

## **Thermal stability of *Lactococcus lactis* bacteriophages: evaluation of phage inactivation in a pilot plant pasteurizer**

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### **Abstract**

Bacteriophages are a frequent cause for fermentation problems in dairies. When bacteriophages infect lactic acid bacteria, slow or incomplete fermentation may occur resulting in significant financial losses. It has previously been shown that phages of *Lactococcus lactis* starter strains may reveal a remarkably high thermal stability under laboratory conditions (i.e., in 1.5-ml stainless-steel test tubes in a water bath), and the most resistant phages were still detectable in skim milk after heating for 5 min at 95°C and 97°C, respectively<sup>[1]</sup>.

The aim of this study was to determine the thermal inactivation of lactococcal phages suspended in high titers in raw milk using a pilot plant pasteurizer (sample volume: 30 l, continuous flow principle) described earlier<sup>[2]</sup>. Phages of two phage species with highest thermal stability (small isometric-headed phages P680 and P1532 of the 936 phage species, prolate-headed phage P635 of the c2 species) were included, in addition to the heat-sensitive reference phage P008. The titer of the later phage decreased after heating for 25 sec at 75°C by 5 log units, whereas phages P635, P680, P1532 required for significant inactivation ( $\geq 99,99\%$  after 25 sec heat treatments) temperatures of 80°C (6-log units reduction), of 95°C (5-log units reduction) and of 97.5°C (4-log units reduction), respectively. Thus, thermal inactivation of phages in the pilot plant pasteurizer is notably more efficient than treatment under laboratory conditions used for screening of phages with high thermal resistance. However, even under pilot plant conditions, high temperature & short time pasteurization does not appear to be a hurdle for temperature-insensitive lactococcal phages.

<sup>[1]</sup> Atamer, Dietrich, Müller-Merbach, Neve, Heller (2009) *Int. Dairy J.* 19:228-235.

<sup>[2]</sup> Peng, Hummerjohann, Stephan, Hammer (2012) *J. Dairy Sci.* 96:3543-3546.

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### *Abstract für:*

**11th International Symposium on Lactic Acid Bacteria: Health, sustainability, diversity, and application - A meeting on the fundamentals and application of the most important bacteria used in food and feed production.**  
Congress Centre "Hotel Zuiderduin", Egmond aan Zee, the Netherlands  
August 31 to September 4, 2014.