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Membrane separation technology to eliminate bacteriophages in whey

Meike Samtlebe[1], Natalia Wagner[2], Erik Brinks[2], Horst Neve[2], Knut J. Heller[2], Jörg Hinrichs[1], Zeynep Atamer[1]

[1] Institute of Food Science and Biotechnology, Department of Dairy Science and Technology, University of Hohenheim, Stuttgart, Germany
[2] Department of Microbiology and Biotechnology, Max Rubner-Institut, Kiel, Germany

Cheese whey that incurs during production of cheese can be transformed into diverse native whey protein supplements and directly used to optimize processes and to develop new products in the dairy industry, which has economical and environmental advantages. However, cheese whey may contain bacteriophages in numbers which limit its applications. Phages are still responsible for most fermentation failures in the dairy industry. In previous studies, heat inactivation of phages has been studied in detail, and it was shown that most phages survive pasteurization [1]. In principle, a reliable thermal inactivation of heat resistant phages is possible in whey, but such a harsh heat treatment leads to a significant denaturation of whey proteins. Therefore, the aim of this work was to establish a non-thermal technology for phage reduction in whey, in order to guarantee a high percentage of native whey proteins.

A cross-flow membrane filtration process was designed and recently set up to separate whey proteins from whey-derived phages while keeping the proteins in their native form. The performance of the filtration process was characterized in terms of phage retention, total protein permeation as well as permeation of the major whey proteins. At first, the effect of pore size of the membrane on the removing efficiency of phages was investigated. Experiments conducted with in dairies widely distributed *Lactococcus lactis* phages P008 have confirmed that a reduction of 4.4-log units is possible using a 100 kDa membrane. The value for the protein permeation amounted to 32%. Furthermore, the effects of bacteriophage morphology and the formation of a surface layer on the retention of phages were analyzed in detail. First results of this cooperative project will be presented and discussed.

[1] Atamer, Neve, Heller & Hinrichs (2012): thermal resistance of bacteriophages in the dairy industry. *In*: Bacteriophages in dairy processing (Quiberoni & Reinheimer, eds), pp. 195-214, Nova Publishers, Hauppauge, NY, USA.