



An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

2019RP312 - A simple method of encapsulation for food

Final Report

This project was funded under the Department of
Agriculture, Food and the Marine Competitive Funding
Programme.

SUMMARY

A SIMPLE METHOD for encapsulation of bioactive compounds was developed and improved (invention disclosure No. IDF2018584, IDF2019147). This low-tech method, based on health promoting soluble fibres has potential application for a range of dairy and non-dairy-based products. The encapsulation process was sufficiently simplified so it can be used and adapt for industrial processes. The process can be used for the development of new and fortified products. In addition, the process was simplified to further decrease the cost of encapsulation of bioactives and to improve the food products. The simple, robust and scalable encapsulation method uses food-grade and “clean” materials. This technology can be adapted to the different food industries for the production of cheese, yogurt, dessert, beverages etc.

This project addressed some of the existing shortcomings of the encapsulation process in order to increase likelihood of a successful technology transfer, namely:

- (i) Formulation: Optimisation of the encapsulation matrix of micro and macro-beads using different grades or blends of polysaccharides; the cost of manufacturing was substantially reduced while retaining the integrity and functionality of the beads.
- (ii) Process optimization: The methods were adapted for the different applications while keeping the ease and robustness of the process.
- (iii) Applications: Prototypes of encapsulated bioactive were produced and evaluated for a range of applications.

KEYWORDS

Encapsulation, bioactives, polysaccharide, novel technology, dairy.

ACRONYM

FoodEnCaps

PROJECT COORDINATOR, INSTITUTION

Dr André Brodkorb, Teagasc.

EMAIL

andre.brodkorb@teagasc.ie

PUBLICATION DATE

November 2022.

Section 1 - Research Approach & Results

Start Date

01 September 2020

End Date

31 December 2021

Research Programme

Food Institutional Research Measure

TRL Scale

TRL 7: System prototype demonstration in operational environment

NRPE Priority area

Food for Health

Total DAFM Award

€99,850.72

Total Project Expenditure

€89,435.89

Rationale for undertaking the Research

Encapsulation is a technology to protect a substance or organism from processing, storage and gastric passage and to control the release at the target site intact. Encapsulation methods for (1) producing microbeads from dairy proteins and (2) protein/polysaccharide mixtures were previously developed at Teagasc, leading to IP with subsequent licencing to a high-potential Irish start-up company. As encapsulation is a specialised field of R&D, three criteria of critical importance were identified for successful technology transfer of any encapsulation method to Irish food and ingredient companies.

- (i) Cost of encapsulation materials and process - Value
- (ii) Ease of production and robustness of technology – Low Tech
- (iii) Diversification of application – One for All

Teagasc researchers have developed a SIMPLE METHOD for encapsulation of bioactive compounds (invention disclosure No. IDF2018584) and further developed (IDF2019147). This low-tech method, based on health-promoting soluble fibres has potential application for a range of dairy and non-dairy-based products. This project addressed some of the previous shortcomings for a successful technology transfer, namely:

- (i) Formulation
- (ii) Process optimisation
- (iii) Applications and development of prototypes

Methodology

In this project, a novel method for encapsulation and protection of water and oil-soluble bioactives was developed, which is suitable for several dairy foods. The method is highly novel, innovative, scalable and was recently protect in form of a patent application.

The method can now be evaluated by food producers. The polysaccharides were used to develop formulations to make macro/micro beads by extrusion methods. The developed method is new, and two inventions have been filed (No. IDF2018584, IDF2019147) outlining the technology. One patent application was submitted on 5 May 2022 to the European Patent Office (Official European application number EP22171944.6).

The concept has been developed on lab scale and applied to several consumer foods including cheese. The technology is also sufficiently simple that it can easily be scaled up.

Project Results

A novel and simple method for the encapsulation of bioactives was developed, with potential application for a range of dairy and non-dairy-based products.

The encapsulation process is sufficiently simple so it can be used and adapted for industrial processes. Three different food-grade and “clean” formulations with variations thereof were developed and tested with a number of food systems e.g., cheese, yogurt, dessert, beverages etc. The encapsulation process was substantially simplified to further decrease the cost of encapsulation, which is a hindrance to many other encapsulation processes.

The technology was submitted as a patent application to the EPO (application number EP22171944.6).

Due to the necessary protection of IP, relatively little detail is given in this report. Any further details can be requested from the project coordinator Andre Brodkorb (andre.brodkorb@teagasc.ie) once a non-disclosure agreement is in place.

