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Vibration Analysis of Nanopillared Chitosan Membrane Using High-Frequency Excitation Technique during Solvent Casting Method

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Extended Abstract

The development of biocompatible skin barriers using chitosan has shown promise and is already widely used in commercial wound dressings [1]. In addition, the potential use of nanopillars in membranes and films has received considerable attention [2]. Because nanopillars increase surface area, nanopillar surfaces are more valuable than conventional flat surfaces [3]. Due to the promise of nanopillar membranes and films for the creation of protective skin barriers [4], it is important to investigate fabrication technologies that involve the control of the geometry of nanopillars.

For the research, the solvent casting method was chosen. The solvent casting technique has many advantages, including low-cost fabrication, the ability to adjust the mechanical and optical properties of the film by changing processing parameters such as the solvent casting time or temperature. In addition, with the increase in environmental friendliness, nanomaterial templating is attracting a lot of interest, as the template allows the reconstruction of the structure with the highest degree of reproducibility and is one of the most promising strategies. Therefore, the solvent casting method is reliable and widely used among various polymer film and membrane design methods.

To determine and control the height of the nanopillars, a new technology of the solvent casting method using high-frequency vibrations is presented. By controlling the height of the nanopillars, the surface area of the membrane can be changed. Moreover, a vibration device developed to produce membranes by the solvent casting method is presented. Nanopillared chitosan membranes were fabricated using the nanoporous AAO membrane as a template. To improve the solvent flow into the nanopores, 40 kHz high-frequency excitation was applied for 5 seconds during the solvent casting method. After conducting research, it was found that high-frequency vibrations during the solvent casting method affected the height of the nanopillars. Chitosan membranes with a nanopillar surface were successfully prepared. SEM images confirmed the formation of nanopillars on the chitosan membrane.

The results of this research will greatly contribute to the research and development of nanopillared chitosan membranes. Therefore, more research should focus on nanopillared chitosan membrane fabrication by using the high-frequency excitation technique to find the dependence of the nanopillar height at different frequencies.

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