CHARACTERISTICS OF SWELLING AND MECHANICAL PROPERTIES OF CHITOSAN FILMS BASED ON SELECTED HYDROXYACIDS

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Introduction

Chitosan is a polymer with versatile properties. It is used in many areas, including medicine, pharmacy and cosmetology. In combination with hydroxyacids that enable it to dissolve, it creates spatial structures with potential applications in tissue engineering, dressing materials and drug delivery systems. Important features of hydrogels made from the combination of chitosan and hydroxyacids, which are important for the mentioned applications, are their swelling capacity (this means the ability to absorb large amounts of water without disturbing the three-dimensional structure), sorption properties towards various substances, for example, those that are components of exudate and their mechanical properties [1-3].

Materials and Methods

LMW chitosan (low molecular weight, degree of deacetylation DD = 78%, Mv = 1.4×10^6 g/mol) was used to obtain chitosan films used for further research. Chitosan (2.6% w/v) was dissolved in 30 ml of aqueous solutions of lactobionic and mandelic acids, 0.002 mol each. 1% glycerin was added. After incubation for 24 hours, the resultant hydrogels were poured 25 g into square Petri dishes (10 cm x 10 cm) and allowed to dry. The finished films were carefully removed from the plates and cut into pieces having an average weight of about 25 mg. The film fragments were placed in a 3% albumin solution, water and an aqueous lysozyme solution (1 mg/7.5 ml) for 1 to 5 hours. Each piece was weighed before being immersed in the solution and then pulled out and dried. The degree of film swelling was calculated.
The mechanical properties of the obtained films were tested with a Zwick and Roell testing machine (Ulm, Germany) [4].

Results and Discussion

The tested films showed a different degree of swelling depending on the solution in which they were immersed.
The films with lactobionic acid showed higher swelling parameters in the albumin solution. In contrast, in the case of water and lysozyme solutions, the films with mandelic acid swelled more. In each test solution, films containing mandelic acid were degraded faster (FIG. 1).
As a result of the mechanical tests, Young's modulus and the maximum tensile force at break were measured.

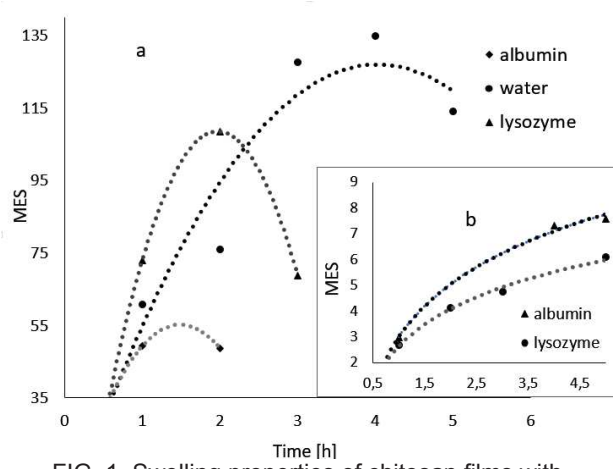

FIG. 1. Swelling properties of chitosan films with mandelic (a) and lactobionic (b) acids.

Conclusions

Films with lactobionic acid swelled less than with mandelic acid, at the same time showed better mechanical properties and were more resistant to dissolution and degradation processes.

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