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Preparation and characterisation of novel PEEKWC capsules by phase inversion technique

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Abstract

Capsules of PEEKWC are prepared using a membrane process combined with phase inversion technique. Polymeric droplets were prepared using a mono-pore film in polyethylene with pore diameter ranging from 300 to 1000 μm. The morphology, porosity and shell thickness of the made capsules are modified changing some process parameters such as the polymeric concentration or the non solvent in the coagulation bath.

Keywords: Capsule preparation; Phase inversion; PEEKWC; Polymeric capsules

1. Introduction

The capsules of different materials can be employed for many industrial applications such as cosmetic, pharmaceutical and chemical.

In this work, capsules using a membrane process combined with phase inversion technique have been prepared [1]. This technique can be identified as an integration between the traditional chemical capsule techniques (coacervation or phase inversion) and the mechanical capsule technique (pressure extrusion).

The objective is to prepare polyetheretherketone (PEEKWC) capsule of different morphology, porosity, size and shell thickness changing the ingredient parameters such as polymer concentration, solvent and non solvent involved phases [2–4].

The morphology and dimension of the prepared capsules are the two fundamental parameters to control the release of different active compounds loaded within the prepared capsules.

2. Experimental section

The polymer solution is pressed through the porous membrane and the formed droplets will immediately polymerise by phase inversion when in contact with the non-solvent phase (Fig. 1). The particles will be then recovered and used for the different applications.

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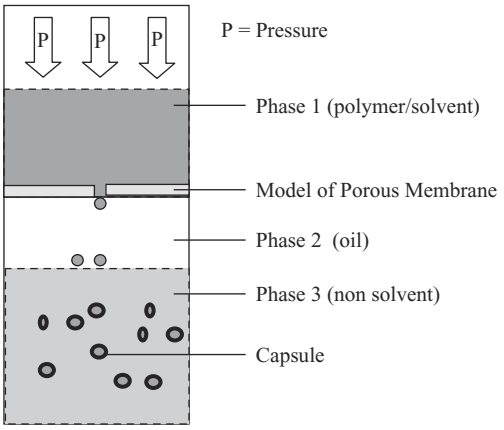

Fig. 1. Scheme of capsule formation unit.

In particular, the particles will be made dissolving the PEEKWC in the organic solvent (phase 1) and pressing its solution in the mono-porous film until the formed drop (phase 2) precipitates in the non-solvent (in this case water, phase 3).

3. Results and discussion

In Fig. 2, the SEM pictures of the made PEEKWC capsules are presented. These capsules are obtained with pore membrane diameter of about 500 μm, using the same polymer solvent (DMF) and non-solvent (water).

In Fig. 3, the influence of different phase 2 (isooctane), which strongly modify the morphology

Fig. 2. SEM pictures of different prepared capsules using a film with the pore size of about 500 μm using as phase 1, PEEKWC/DMF 8 wt%; phase 2, dodecane and phase 3, water.

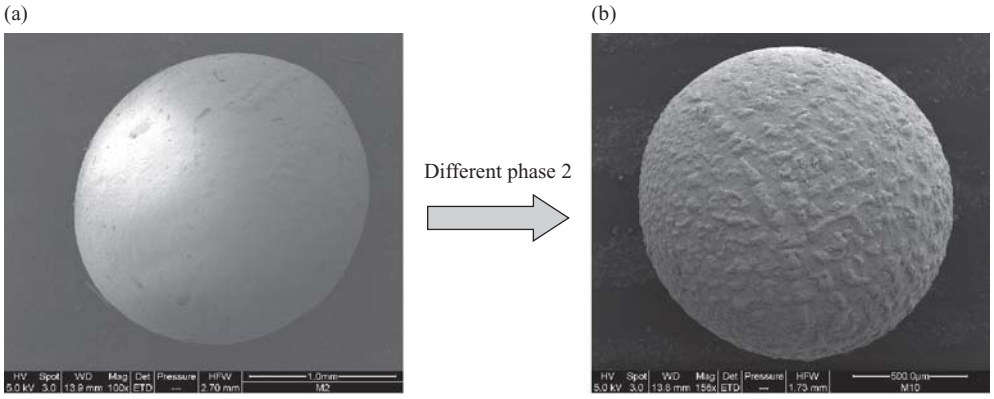

Fig. 3. SEM pictures of different capsules using: pore size (800 μm), PEEKWC/DMF 10 wt.%, dodecane (a) and isooctane (b) as phase 2.

of the made capsule from a dense to a porous surface, is shown.

4. Conclusions

The formation of mono-dispersed PEEKWC capsules with different morphologies has been carried out. The capsule morphology and dimension can be easily adjusted changing the involved phases (phase 1, 2 and 3) in the process and the membrane pore sizes respectively. These preliminary tests, using membrane pore diameter ranging from 300 to 1000 μm, show that droplet sizes are almost constant. Furthermore, computational studies on the controlled release of active chemical compounds in function of capsule morphology and dimensions are in progress. This study can be considered as the starting point toward the production of loaded nano-sized capsules by phase inversion.

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