Encapsulation and controlled release of bacteriophages to modulate the human gut microbiota

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Various studies have proposed an interrelation ship between the gut microbiome and human health and diseases. In this regard, bacteriophages have been discussed to modulate the microbiota associated with the human gastrointestinal tract. The phage population in humans is specific to individuals and thus a personalized feature. Phages in food systems, which may alter the composition of the gut microbiota, are gaining increasing interest. Phages are ubiquitous and natural predators of bacteria. Furthermore, phages have a narrow host range, thus they may be selected to not disturb the healthy intestinal flora. Nevertheless, the application of phages in food products faces numerous challenges, i.e., limited host ranges, bacterial resistances to phages, manufacturing issues and delivery systems. Although the use of phages against pathogens on food surfaces (post-harvest) and in live animals (pre-harvest) has been studied, it has been reported that the efficient effect of pre-harvest use was reduced due to the sensitivity of some phages to the chemical composition of the gastrointestinal tract. Our hypothesis is that phages can be microencapsulated in such a way that they survive the passage through the gastrointestinal tract and are released in active form in the intestine.
Different methods for encapsulation of infective phage particles were tested and optimized. A commonly studied dairy phage, i.e., *Lactococcus lactis* phage P008, was used as model phage for the experiments. Phage microcapsules were prepared either by the emulsion method (e.g. rennet gelation of milk proteins) or by the extrusion method (e.g. calcium alginate whey protein). The stability of encapsulated phages was compared to non-encapsulated phage controls. The sensitivity of the encapsulated and free phages to simulated gastric fluid (pH 2) as well as the release of the phages from the microspheres by exposure to simulated intestinal fluid (pH 6.8) was determined *in-vitro* within 2 hours. First results of this project will be presented and discussed.