used to collect microorganisms as small as bacteriophages. It is a useful tool to monitor phages concentration and schedule decontamination treatments to avoid production quality issues in dairy plants. The ozone treatment had an impact on bacteriophages C2. These phages have been described to have a much wider host range compared to SK1 and P335 type. For this reason, it is important to eliminate C2 phages in order to avoid eventual contaminations affecting production.

## / RESULTS

The bacteriophage detection was carried out by simplex PCR specific for Lactococcus lactis phages. The detection limits are from 10<sup>1</sup> to 10<sup>2</sup> phages / ml for Lactococcus phages.

|                                       | C2 phages /ml | SK1 phages /ml | PP35 phages /ml |
|---------------------------------------|---------------|----------------|-----------------|
| Control                               | undetectable  | undetectable   | undetectable    |
| Before O <sub>3</sub> treatment       | 1000          | 100000         | 1000            |
| Just after O <sub>3</sub> treatment   | 10            | 1000           | 10              |
| 2 days after O <sub>3</sub> treatment | 100000        | 100000         | 1000            |
| After second O <sub>3</sub> treatment | 10            | 100000         | 0               |

Table 1. Ozone treatment had an impact on bacteriophages C2 type after each treatment the values went down to 10 phages /ml. SK1 type population seems to be hard to reduce, due either to higher contamination or resistance to this ozone treatment (under these experimental conditions). The second treatment did not seem to have an impact.



Fig 1. Coriolis® Compact on dairy plant facilities and Alphatech Mobile disinfection unit C28 N°439

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