Microencapsulation of Extra Virgin Olive Oil by freeze Drying: Effect of Wall Materials Composition and Emulsification Method

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INTRODUCTION

Because of its high instauration degree, olive oil is subject to oxidation during processing, distribution, and handling. Thus, microencapsulation presents an alternative to protect the unsaturated fatty acids against oxidation. It has been used by many researchers to retard or avoid the oxidation of olive oil.

The objective of the study was to investigate the microencapsulation of extra virgin olive oil by freeze drying to increase its stability and application area. The effect of homogenization methods in terms of rotor–stator (RSH) and cross flow membrane emulsification (CFME) and the effect of wall materials composition were examined on physical properties of microencapsulated extra virgin olive oil powder (MEVOP). Maltodextrin (MD), carboxymethylcellullose (CMC) and gum Arabic (GA) were used as wall materials and micro- encapsulation was carried out in a laboratory type freeze dryer. First, the quality of emulsion was discussed by determining droplet size and emulsion stability. Then, the quality of microcapsules obtained either by RSH and CFME was evaluated by determining Encapsulation Efficiency (EE), particle size distributions and moisture content.

As result, the maximum EE was 68.96 %. The optimum wall material composition for this process is when the CFME method was used.

MATERIAL AND METHODS

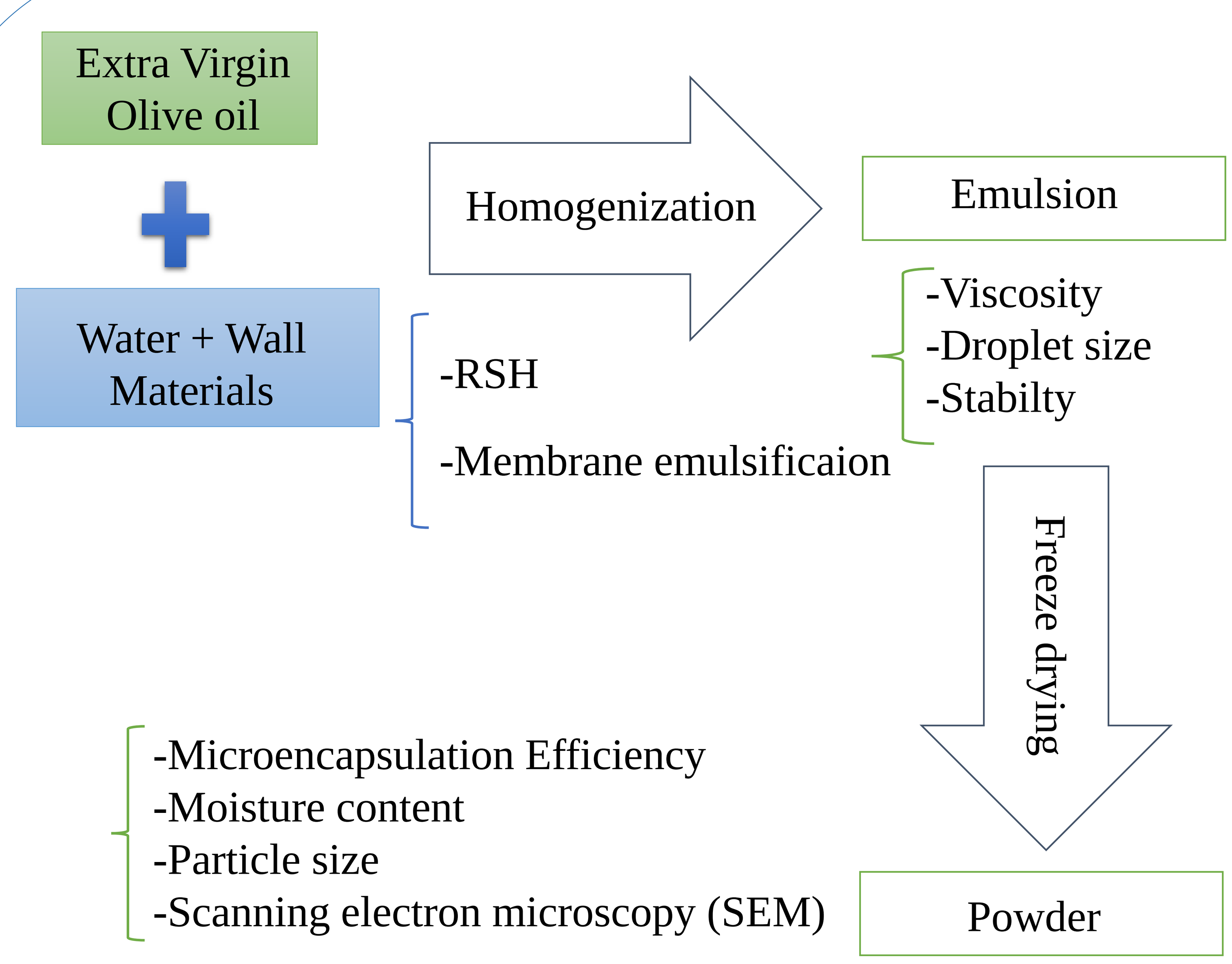

Fig. 1 Flow diagram of the microencapsulation process.

Table. 1 Microcapsules composition.

	Conventional membrane emulsifcation method		Ultraturrax homogenisation method	
	MD/CMC-GA 1	MD/CMC-GA 2	MD/CMC-GA 1	MD/CMC-GA 2
Maltodextrin (g)	10	15	10	15
Gum Arabic (g)	15	15	15	15
carboxymethylcellulose (g)	10	5	10	5
olive oil (g)	30	30	30	30
tween 80 (g)	5	5	5	5
deionized water (g)	700	700	700	700
solid % W/V	9,09	9,09	9,09	9,09
O/W Ratio (g/g)	0,1	0,1	0,1	0,1
wall material/oil ratio (g/g)	1,16	1,16	1,16	1,16

RESULTS AND DISCUSSION

The results are summarized in tables 2 and 3 and figures 2 and 3.

Table. 2 Results of Emulsification

	Conventional membrane emulsifcation method		Ultraturrax homogenisation method	
	MD/CMC-GA 1	MD/CMC-GA 2	MD/CMC-GA 1	MD/CMC-GA 2
% of separation	20	24	0	0
D32 (µm)	20	41.67	5.82	5.61
Span	0.815	0.405	1.05	0.33

Table. 3 Results of Freeze-drying.

	Conventional membrane emulsifcation method		Ultraturrax homogenisation method	
	MD/CMC-GA 1	MD/CMC-GA 2	MD/CMC-GA 1	MD/CMC-GA 2
Encapsulation efficiency %	68,96	48,48	54,88	33,69
Moisture %	4	4	1	1
D32 (µm)	37,5	17,76	80,36	55,69

