Encapsulation of iron for fortification of plant protein-based structured food

Duque Estrada, P.; Pierucci, A. P. T. R.; Berton-Carabin, C.; Van Der Goot, A. J.

Background

Increased meat consumption per capita and global population growth has resulted in an overall increase of global meat production and consumption. This tendency puts serious pressure on the environment as livestock production is one of the major causes of greenhouse gas emissions (1). Therefore, new sources of proteins to replace meat have become a topic of research during the past years. However replacing meat is not trivial. It is relevant to consider some aspects like the unique structure and the nutritional profile. Since meat is a source of iron due to the more bioavailable molecular form compared to other food, fortification of meat replacers with iron is a promising strategy to turn these products into healthy alternatives to consumers. However, iron is a transition metal which can promote lipid and protein oxidation, and hence alter the nutritional and organoleptic characteristics of food products. A solution could be to encapsulate iron and hence to prevent such alterations in the final product, while keeping iron bioavailable after ingestion. Therefore, the aim of this project is to produce stable iron encapsulates to fortify plant protein-based structured foods.

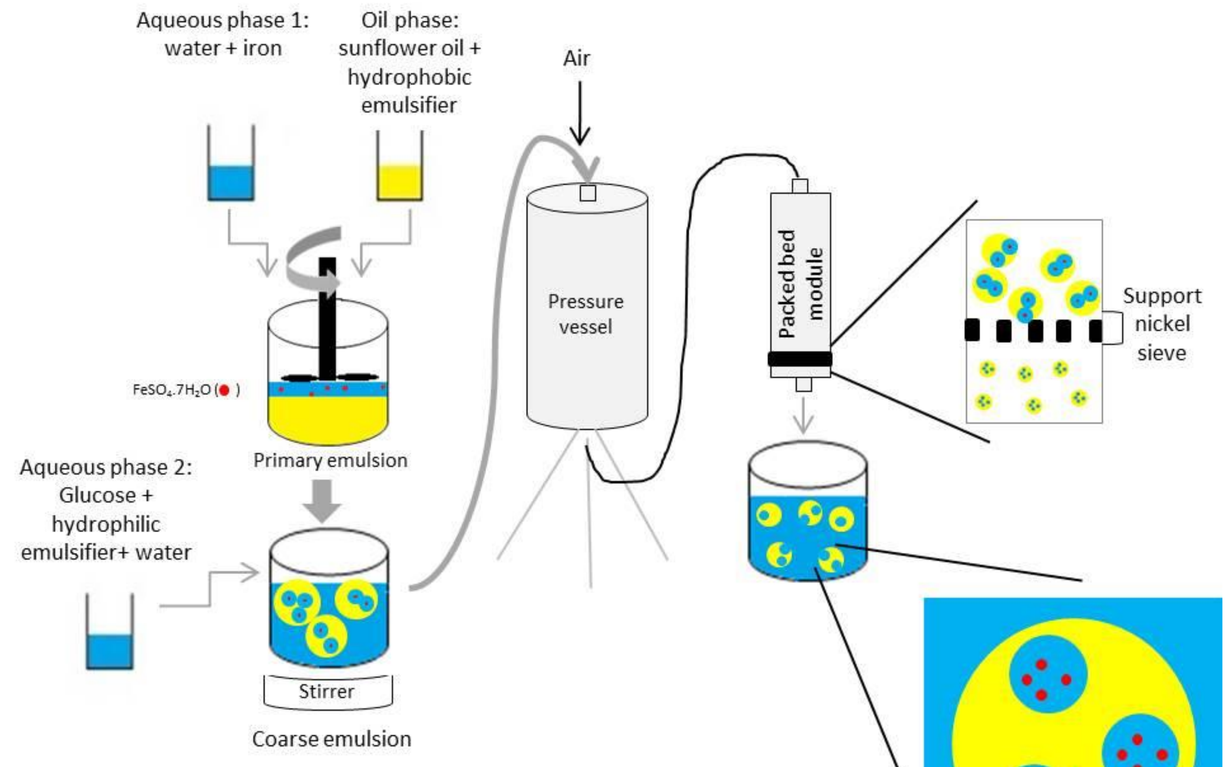
Approach

Spray-dried microcapsules, liposomes and double emulsions will be tested as encapsulation systems to obtain stable ferrous sulfate microencapsulates, leading to high bioaccessibility of iron and minimizing nutritional and sensorial degradations in structured plant protein-based products. We will investigate their encapsulation efficiency (EE) and physical stability, not only after preparation but also after incorporation into plant protein-based matrices made in a shearing device, and over storage.

