Evaluation of microencapsulation of flaxseed oil performed using membrane emulsification along with spray-drying and freeze-drying technologies

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Introduction

Increasing attention has been giving to flaxseed oil due to its potential health benefits. An investigation was carried out to evaluate the effect of different combinations of wall materials with different ratios of maltodextrin, gum arabic and modified starch, and the use of two spray drying and freeze drying technologies following the membrane emulsification on the encapsulation of flaxseed oil through the study of emulsion properties and encapsulation efficiency.

The effect of different wall materials on emulsion properties was investigated by determining the emulsion stability.

A comparison between the characteristics of powders produced using spray-drying technology and those produced using freeze-drying technology was done through the evaluation of microencapsulation efficiency and moisture content.

Membrane emulsification

Membrane emulsification is a low energy consuming technique, simple to manipulate and capable of producing emulsions with better control of droplet characteristics by pressing the dispersed into a continuous phase flowing through a microporous membrane pores with the help of an applied pressure.

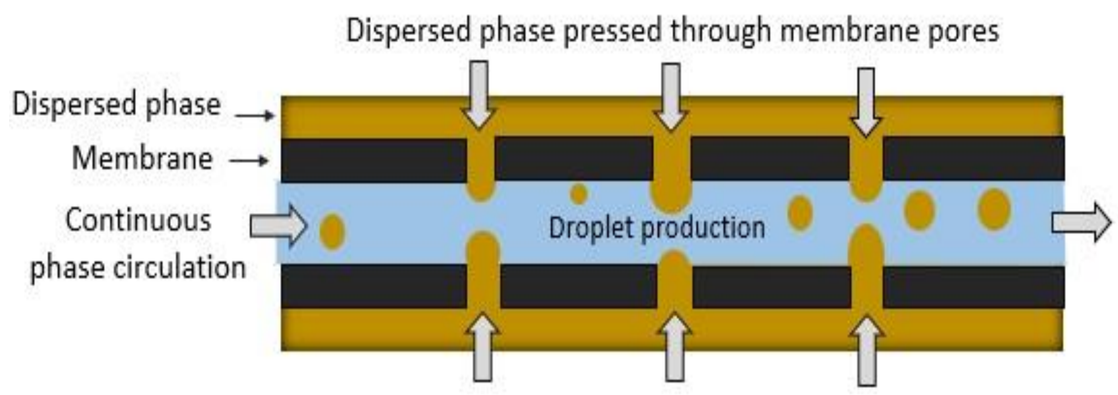
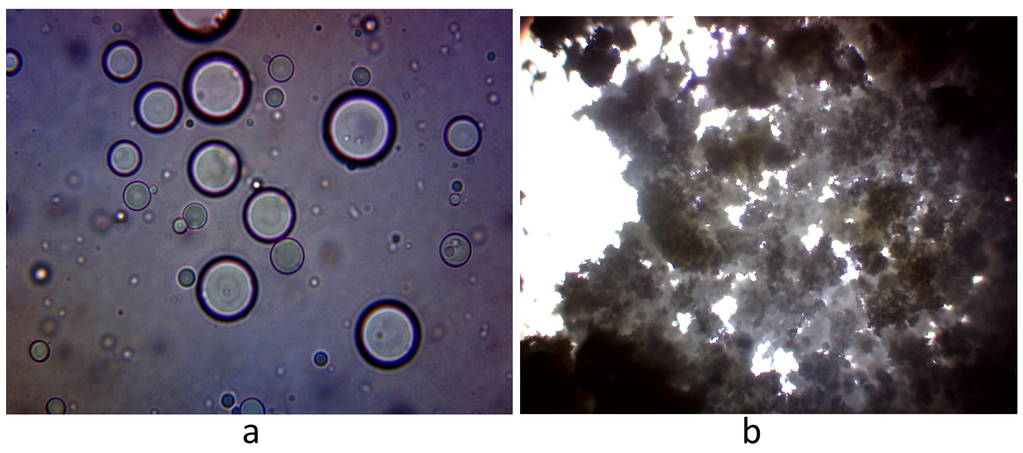


Figure 1 : Membrane emulsification process for O/W emulsion preparation.

Table 1 :Table of content

	Oil content	Solid content	MD	GA	MS
Sample 1	20%	30%	0	80	20
Sample 2			50	50	0
Sample 3			25	55	20

$$\%\ Emulsion\ Separation = \left(\frac{Upper\ phase\ height}{Emulsion\ initial\ height}\right) \times 100$$



a b

Figure 2 : Microscopic image of the sample 1 after membrane emulsification a and after spray drying b

Results and discussion

Sample	Encapsulation efficiency %		Moisture	
	Spray Drying (SP)	Freeze Drying (FD)	SP)	FD
S1	70,86	58,22	3,22	5,4
S2	83,15	71,4	2,7	4,6
S3	85,8	72,55	2,82	5,2

→All emulsions were stable after 24 hours. There was no upper phase formed in the emulsions.
→Sample produced using the combinaition of membrane emulsification and spray drying had a visibly higher encapsulation efficiency and lower moisture content than sample produced using membrane emulsification and freeze drying.
→Microencapsulation efficency was also influenced by the wall material concentrations and the higher efficiency was obtained for sample 3.
→ The membrane emulsification of flaxseed oil resulted in microcapsules with spherical shapes.
→ High moisture content → oil oxidation + flowability of powder.

Conclusion

In this work, we were able to evaluate the effect of varying the wall materials concentrations and varying the drying technique in flaxseed oil microencapsulation. After spray drying, better encapsulation efficiency has been recorded when using higher concentration of maltodextrin in combination with gum arabic and modified starch**.**

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