

Material Properties of Films and Fibers Made of Chondroitin Sulfate/Chitosan Complexes

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Introduction In recent years, natural polysaccharides have been received attention from the viewpoints of development of environment-friendly materials and utilization of biomass. We have developed processes to obtain water-insoluble thin films and fibers from polyion complexes (PIC) of chondroitin sulfate C (CS, Figure 1A)/chitosan (CHI, Figure 1B) by utilizing hot press techniques [1] and interface-spinning methods, respectively. In this study, we evaluated material properties of the resultant films and fibers such as flexibility and tensile strengths under various conditions.

Methods CS/CHI composite films were prepared by hot pressing PIC of CS and CHI at 120 °C, 20 MPa. To obtain CS/CHI fibers, a solution of CS was gently placed on a CHI solution, which resulted in formation of PIC at the interfaces. Fibers were spun by withdrawing from interfaces, then dried by passing through an acetone bath and finally rolled up. Mechanical property of the films and fibers was evaluated as tensile strength.

Results and Discussions As shown in Figure 2, the resulting CS/CHI films (100 μm thick) with optical transparency were homogeneous and flexible. These film had 2~4 times of higher tensile strength than that of CHI film. On the other hand, several meters-long CHI/CS composite fibers having several tens of micrometers diameter were successfully obtained through this process. Interestingly, it was found that tensile strength increased as the molecular weight of CHI increased. Swelling-stretching treatment made these fibers denser and stronger than those before treatment. The experimental results revealed that these films and fibers made of CS/CHI PIC had sufficient mechanical property as structural materials.

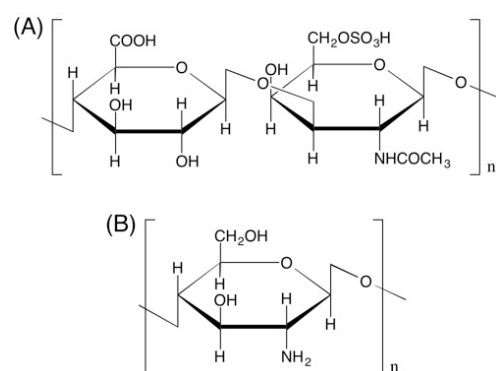


Figure 1. Structure of (A) chondroitin sulfate C (CS) and (B) chitosan (CHI).



Figure 2. Macroscopic images of the CS/CHI composite film (50 mm square, left) and fiber (right).

Reference

- [1] M. Hashizume, H. Kobayashi, M. Ohashi, *Colloids Surf. B* **2011**, 88, 534–538.