

Lutein in microbeads and core-shell microcapsules

Encapsulator B-390 / B-395 Pro: Production of Ca-alginate microbeads and uniform core-shell microcapsules containing the carotenoid lutein

1. Introduction

Lutein is a naturally and commonly occurring carotenoid found in plants. It is red-orange colored and has antioxidant properties, hence, it is oxygen sensitive. Furthermore, it is basically insoluble in water.

Lutein together with the carotenoid zeaxanthin is found in human eye's retina and is important for seeing.

The aim of this study was to protect the antioxidant from oxidation, by making it dispersible in water. Therefore, lutein microbeads and microcapsules were produced using the Flow Vibration Nozzle and Concentric Nozzle systems on the Encapsulator B-390 and B-395 Pro. Microbeads are spherical, homogeneous beads while microcapsules consist of a core and a shell of different composition. The here produced microbeads and microcapsules show uniform and spherical morphology.

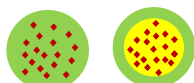


Fig. 1: Left: Model of microbead; Right: Model of microcapsule.

2. Equipment and Chemicals

Equipment:

Encapsulator B-390 / B-395 Pro

Chemicals:

1.5 % (w/w) and 1.8 % (w/w) sodium alginate solution.

0.1 M CaCl₂.

Sample 1: 7.5 g lutein powder suspended in 142.5 g sodium alginate solution (1.5 %).

Sample 2: 5 g lutein powder dissolved in 100 mL peanut oil and magnetic stirring.

3. Experimental

Experiment 1:

Encapsulating lutein in Ca-alginate matrix was performed using the Flow Vibration Nozzle and applying the parameters listed in Table 1. With this experiment microbeads are produced.

Table 1: Process parameters of Experiment 1.

Instrument	Encapsulator B-390
Flow Vibration Nozzle	750 µm inner / 1.5 mm shell
Frequency	870 Hz
Feeding (external syringe pump)	Sample 1 5.45 mL / min
Pressure	1013 mbar for nozzle
Nozzle air flow	1 L / min
Dispersion tension	0 V
Amplitude	9
Hardening bath	0.1 M CaCl ₂
Stirring	Gently stirred (no vortex)

Experiment 2:

Encapsulating lutein-oil within a Ca-alginate membrane was performed with the Concentric Nozzle and the parameters shown in Table 2. With this experiment microcapsules are produced.

Table 2: Process parameters of Experiment 2.

Instrument	Encapsulator B-395 Pro
Concentric Nozzle	450 µm core / 700 µm shell
Frequency	300 Hz
Feeding	Core: Sample 2 (fed via a syringe pump) Shell: 1.8 % alginate solution (fed via a pressure bottle)
Feed rate core	11.5 mL / min
Pressure	300 mbar for shell nozzle
Dispersion tension	0 V
Amplitude	5
Hardening bath	0.1 M CaCl ₂
Stirring	Gently stirred (no vortex)

4. Results

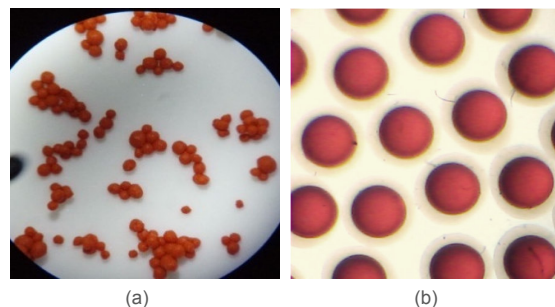


Fig.2: (a) The lutein microbeads using Flow Vibration Nozzle with a diameter between 300 µm to 600 µm; (b) The lutein microcapsules using Concentric Nozzle with a narrow diameter band ranging from 1200 µm to 1400 µm.

5. Conclusion

Two possibilities to encapsulate oil-soluble solids using Encapsulator are presented.

The BUCHI Encapsulator B-390 and B-395 Pro were applied to produce spherical lutein-containing microbeads and microcapsules.

6. Reference

For more detailed information and safety considerations please refer to the Application Note No. 246/2016