THE PROPERTIES OF COLLAGEN/CHITOSAN POROUS MATRICES IN THE PRESENCE OF SMALL AMOUNT OF POLY(ETHYLENE)GLYCOL

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Introduction

Collagen is an especially abundant protein in animals. It is the main protein of connective tissue. Collagen is readily available and it possesses many interesting properties, such as biocompatibility, non-antigenecity, non-toxicity. For this reason, this protein is regarded as one of the most important and useful biopolymer in biomaterial's research [1]. Collagen based materials are widely used in tissue engineering. However, the disadvantage of using collagen as a biomaterial for tissue repair is its high degradation rate, which leads rapidly to a loss of mechanical properties [2] Many attempts have been made to overcome this problem through the means of mixing collagen with either natural (e. g. chitosan) or synthetic polymers or different crosslinking method [3]. Chitosan is a natural polymer (polysaccharide) prepared from chitin by deacetylation. Chitosan-based materials possess high biocompatibility and various biological functions such as wound healing, antibacterial activity [4]. The aim of present study was to investigate the influence of addition a small amount of poly(ethylene)glycol on the properties of collagen/ chitosan porous matrices.

Materials and Methods

Collagen (col) was obtained in our laboratory from the tail tendons of young rats. Chitosan (chit) and poly(ethylene)glycol (PEG) were supplied by the company Sigma–Aldrich. In this work a porous collagen/chitosan/poly(ethylene) glycol matrices were fabricated by the freeze-drying method. Firstly, collagen solution with concentration of 1% was prepared from lyophilized collagen in deionized water using an IKA disintegrator. Then, 1% chitosan solution in acetic acid and 2% PEG solution were prepared. Polymeric blends were obtained by mixing suitable volumes of chitosan, collagen and PEG solutions and the final weight ratio were presented in TABLE 1.

TABLE 1. The composition of studied samples

	Sample
1	col
2	chit
3	col50/chit50
4	col25/chit75
5	col75/chit25
6	col50/chit50 + 5% PEG
7	col75/chit25 + 5% PEG
8	col25/chit75 + 5% PEG

In order to improve especially the mechanical properties and susceptibility to degradation of the materials, the samples were physically modified using a dehydrothermal treatment (DHT). For DHT crosslinking, freeze–dried samples were placed under a vacuum at a temperature of 110°C for 24 h.
The effects of poly(ethylene)glycol addition was examined using measurements: water uptake ability, porosity and mechanical properties.

Results and Discussion

FIG. 1 shows SEM images of the horizontal cross section of freeze-dried samples.

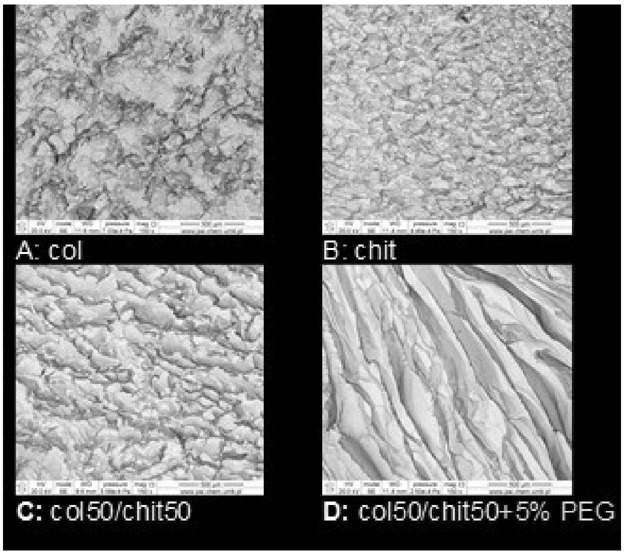

FIG. 1. SEM images of different porous matrices.

The samples prepared by freeze-drying resulted in porosity from 63.5% (chit) to 83.8% (col25/chit75) (TABLE 2). Compressive moduli (E_c) of prepared samples are shown in TABLE 2. The addition both chitosan and PEG gives rise to an increase in the stiffness of samples which enhanced the values of the mechanical characteristics.

TABLE 2. Porosity (Є) and compressive modulus [E_c] of different col/chit and col/chit/PEG matrices.

Sample	E_c [kPa]	Є [%]
col	3.61	78.5
chit	21.8	63.5
col75/chit25	14.4	80.2
col50/chit50	10.4	81.3
col25/chit75	17.5	83.8
col75/chit25 + 5% PEG	14.8	75.5
col50/chit50 + 5% PEG	9.18	66.7
col25/chit75 + 5% PEG	17.7	78.3

The samples containing collagen and chitosan show a great ability to absorb water (results not shown) and have the highest degree of porosity and good mechanical properties.

Conclusions

The addition of PEG caused the reduction of the degree of porosity and the degree of swelling but it led to the increase of the value of the degree of enzymatic degradation.

Acknowledgments

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