Methods

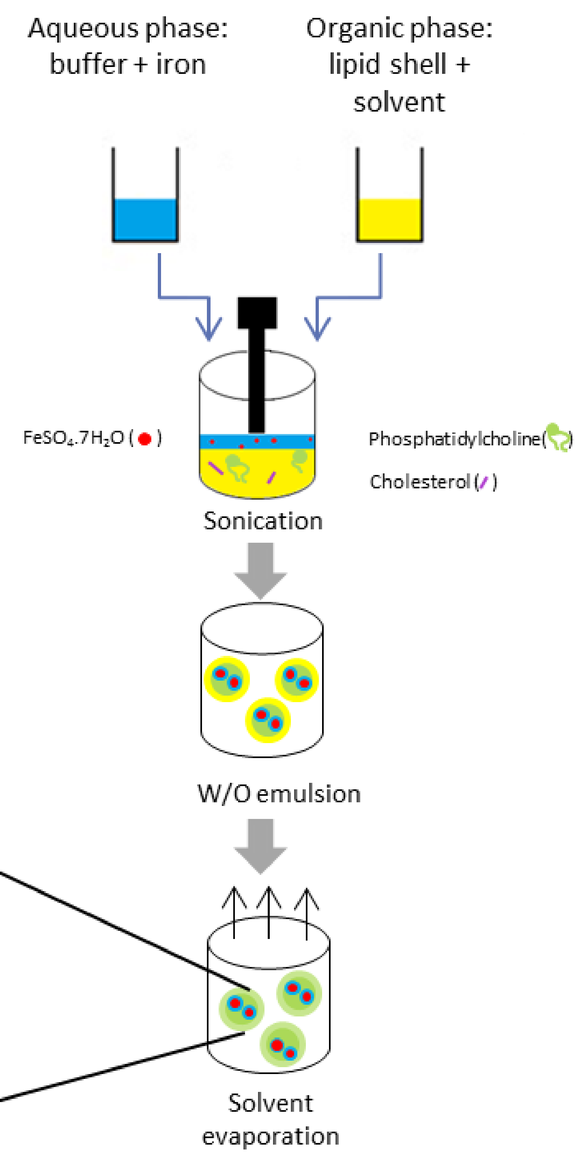
Double emulsions

Premix emulsification



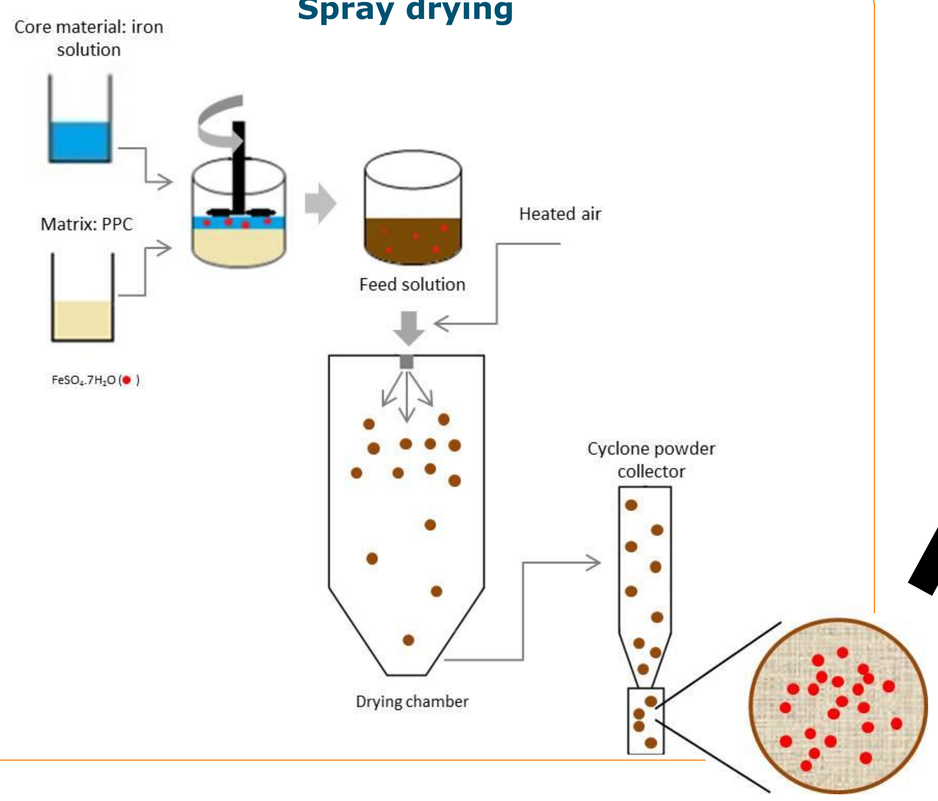
Liposomes

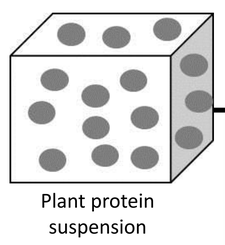
Reverse-phase evaporation

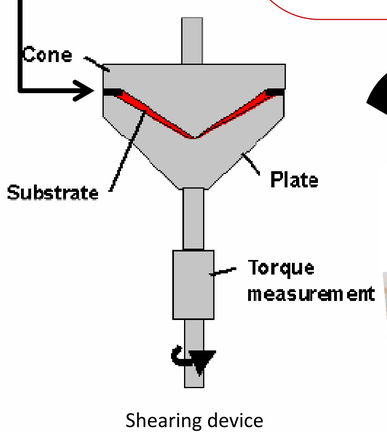


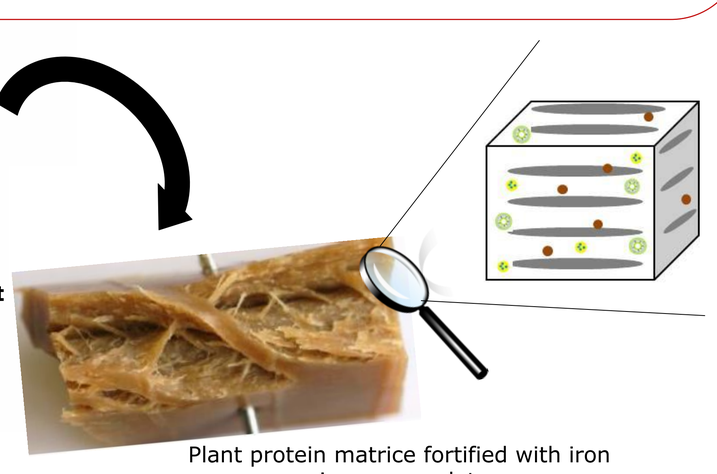
Spray-dried particles

Spray drying









Plant protein matrice fortified with iron microencapsulates

Concluding remarks

Three different systems to encapsulate iron will be tested in order to choose which one will be more suitable to fortify plant protein-based structured food. For this we will consider EE, stability during shearing process and over storage, and bioaccessibility of the iron microencapsulates. The ultimate goal of this project is to be able to produce not only sustainable but also healthy plant protein-based structured food.

Wageningen University, Food Process Engineering Group
P.O. Box 17, Bornse Weilanden 9, 6708 WG Wageningen, The Netherlands
E-mail: patricia.duqueestrada@wur.nl
☎ +31 03174 82240

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References

1. Vranken et al. Curbing global meat consumption: Emerging evidence of a second nutrition transition. Environmental Science & Policy, 3 9, 9 5 – 1 0 6, 2014.