Project number: 5457
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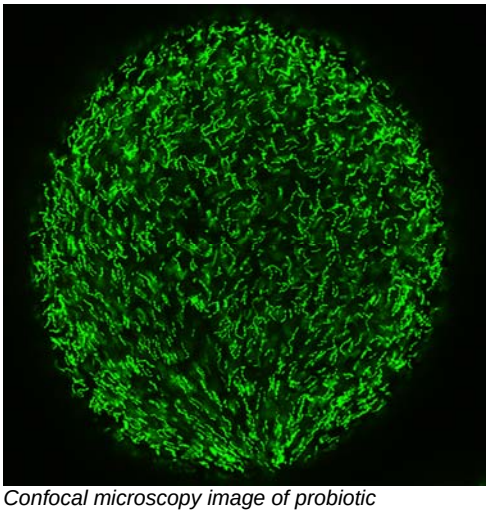
Novel Gel-encapsulation Technology



Confocal microscopy image of probiotic bacteria entrapped in a gel micro-bead.

Key external stakeholders:

Food/Medical food, pharmaceutical and animal feed companies, biotechnology start-up companies, scientific community

Practical implications for stakeholders:

A novel gel-encapsulation technology was developed, which would be of interest to companies wishing to incorporate sensitive components, including probiotics, into their products. Encapsulation matrices are suitable for incorporation into liquid of high moisture food/feed.

Main results:

A novel gel-encapsulation technology was validated for the protection of probiotic bacteria but would also be suitable for other sensitive ingredients such as peptides or phytochemical compounds. Gel-encapsulation ensured high probiotic viability during extended storage in fruit-based products, such as cranberry juice. *In vivo* gastro-intestinal transit demonstrated delivery of high numbers of live probiotic bacteria to the lower intestine.

Opportunity / Benefit:

A patent application has been filed by Teagasc covering process conditions for generating gel microbeads and application of the encapsulation method. Teagasc is seeking partners for commercialisation of the technology with a view to licensing.

Collaborating Institutions:

UCC

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Teagasc project team: Dr André Brodkorb (PI)
Dr Catherine Stanton (PI)
Prof Paul Ross
Sinéad Doherty (WF)
External collaborators: Prof Ger Fitzgerald (UCC)

1. Project background:

Health-promoting ingredients, such as probiotic bacteria, must be active and intact at the point of consumption to achieve a positive health effect on the host and to support health claims. However, bacteria can exhibit high mortality rates during storage and transit through the upper gastro-intestinal tract, which may result in a reduction or complete loss of its health impact.

2. Questions addressed by the project:

Are encapsulated probiotic bacteria still viable during:

- storage at elevated temperatures?
- storage in fruit-based products?
- *in vivo* gastro-intestinal digestion?

Is encapsulation technology suitable for a wide range of sensitive ingredients?

3. The experimental studies:

A novel encapsulation method was developed and validated, which showed enhanced stabilisation of probiotic bacteria in liquid (non-dried form), so as to survive and remain functional during storage and gastric transit. These novel gel-microbeads were tested for probiotic stability during long term-storage and subsequent gastro-intestinal transit (*in vitro, ex vivo* and *in vivo*).

4. Main results:

- A novel gel-encapsulation technology was developed using whey protein-based matrices with optional coating.
- Encapsulation of probiotics can ensure high viability during storage and gastro-intestinal transit; *in vivo* trials showed up to 4 log cycle increase in viable probiotics in the porcine intestine.
- Encapsulation of probiotics can ensure high viability during storage in fruit-based products, including red berry products such as cranberry juice.
- Gel-encapsulation can be used as platform technology for inclusion and protection of a wide range of sensitive bioactive compounds.
- Delayed release mechanism can be achieved for targeted delivery of bioactives and probiotics to the gut.

5. Opportunity/Benefit:

A patent application has been filed by Teagasc covering process conditions for generating gel microbeads and application of the encapsulation method. This technology would be of interest to food/medical food, pharmaceutical and animal feed companies wishing to incorporate sensitive components including probiotics into their products. Validation and optimisation for specific commercial solutions may be required we are currently seeking partners for such commercialisation with a view to licensing.

6. Dissemination:

The research project resulted in 7 peer-reviewed publications, 1 patent, 1 book chapter, 6 oral presentations at international conferences (2 invited) and several prizes and awards for Sinéad Doherty and André Brodkorb.

Main publications:

Brodkorb *et al.* (2010). Method of Producing Microbeads. Patent Aplication number WO2010119041 (A2)

Doherty *et al.* (2010) Use of viability staining in combination with flow cytometry for rapid viability assessment of Lactobacillus rhamnosus GG in complex protein matrices. Journal of Microbiological Methods 82(3) 301-310.

Doherty *et al.* (2011) Development and characterisation of whey protein micro-beads as potential matrices for probiotic protection. Food Hydrocolloids 25(6) 1604-1617.

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Popular publications:
Bioencapsulation Innovation Newsletter (http://bioencapsulation.net/)

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