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For quality of life

Food-grade microcapsules for post-stomach targeted delivery: an overview of recent approaches

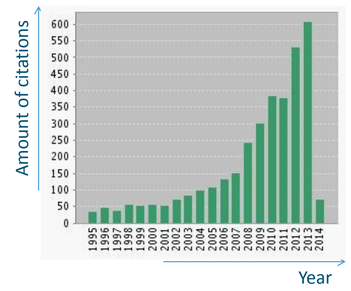
Meinou Corstens[1a], Claire Berton-Carabin[1a], Renko de Vries[1b], Freddy Troost[2], Ad Masclee[2], Karin Schroën[1a]
[1]Wageningen University, Department of Agrotechnology & Food Sciences, a)Food Process Engineering and b)Physical Chemistry and Colloid Science group [2]Maastricht University Medical Centre

Introduction

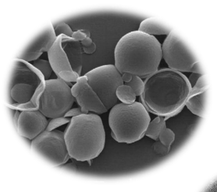
Interest has been rising in smartly designed encapsulation system for food applications, to achieve controlled post-stomach delivery of functional ingredients, so that they can produce a desired physiological or physical-chemical effect. A range of materials and techniques have been investigated for the production of microcapsules that respond to a specific release trigger.

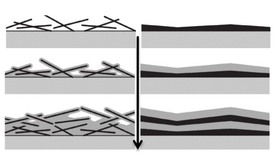
Relevance

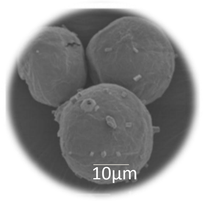
This graph shows the results of a search conducted on the Web of Science on March 18th 2014 for the topic "capsule AND delivery AND food". The amount of citations increased substantially over the last decade; our findings are summarised in this poster.

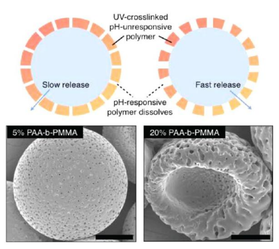


Main published experimental studies on microencapsulation systems









Encapsulation material

- (Solid)(Nano) particles[1–4 5 6]
- Biopolymers [13–16]
- Synthetic copolymers [9–12]
- Low MW emulsifiers [7,8]

Functional ingredient

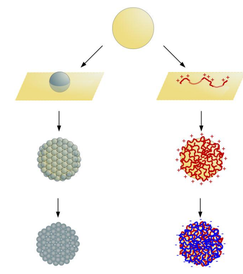
- Probiotics [29–32]
- Poly-unsaturated fatty acids [2,25]
- Antioxidants [17]
- Vitamins [7]
- Other bioactive components [25,28,32–34]
- Flavours [35,36]

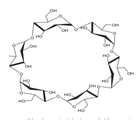
Release trigger

- pH [12,18,39,40]
- Mechanical stress
- Enzymes [22,37]
- Ultrasound [38]
- Temperature [41]
- Ionic strength

Encapsulation technique

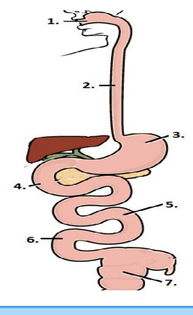
- Spray drying
- Emulsion based [8,15,25,26]
  - Pickering stabilization [5]
  - Self-assembling [42]
  - Layer by layer [6,21–24]
  - Fibrillar structures [18,19]
  - Induced by solvent change/removal [20]
- Fluid bed coating
- Extrusion
- Supercritical fluid
- Coacervation [27]
- Liposomes [28]





Physiological fate of the encapsulate

Orally taken microcapsules have to face various challenging environments in the human digestive system (1.mouth; 2.oesophagus; 3.stomach; 4.duodenum; 5.jejunum; 6.ileum and 7.colon), including acidic pH, a range of degrading enzymes, the presence of bile salts and mechanical stresses.



The approach of current PhD project

This project was initiated to design and test an encapsulation system that releases functional ingredients in the ileum. As a start, approaches that have previously been attempted for targeted delivery have been reviewed. In our project, key requirements include the use of food grade ingredients, and the delivery of lipophilic molecules. Therefore, an O/W emulsion with multi-layered interface to control digestion seems like a promising system. The digestion and release from the microcapsules will be tested both *in vitro* and *in vivo*, which constitutes a strong point for assessing their performance and relevance as food supplements.

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PhD student: Meinou Corstens
Wageningen University
Food Process Technology group
Visiting address: Bornse weilanden 9
6708WG Wageningen
Contact: **meinou.corstens@wur.nl**

WAGENINGEN UR *For quality of life*
The Graduate School VLAG
Maastricht University