PRIMARY STUDY OF ETHYL CELLULOSE NANOFIBER FOR OXYGEN-ENRICHMENT MEMBRANE

by

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Short paper
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Ethyl cellulose is widely used for oxygen-enrichment membrane, however, its nanofiber membrane was rarely developed though it behaves more excellent performance. This paper gives a preliminary study to produce oxygen-enrichment membrane by bubbfil spinning.

Key words: *oxygen-enrichment, bubble electrospinning, nanofiber membrane, diameter*

Introduction

Ethyl cellulose (EC) has been widely regarded as a kind of water-insoluble materials with better membrane-forming ability, sustainable drug release, and gas-separation performance. The EC has the enhanced diffusivity selectivity for gas pairs of oxygen/nitrogen [1], and blend membranes of liquid crystal compound with EC have been widely used as the oxygen-enrichment membranes, which are usually prepared by a solution casting technique [2]. Recent study reveals that the oxygen flux increases as the thickness of thin dense layer decreases [3]. Nanotechnology makes it possible to make the membrane extremely thin [4, 5]. The EC nanofiber membrane for oxygen-enrichment is a promising new field in energy, materials science, and nanotechnology as well.

Nanofiber membranes possess fantastic physical properties, such as high surface reactivity [6] and excellent air permeability [7], and the bubbfil spinning is a perfect method to produce nanofiber [8-10].

Experiment

In this paper, EC particles are dissolved into alcohol/DMAc (9:1) at 25 °C. Other spinning conditions in bubbfil spinning process are used to adjust to control the fiber diameter. We adjust the collector distance from 5 cm to 30 cm with the fixed 20% concentration of solution and 25 kV applied voltage. The experiment is repeated for the concentration of 27% and 30%, respectively.

We observe that the fiber diameter increases when concentration of solution increases, this is because the thickness of bubble wall becomes larger for higher concentration of solution. Furthermore, we obtain the relationship between the diameter distribution and collector distance under different concentrations of solution, figs. 1(a)-(c).

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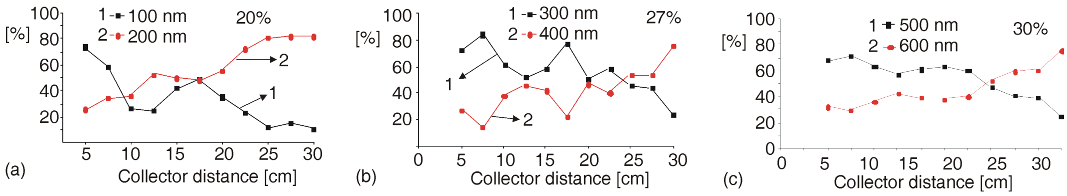

Figure 1. The relationship between the diameter distribution and collector distance

Table 1. Spinning conditions for EC nanofiber membranes

Diameter of nanofiber	Concentration of solution	Applied voltage	Collector distance
100 nm	20%	25 kV	5 cm
200 nm	20%	25 kV	30 cm
300 nm	27%	25 kV	7.5 cm
400 nm	27%	25 kV	30 cm
500 nm	30%	25 kV	7.5 cm
600 nm	30%	25 kV	30 cm

Results and conclusion

Figure 1(a) shows that the number of fibers with diameter of 100 nm decreases with increase of the collector distance, while number of larger fiber with diameter of 200 nm increases. Figure 1(a) shows an EC nanofiber membrane with fiber diameter of 100 nm and 200 nm can be prepared, respectively, when the collector distance is 5 cm and 30 cm, tab. 1. We can obtain nanofiber membranes with fiber diameter varying from 100-600 nm by adjusting spinning conditions.

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