MODIFICATION OF CHITOSAN FILMS WITH FISH SKIN COLLAGEN

ALINA SIONKOWSKA[1]*, KATARZYNA MUSIAŁ[1], MAGDALENA GADOMSKA[1], KATARZYNA ADAMIAK[2]

[1] DEPARTMENT OF BIOMATERIALS AND COSMETICS CHEMISTRY, NICOLAUS COPERNICUS UNIVERSITY IN TORUN, POLAND
[2] WELLU, SP. Z.O.O. GDYNIA, POLAND
*E-MAIL: ALINAS@UMK.PL

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Introduction

Chitosan is a biopolymer obtained from chitin by its alkaline deacetylation. Due to its unique properties, it is practically used in many areas such as medicine, pharmacy, the cosmetics and food industry, and many others. Chitosan is used in various forms, such as solution, film, foam, fibers, scaffolds, etc. [1].
Collagen is a protein that is also widely used in medicine, cosmetics and food, as well as chitosan. Usually, collagen is obtained from the skins of land animals such as cows or pigs, but due to the possibility of transferring bovine spongiform encephalopathy (BSE) and transmissible spongiform encephalopathy (TSE), alternatives are sought. Hence the interest in fish collagen increases, however, the disadvantage of such collagen is the low denaturation temperature [2].
Mixtures of collagen and chitosan are not found in nature but can be obtained, among others, due to the presence of hydrogen bonds [3].
The aim of this study was to investigate the effect of fish collagen addition on the properties of chitosan films.

Materials and Methods

Collagen was purchased by WellU Sp. z.o.o, Gdynia, Poland. It was obtained by isolation collagen from the skin of *Silver Carp*. The skins were removed manually and washed with chilled tap water to get rid of the adhering tissues. The next stage was disinfection of the material using 3% hydrogen peroxide in water. Then leached its residue. Purified skins were placed in lactic acid solution for 3 days to extract the collagenous proteins. Then obtained solution was pressed through a material which allows collagen separation. The samples were then placed in polyethylene bags and stored at –25°C until used.
Medium and low molecular weight chitosan was purchased from Sigma-Aldrich.
2% solutions of both chitosans and a 20 mg/mL collagen solution were prepared using 0.5M acetic acid as solvent.
Mixtures of low and medium molecular weight chitosan with collagen were prepared in the following ratios: 25:75; 50:50; 75:25.
Solutions of both pure chitosans, pure collagen, and each mixture were poured onto plastic plates to form films.
The resulting films were analyzed with a PIKE GladiATR NICOLET iS10 FTIR spectrometer to obtain IR spectra.
The mechanical properties of each film were tested with a Zwick & Roell testing machine.

Results and Discussion

FIG. 1 shows the IR spectra of the three films. The first is made of a 20 mg/ml collagen solution, the second is made of a 2% medium molecular weight chitosan solution, and the third is a 50:50 mixture of the aforementioned chitosan and collagen.

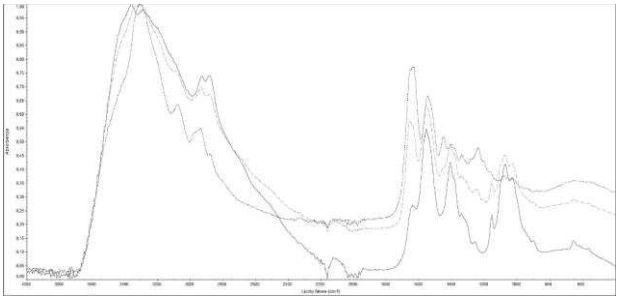

FIG. 1. IR spectra: collagen (dotted line), medium molecular weight chitosan (solid line), 50:50 mixture of chitosan and collagen (dashed line).

From IR spectra one can see that the interactions between two biopolymers, namely collagen and chitosan are due to hydrogen bonds. The shifts of amide bands in IR spectra have been observed.
Low molecular weight chitosan differs in mechanical properties from medium molecular weight chitosan.
The addition of collagen influences the mechanical properties of chitosan in various ways, depending on its molecular weight and share in a given mixture.

Conclusions

IR spectroscopy showed interactions between chitosan and fish collagen. Modification of the mechanical properties of chitosan films by fish collagen depends on the molecular weight of chitosan.

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