Journal of Fiber Bioengineering & Informatics 5:1 (2012) 67–76
http://www.jfbi.org | doi:10.3993/jfbi03201206

Preparation and Properties of Olive Oil Microcapsules

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Abstract

In this paper, microcapsules were produced by complex coacervation using gelatin and acacia as wall materials and olive oil as the core substance. Process parameters, such as the dosage of the crosslinker, concentration of the wall materials, pH Value and the ratio between core and wall materials were analyzed in detail. Moreover, crosslinking degree of wall materials was more important in obtaining good slow release microcapsules. The morphology and particle size distribution of the microcapsules were analyzed by scanning electron microscope and laser particle size analyzer. The oil content and the release rate of the olive oil were also studied. In order to obtain microcapsules with good mobility and dispersal, a spray drying process was used to dry the product. The olive oil microcapsules were obtained with particle size of 3∼8 μm, and an oil content of about 60%. The optimum process parameters were as follows:dosage of the cross linking agent was 3 ml, the concentration of wall materials was 3%, the pH value of coacervation was 4.0 and the ratio of core/wall material was 1:1. Olive oil microcapsules prepared with these optimal process conditions had good disperse effect and high encapsulation efficiency.

Keywords: Gelatin; Microcapsules; Complex Coacervation; Olive Oil; Arabic Gum

1 Introduction

Microencapsulation has been widely used in applications such as the controllable release of drugs and improvement of the stability of core substance and many other fields. Volatile liquids and solids are easily damaged during long-term use, due to their external environment, and this leads to the degradation of mechanical properties and even loss of function. It is possible to prevent this by embedding them into polymer wall materials, forming microcapsules [1]. Complex coacervation is an important method which is widely used to prepare microcapsules for controllable drug release because of its simplicity and low pollution. In this method, two or more than two kinds of molecules of opposite charge are joined as the walls, and then disperse the core substance into the aqueous solution of wall materials. When the conditions are right, the wall materials will attract with each other because of the opposite charges, and then embed the core material [2]. Research of complex coacervation technology is very helpful in order to increase the yield and quality of microcapsules and actual production process [3]. Spray drying is a commercial process

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which is widely used in large-scale production of encapsulated flavors and volatile. The merits of process have ensured its dominance; these include availability of equipment, low process cost, wide choice of carrier solids, good retention of volatiles, good stability of finished product, and large-scale production in continuous mode [4]. In recent years, the technology of microcapsules has played an important role in preparing functional textile [5].

The gelatin–arabic gum couple has been known for a long time to undergo complex coacervation and serve well as a wall-forming material for microcapsules [6]. The primary reasons to use gelatin and arabic gum as wall materials are their abundance and biodegradability. The fact that the charge on gelatin is pH-dependent makes this method of preparation of microcapsules extremely dependant on pH and hence it is easy to control the reaction [7].

Olive oil is a natural green vegetable oil which is abundant in vitamin, carotene and many trace elements and it has many functions in nutrition and health care [8]. Olive oil is rich in the essential fatty acidsVitamin A, D, E, K and other antioxidant substances which can be rapidly absorbed by the body and can maintain skin elasticity and moisture. These substances can be absorbed through the skin and make it glossy and soft, as well as promoting blood circulation and skin metabolism. It can also help to lose weight, reduce wrinkles, and slow down signs of aging. The unsaturated fatty acids are able to fight cancer, and phenols can help to reduce radiation [9].

In this paper, gelatin and arabic gum are used as wall materials to obtain microcapsules that can be controlled to release the core substance. Complex coacervation was used to first carry encapsulation and spray drying was later used to dry the microcapsules. The first layer of microcapsule was received by complex coacervation and the second layer of microcapsule was obtained by following spray drying. Microcapsules prepared by this method can resist higher temperature.

2 Experiment

2.1 Materials

The Arabic gum was purchased from Tianjin Guangfu Fine Chemical Research Institute (Analytically Pure). The gelatin was purchased from Chemical Reagent Factory of Tianjin Fu Chen (Biochemistry Reagents). Olive oil was purchased from National Pharmaceutical Group Chemical Reagent Co., Ltd (Chemical Pure). Citric Acid (20%) and saturated sodium carbonate were prepared in lab to adjust pH.

2.2 Preparation of Microcapsules

The olive oil microcapsules were prepared by complex coacervation and spray drying. Firstly, arabic of 1.5 g was dissolved in 50 ml water and was added into four-neck flask with agitation, thermometer and condensator. The stirring rate and temperature of reaction system were adjusted to 1000 rpm and 45℃ respectively. Then olive oil of 3 g was poured into after the Arabic gum fully dissolved. Lastlythe gelatin solution with the concentration of 3% was added into four-neck flask. The pH of system was adjusted to 4.0 with citric acid (20%) after 30 minutes. The coacervation reaction started and reaction was kept for some time. Stop the heating and remove off the hot water when the reaction was up 2 hours and cool down the solution in air. When the temperature became around 30℃-35℃, some ice blocks was use to lower the temperature below