Section 2 - Research Outputs

Summary of Project Findings

Fortification of dairy products is a growing market, expected to increase to US \$150 billion by 2026, with consumers expecting everyday food products to deliver enhanced nutritional functionality. In contrast to this growing need, there is a market desire to minimise the amount of processing in consumer food products. The challenge for food producers is to meet both these needs simultaneously.

The technology developed during this project offers a bioactive encapsulation approach in dairy and whey-based ingredients as well as non-dairy food products with minimal use of additional ingredients that require less processing steps to render the product safe for human consumption.

Advantages of Technology:

This novel process offers a facile approach to incorporate encapsulated bio-actives into dairy products.

The novel technology:

- Requires only food grade ingredients
- Fewer production steps
- Is applicable in a variety of dairy products, including milk, cheese, yogurt, drinking yogurt etc.
- Has successfully encapsulated key bioactives such as black carrot extract, beta-carotene and red cabbage extract
- Has been demonstrated functionality in several food products including yogurt, cheese, milk, baked goods containing dairy

Development Stage:

This technology has been extensively demonstrated in a range of dairy and whey-based food products:

- A. Yoghurt prepared with encapsulated black carrot extract
- B. Cheese prepared with encapsulated β – carotene

Summary of Staff Outputs

Research Output	Male	Female	Total Number
Post Doctorates	0	1	1

Summary of Academic Outputs

Research Outputs	Total Number	Details
Other	1	A scientific manuscript will be submitted once the IP is fully protected, and scientific details can be disclosed.

Intellectual Property

Intellectual Property Status:

Patent application filed by Teagasc in 2021, claiming a novel method of encapsulating bio-actives and preparing bioactive encapsulated dairy-based ingredients for application in dairy, cheese and yogurt production. Official European application number EP22171944.6

Teagasc is currently seeking partnerships with interested company/companies (existing and start-ups) to commercialise this technology.

Summary of other Project Outputs

Project Outputs	Details	Total No.
New Technology	<ul style="list-style-type: none">The developed method is new, and an invention has been filed with the Teagasc TTO (No. IDF2019147)A Patent application was filed by Teagasc in 2021, claiming a novel method of encapsulating bio-actives and preparing bioactive encapsulated dairy-based ingredients for application in dairy, cheese and yogurt production. Official European application number EP22171944.6	2

Potential Impact related to Policy, Practice and Other Impacts

Impact	Details
Industry	Teagasc is currently seeking partnerships with interested company/companies (existing and start-ups) to commercialise this technology.

Dissemination Activities

Activity	Details
Other	<p>A commercialisation offer "T-Offer" was published on the Teagasc website and is circulated to potential commercial partners.</p> <p>https://www.teagasc.ie/about/research--innovation/engage-with-us/commercialisationopportunities/novel-low-cost-micro-encapsulation-tech-for-dairy/</p>

Knowledge Transfer Activities

Identify knowledge outputs generated during this project.

The developed encapsulation technology is new, simple and scalable. The technology has been deemed patentable and can be protected as a patent

Identify any knowledge transfer activities executed within the project.

A commercialisation offer "T-Offer" was published on the Teagasc website <https://www.teagasc.ie/about/research--innovation/engage-withus/commercialisation-opportunities/novel-low-cost-micro-encapsulationtech-for-dairy/> and is circulated to potential commercial partners.

List any impacts resulting from the knowledge transferred during the project.

Teagasc is currently seeking partnerships with interested company/companies (existing and start-ups) to commercialise this technology.

Section 3 - Leveraging, Future Strategies & Reference

Leveraging Metrics

Type of Funding Resource	Funding €	Summary
EU R&I programmes	€106,000.00	The coordinator Andre Brodkorb has successfully secured funding under the Eu Horizon 2020 MCS-RISE call 2019. The topic of the project is: ENCAP4HEALTH (872019) - Innovative sustainable ENCAPsulation systems for improving human HEALTH and well-being. The project is coordinated by TU Berlin, Andre Brodkorb is the Irish lead. Total value: €607.000 Value for Teagasc: €106,000

Future Strategies

Teagasc is currently seeking partnerships with interested company/companies (existing and start-ups) to commercialise this technology. It is the ambition to licence the technology to an Irish or international commercial partner.

Project Publications

1. Commercialisation offer "T-Offer", published on the Teagasc website <https://www.teagasc.ie/about/research-innovation/engage-with-us/commercialisation-opportunities/novel-low-cost-micro-encapsulation-tech-for-dairy/>