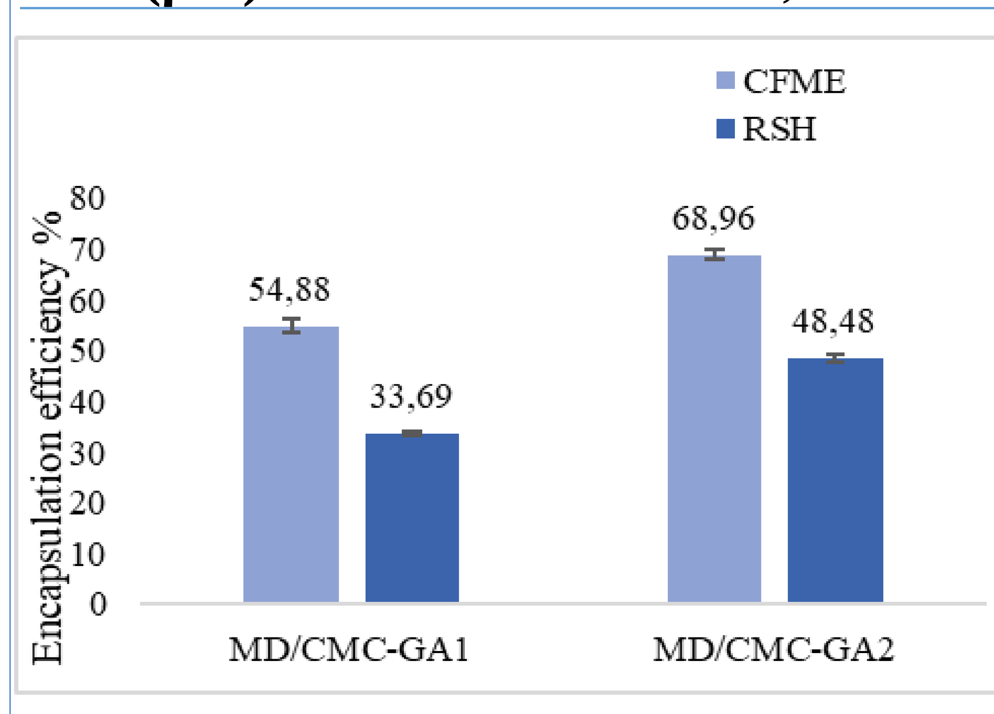

Fig. 2 Encapsulation efficiency of microcapsules produced with different emulsification methods.

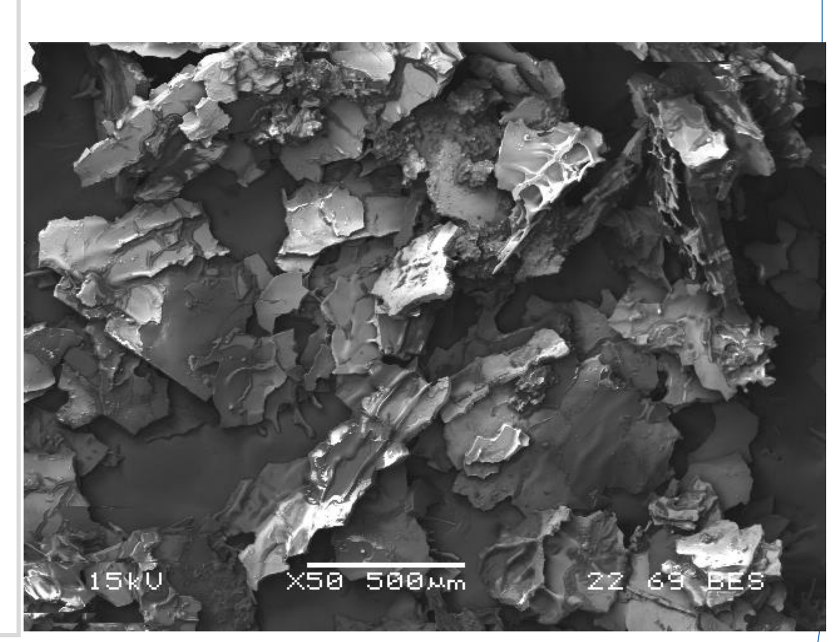

Fig. 3 SEM image (at 50×magnification) of the optimum sample,.

Acknowledgement

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CONCLUSIONS

In this work, it was possible to evaluate the performance of two different emulsification methods in the microencapsulation of virgin olive oil. CFME method gave the highest efficiencies for both formulations. It can be concluded that the most effective wall material composition for microcapsules production is MD/CMC-GA 1 when the feeding emulsion contains 15g maltodextrin, 5g carboxymethyl cellulose and 15g gum Arabic. Increasing the emulsion viscosity by using bigger amount of CMC have negatively affected the efficiency for both emulsification methods CFME technology looks suitable for industrial applications. .