Ex vivo digestibility of protein based encapsulation devices

André Brodkorb[1*], Sinead Doherty[1], Vivien L. Gee, Mark A. Auty and Catherine Stanton[1,2]

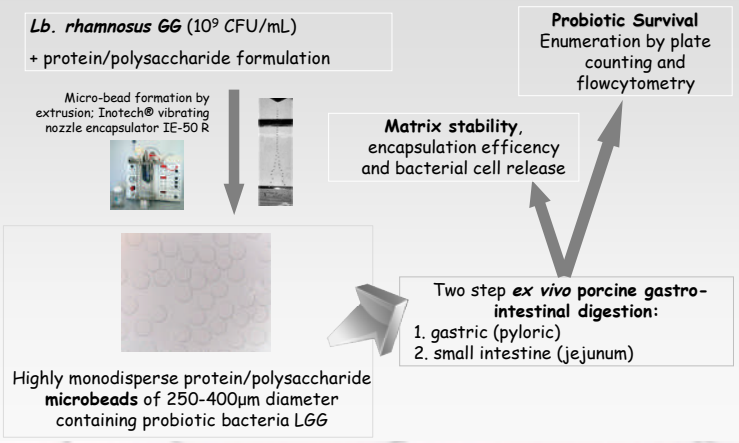
[1] Moorepark Food Research Centre, Teagasc, Moorepark, Fermoy, Co. Cork; [2] Alimentary Pharmabiotic Centre, Cork, Ireland
*Corresponding author: andre.brodkorb@teagasc.ie

Abstract

The recent escalation in consumer health awareness has lead to an explosive growth of functional foods, with major emphasis on probiotic products. However, viability of probiotics presents numerous technological challenges for industrial producers. Ultimately, this has created demand for novel encapsulation strategies within the food industry. The ability of whey proteins to form cold-set gels opens interesting opportunities for whey proteins as cost-effective carriers of probiotics. Thus, the core **objective of this study** was the development of immobilisation techniques for the production of protein based carrier systems, for enhanced probiotic protection. An immobilisation technique was developed involving microencapsulation of *Lactobacillus rhamnosus GG* in highly dispersed micro-beads, using a protein based formulation in combination with polysaccharides. Bacterial loading and encapsulation efficiencies of the micro-beads were optimised for the bacterial strain.

Stability and digestibility of the protein based matrix was assessed by *ex vivo* porcine gastric contents (pH 2.0 to 3.4) at 37°C by size-exclusion HPLC and confocal fluorescence microscopy. High stability of micro-beads was observed during extended periods of time. Subsequent exposure to *ex vivo* porcine content of the small intestine lead to a complete disintegration of the protein matrix with in less than 30 min, with complete release of the probiotic bacteria, making it possible to envision microencapsulated food ingredient based on this formulation.

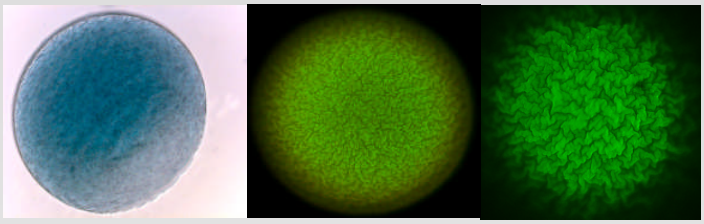
Material and Methods



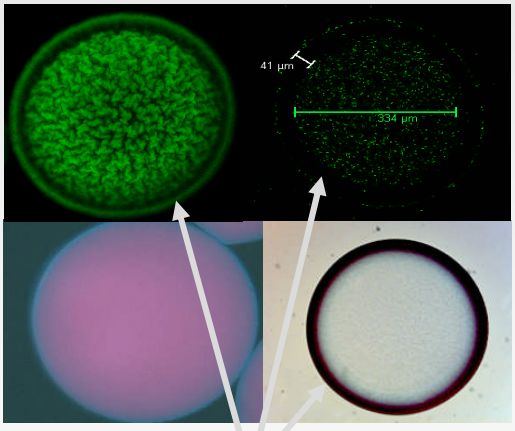
Results

Microbead morphology

confocal fluorescence and light microscopy



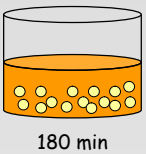
- High encapsulation efficacy (>95%)
- Highly porous surface topography
- High storage stability in liquid phase

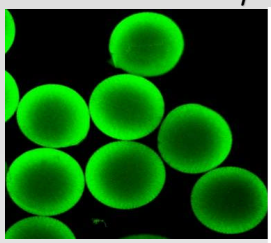


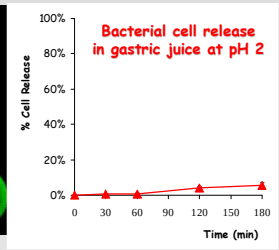
Coating by electrostatic deposition for additional protection of sensitive probiotic bacteria

Ex vivo porcine gastro-intestinal digestion

1. Gastric incubation at pH 2

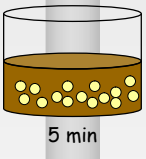


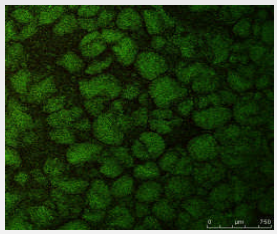


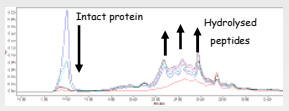


- High stability of microbeads in gastric juice at pH 2
- Low release of probiotic bacteria into serum

2. Intestinal digestion at pH 7.2

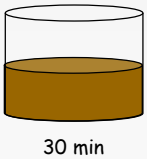


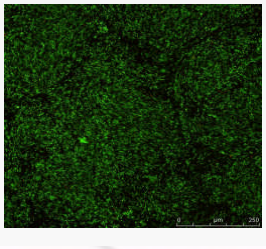


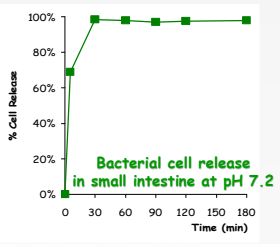


Size exclusion- HPLC of protein in protein/polysaccharide matrix

- Proteolytic hydrolysis of protein matrix
- Complete breakdown of bead structure and release of bacteria







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