DEVELOPMENT OF CARBOXYMETHYL CHITOSAN/POLYVINYL ALCOHOL/GLYCEROL NANOFIBROUS MEMBRANE AS WOUND DRESSING

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Abstract: Chitosan is a promising material for wound dressings. However, it has poor water solubility and insufficient antibacterial property. In order to improve the above problem of chitosan, the chitosan was treated by carboxymethyl modification in this work, and then the carboxymethyl chitosan was mixed with polyvinyl alcohol and glycerol for preparing nanofibrous membranes by electrospinning.

Preparation of carboxymethyl chitosan (CMCS): a certain amount of solid sodium hydroxide was added into deionized water to prepare a sodium hydroxide solution with a concentration of 20%, and then chitosan and chloroacetic acid were added into sodium hydroxide solution while maintaining stirring till to a homogenous solution. After reaction, the pH of the homogenous solution was adjusted to neutral and separated by centrifugation. The filtrate was collected and mixed with excessive ethanol, after precipitation, the solution was filtrated and the filtered solid was obtained. The filtered solid was washed with ethanol for several times until it turned pale yellow or white. The filtered solid was dissolved in deionized water and then freeze-dried to obtain carboxymethyl chitosan powder.

Preparation of CMCS/PVA/Gly nanofibrous membrane: polyvinyl alcohol (PVA) powder was dissolved in deionized water with a ratio of 10:90, while maintaining stirring for 4 hours at a temperature of 80°C to get a homogenous solution, and then the CMCS and glycerin (Gly) were added into PVA solution under stirring at a temperature of 80°C to get a homogenous CMCS/PVA/Gly solution with 3%, 5% and 7% CMCS mass fraction. The CMCS/PVA/Gly solution was used for needle electrospinning; the inner diameter of needle was 0.4 mm, the distance between electrode and collecting substrate was 15 cm, the spinning voltage was 18 kV, the winding speed was 300 r/min, the temperature was (25±2) °C and relative humidity was (50±5)%.

The experimental results demonstrated that the nanofibrous membrane had good morphology and its thermal stability and mechanical properties was also improved. The swelling rate of CMCS/PVA/Gly nanofibrous membrane increased to 432.1% from 332.1% by CS/PVA/Gly nanofibrous membrane. The antibacterial rates against Escherichia coli and Staphylococcus aureus reached to 99.47% and 96.93%. And the cytotoxicity test showed that the CMCS/PVA/Gly nanofibrous membranes had good biocompatibility. The SEM images of CMCS/PVA/Gly nanofibrous membranes are given in figure 1.

Keywords: *carboxymethyl chitosan, glycerin, polyvinyl alcohol, nanofibrous membrane,*

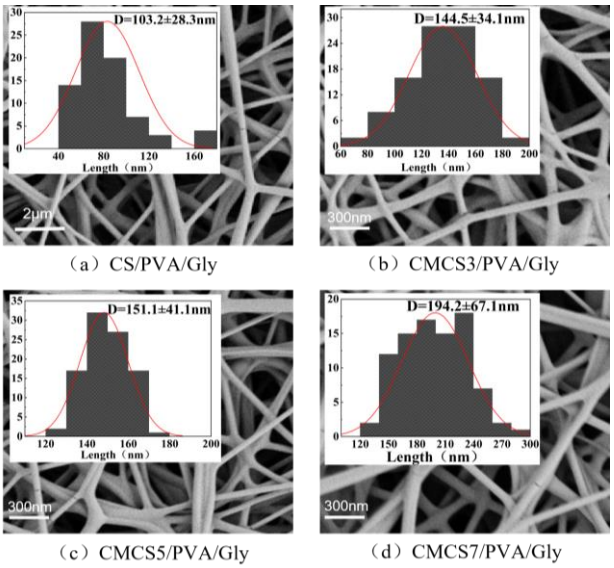

Figure 1 Morphology of nanofibrous membranes and the distribution of fiber diameter

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