

Encapsulation and delivery of carotenoids-rich extract from tomato pomace in a prebiotic matrix

Cláudia Duarte^a, Sara Beirão-da-Costa^{a,b}, Ana I. Bourbon^b, Ana C. Pinheiro^b, Ana Teresa Serra^c, Margarida Moldão-Martins^a, António A. Vicente^b, Catarina M.M. Duarte^c, Maria Luisa Beirão-da-Costa^a

^a CEER – Biosystems Engineering. ISA. Technical University of Lisbon. Tapada da Ajuda. 1349-017 Lisboa, Portuga (lbeirao@isa.utl.pt)

^b IBB – Institute for Biotechnology and Bioengineering, Centre of Biological Engineering, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal (avicente@deb.uminho.pt)

^c Instituto de Biologia Experimental e Tecnológica, Avenida da República, Quinta-do-Marquês, Estação Agronómica Nacional, Apartado 12, 2781-901 Oeiras, Portugal (cduarte@itqb.unl.pt)

INTRODUCTION

Microencapsulation involves coating or entrapment of one material into another material or system. Encapsulation may be used to protect a given molecule from an adverse environment and/or to produce complexes exhibiting controlled release or targeted delivery of the core material.

Carotenoids are often added to food products in order to provide protection against chronic and age-related diseases. They may also be utilized to protect the sensory and nutritive quality of the food itself. However their bioactivity may be compromised due to oxidation and/or losses during processing and storage of the end products.

Inulin is a prebiotic agent and therefore it is only metabolized at the intestinal track. This feature turns this polysaccharide into a potential interesting shell material for encapsulation and later targeted release of carotenoids.

The aim of the present study is to evaluate the potential of inulin to encapsulate, protect and deliver carotenoids' rich extract obtained from a tomato paste industry residue. This extract (oleoresin) is rich in lycopene but also other carotenoids are present such as α -carotene and β -carotene.

MATERIALS & METHODS

Encapsulation of tomato paste oleoresin in inulin was performed by spray drying at inlet temperatures of 120 °C, 155 °C and 190 °C. Inulin (25 % w/w) was totally dissolved in hot water (70-80 °C) and oleoresin was added to the cooled solution. The incorporation level of oleoresin was 40 % (w/w inulin) that corresponds to a concentration of about 0.2 % (w/w) of carotenoids. The capsules produced were observed both by scanning electron microscopy (SEM) and by confocal laser scanning microscopy (CLSM) in order to evaluate capsules size and morphology and to visualize the core material. The carotenoids release was evaluated at 25 °C by UV-VIS spectroscopy and diffusion coefficients (D) were calculated. Microencapsulates were also assessed for their antioxidant activity using ORAC method, that reflects peroxy radical absorption capacity, and a cellular model which address some issues of uptake, distribution and metabolism.

RESULTS & DISCUSSION

Inulin microcapsules range in size between 0.5-15 μm with an average diameter about 3-4 μm . No significant differences were noticed in capsules' size due to drying temperature. The observation of CLSM images shows that the core material was efficiently retained in the inulin matrix. Diffusion coefficient (D) of carotenoids from inulin capsules decreased with the increase of drying temperature, ranging between 1.15×10^{-16} and $3.41 \times 10^{-16} \text{ m}^2\text{s}^{-1}$. Fig 1 shows that drying temperature clearly affected the kinetics of release of the bioactive from the matrix.

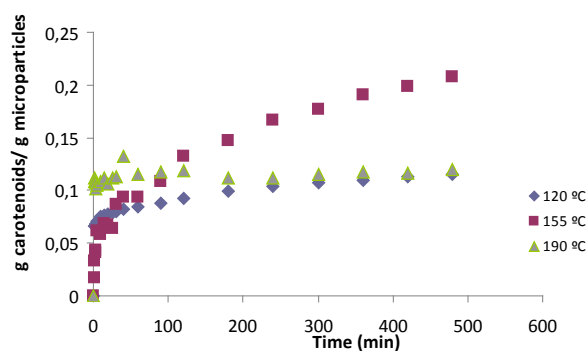


Figure 1. Effect of drying temperature on the release kinetics of a carotenoid from tomato pomace

The antioxidant potential of tomato oleoresin encapsulated in inulin capsules is preserved and independent of the drying conditions

Table 1 ORAC values of inulin particles with tomato paste oleoresin

Sample	ORAC value (umol TEAC/g)*
25% 120°C	21.2 ± 3.0
25% 155°C	21.6 ± 2.4
25% 190°C	22.6 ± 2.3

* ORAC values presented are a mean of at least 6 replicates ± sd

CONCLUSION

The successful encapsulation of carotenoids (mainly lycopene) was achieved in a prebiotic matrix system, potentially leading to an added-value ingredient for formulation of functional foods.