COLLAGEN TYPE I HYDROGELS MODIFIED WITH SODIUM ALGINATE

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Introduction

Collagen is a structural protein that forms extracellular matrix of connective tissues. It is one of the most commonly used material for biomedical applications. Collagen solution may form hydrogel e.g. due to neutralization, but this process is time-consuming and the gels obtained are relatively weak [1,2].

Sodium alginate is a natural, linear polysaccharide obtained mainly from brown algae. It easily creates stiff, thermo-irreversible gels in the presence of divalent ions (Ca^{2+}) [3,4].

The aim of our work was to shorten the time of gel preparation and improve of its strength by mixing collagen solution with sodium alginate.

Materials and Methods

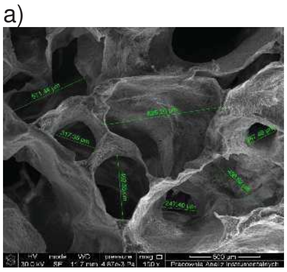
The collagen type I 0,5% solution in 0.1 M acetic acid was prepared, neutralized by 0.1M NaOH addition and mixed with 5% alginate solution at various weight ratios of dry polymers (5:5, 4:6, 3:7, 2:8, 1:9). Then the blends were dialysed against water and calcium chloride solution.

The porous structure of the lyophilized hydrogels was investigated using SEM (Quanta 3D FEG). The gels were mechanically tested (compressive strength) using Zwick&Roell Z0.5 machine. The cytotoxicity of these materials was also studied by culturing 3T3 cells with the addition of collagen/alginate hydrogel extract.

Results and Discussion

The developed method allowed to obtain rigid, homogeneous collagen/alginate hydrogels. SEM image presented in FIG. 1 shows porous structure of the materials.

a)



b)

Sample	Pore size [μm]
K5-5A	417 ± 214
K4-6A	311 ± 124
K3-7A	215 ± 87
K2-8A	205 ± 60
K1-9A	198 ± 88

FIG. 1. SEM image of porous structure of K5-5A hydrogel (a) and average pore size of various collagen/alginate hydrogels (b).

The pore size decrease when alginate content in hydrogel is bigger. Furthermore, the mechanical strength of the materials also grows (FIG. 2).

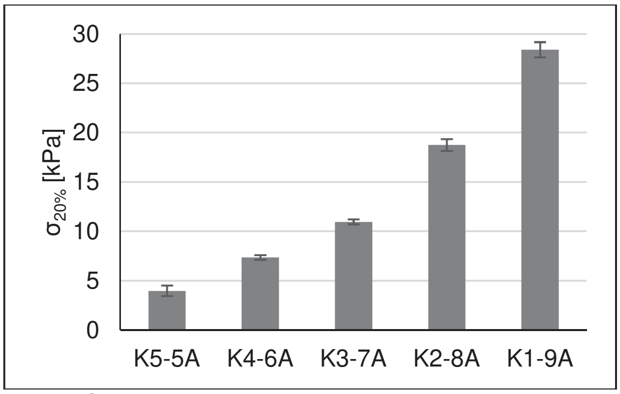


FIG. 2. The compressive stress at 20% sample deformation of collagen/alginate hydrogels.

Viability of 3T3 cells cultured with the addition of collagen/alginate hydrogel extract was also tested (FIG. 3). None of the materials shows cytotoxicity.

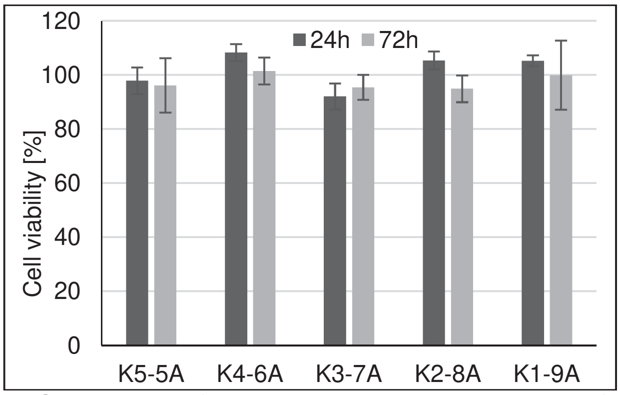


FIG. 3. Viability of 3T3 cells cultured with the addition of collagen/alginate hydrogel extract.

Conclusions

The mixing of collagen type I and sodium alginate significantly accelerate the hydrogel formation and improve its mechanical properties.

References

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