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Research Article

Chitin Hydrogels Prepared at Various Lithium Chloride/*N*,*N*-Dimethylacetamide Solutions by Water Vapor-Induced Phase Inversion

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Chitin was chemically extracted from crab shells and then dissolved in *N*,*N*-dimethylacetamide (DMAc) solvent with lithium chloride (LiCl) at 3, 5, 7, and 10%. The concentrated chitin-DMAc/LiCl solutions were used for the preparation of chitin hydrogels by water vapor-induced phase inversion at 20°C. The coagulation process was investigated while altering the concentration of LiCl in the DMAc solution. The shear viscosity of the chitin solution increased with higher LiCl amounts and decreased when the concentration of LiCl was reduced by adding water to the chitin solution, implying high LiCl concentration delayed the coagulation of chitin solution in the presence of water. The viscoelasticity of the chitin solutions indicated the gel formation intensification was dependent on the dose of LiCl and chitin in the DMAc solution. After the chitin solution was coagulated, the resultant hydrogels had water contents of 387–461% and the tensile strength varied from 285 to 400 kPa when the concentration of LiCl in the hydrogel was adjusted to 3% and 7%, respectively. As for viscoelasticity, the complex modulus of the chitin hydrogels indicated that the increment of the LiCl concentration up to 7% formed the tight hydrogels. Atomic force microscopic (AFM) image revealed the formation of the entanglement network and larger domains of the aggregated chitin segments. However, the hydrogel prepared at 10% LiCl in DMAc solution exhibited weak mechanical properties due to the loose hydrogel networking caused by the strong aggregation of the chitin segments.

1. Introduction

Hydrogels are defined as the hydrophilic structure being able to hold an excess amount of water inside their three-dimensional polymeric network [1–4], which can be classified based on different criteria, such as source, polymeric composition, configuration, and type of cross-linking [5]. The most common way to classify hydrogel is based on the material source. In the biomass hydrogel materials, natural polymers are available such as hyaluronic acid [6], alginate [7], chitosan [8], cellulose [1], chitin [2], and starch [9]. There are several advantages of biopolymer hydrogels. Especially, biopolymer hydrogel has the excellent biocompatibility and is better than other synthetic polymer-based hydrogel in medical applications. Biohydrogels have been demonstrated as a potential material in various fields due to its excellent strength, good compatibility, and degradation [10–15]. There are reports about the fabrication of the hydrogels with freeze-thawing process [3, 16], which are repeatedly performed at low temperature. However, the phase inversion method was successfully used to obtain biomass hydrogel contracting without cross-linker chemicals at room temperature [11, 14]. In this process, the biomass polymer is transformed in a controlled way from a solution state to a solid state by the solvent exchange in polymer solution to