MODERN DRESSING AND COSMETIC MATERIALS BASED ON HYALURONIC ACID MODIFIED WITH EGG ALBUMIN

MAGDALENA GADOMSKA*, KATARZYNA MUSIAŁ, ALINA SIONKOWSKA

DEPARTMENT OF BIOMATERIALS AND COSMETICS CHEMISTRY, NICOLAUS COPERNICUS UNIVERSITY IN TORUN, POLAND
*E-MAIL: MAGDALENA.GADOMSKA@O2.PL

[ENGINEERING OF BIOMATERIALS 163 (2021) 89]

Introduction

For many years, hyaluronic acid has been one of the most frequently used natural polymers in cosmetics and biomedical materials due to its many valuable properties [1]. Hyaluronic acid can be modified with natural and synthetic polymers and substances of natural origin [2]. Modifications of hyaluronic acid can allow the creation of new and environmentally friendly biomedical or cosmetic materials that can be widely used in pharmacy, cosmetology, and medicine. Egg albumin obtained from an egg can accelerate the process of wound healing [3]. Therefore, a mixture of hyaluronic acid and albumin can be used as biomedical dressings.
The research aimed to check the interaction of hyaluronic acid with egg albumin and the mechanical properties of mixtures and pure substances.

Materials and Methods

Hyaluronic acid (HA) with three different molecular weights was purchased from Zrób Sobie Krem, Prochowice, Poland. Egg albumin was purchased from Sigma-Aldrich Sp. z o.o., Poznań, Poland. A 1.5% high molecular weight HA solution, a 1.5% low molecular weight HA solution, and a 1.5% solution in ultra-low molecular weight HA in water were prepared. 25g of each hyaluronic acid solution was poured onto plastic plates and the polymer film was allowed to dry for a week. The polymer films were then removed from the plates and subjected to FTIR analysis using a ThermoFisher Scientific Nicollet IS10 spectrometer. Fittings were cut from each film and then rip up a ZwickRoell testing machine to test the mechanical properties. Mixtures were prepared by mixing 25 g of a hyaluronic acid solution with 0.25 g of albumin and poured onto plates. Fittings were cut from the formed films, rip up at the machine, and subjected to FTIR analysis.

Results and Discussion

FIG. 1 shows the IR spectra of 1.5% high molecular weight HA and a mixture with 0.25 g ovalbumin. The black color shows the spectrum of 1.5% high molecular HA, and the grey color of the mixture. The obtained IR spectra show the differences between pure HA and its modification with albumin. We observe the shift of the bands in the spectrum and the increase in absorbance at the wavenumber 2929 cm^{-1}.
FIG. 2 shows the IR spectra of 1.5% ultra-low molecular weight HA and a mixture with 0.25 g of albumin. The black color shows the spectrum of 1.5% ultra-low molecular weight HA, and the grey color of the mixture. On the obtained spectra, one can see the shift of the spectrum of the mixture relative to the spectrum of the pure HA, which shows the interaction between the components of the mixture. One can observe a decrease in absorbance at the wavenumber 609 cm^{-1} and at the wavenumber 1039 cm^{-1}.

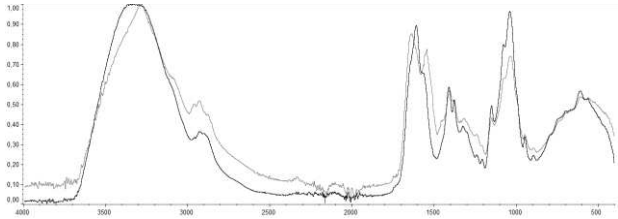

FIG. 1. IR spectra for 1.5% high molecular HA and 1.5% high HA with 0.25 g of albumin.

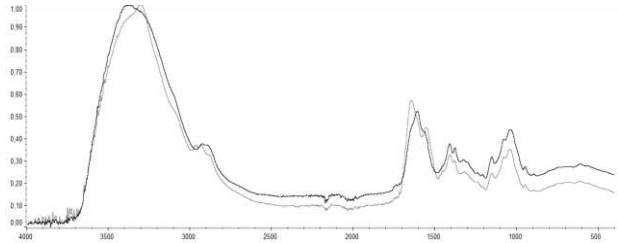

FIG. 2. IR spectra for 1.5% ultra-low molecular weight HA and 1.5% ultra-low molecular weight HA with 0.25 g of albumin.

Conclusions

Modification of hyaluronic acid with egg albumin leads to the creation of a new biomaterial significantly different from pure substances. FTIR analysis confirms the interactions between hyaluronic acid and albumin and the differences between mixtures of hyaluronic acids with three different molecular weights.

References

[1] A. Olejnik, J. Gościańska, I. Nowak, Significance of hyaluronic acid in cosmetic industry and aesthetic medicine, Chemik 2012, 66
[2] A. Sionkowska, M. Gadomska, K. Musiał, J. Piątek, Hyaluronic Acid as a Component of Natural Polymer Blends for Biomedical Applications: A Review, Molecules 2020, 25(18), 4035
[3] W. Wattanakaroon, P. Akanitkul W. Kaowkanya, W. Phoudee, Albumin-natural rubber latex composite as a dermal wound dressing, Materials Today: PROCEEDINGS 2017, 4(5), 6633.