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Keratin-based films for biomedical application

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Introduction

One of the promising ways of the creation of biomaterials is the production of keratin films used in biomedicine, in particular as a substrate for cell cultivation. In this regard, keratins have successfully demonstrated the possibility of replacing polystyrene previously used for the manufacture of materials of this type.

According to literature, pre-treatment of substrates with keratins stimulates cell adhesion and proliferation.

Material & Methods

- ✓ Extraction of keratins was performed by a modified Nakamura method using 250 mM DTT.
- ✓ The protein concentration in the supernatant was determined by Bradford method.
- ✓ The protein composition was studied by their electrophoretic separation in a polyacrylamide gel in the presence of sodium dodecyl sulfate.
- ✓ The films were made by casting.
- ✓ The surface characteristics of the films were determined using a scanning electron microscope REMMA-102.
- ✓ The elemental composition of the films was determined using an X-ray microanalyzer.

Results

- ✓ The protein concentration in the supernatant was 3.75 mg/mL. After using dithiothreitol in the extraction mixture, we obtained proteins of intermediate filaments with a molecular weight of 40–60 kDa and a low Sulfur content. In the low molecular weight region, we obtained keratin-associated proteins with a molecular weight of 10– 30 kDa and a high content of Sulfur. These proteins belong to fibrillar proteins, which can be used as a matrix for the creation of new keratin-containing biocomposites with a wide range of applications in reparative medicine and tissue engineering.
- ✓ Based on the obtained keratin extract, polymer films with and without the addition of glycerol were made. Scanning electron microscopy revealed that glycerol provided the film structure with homogeneity and plasticity due to the accumulation of moisture after the fixation by water vapor.
- ✓ The X-ray microanalysis of films revealed such elements as Sodium, Silicon, Sulfur, Potassium. Among the detected elements, Sulfur has the largest share that is due to the large number of disulfide bonds in the keratin molecule.

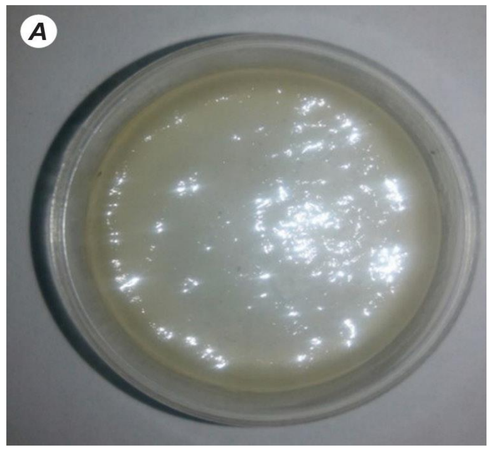

Fig.1. The film based on 4% keratin solution with addition of 1% glycerol;

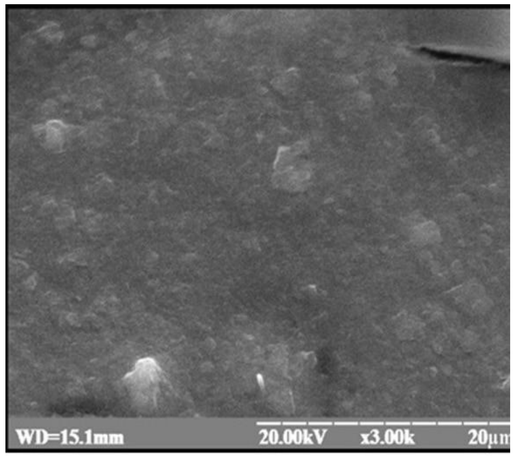

Fig. 2. SEM of the film made of 4% keratin solution with addition of 1% glycerol

Element	The film made with 4% keratin solution with the addition of 1% glycerol
Sulfur	12.89
Sodium	3.11
Silicon	0.21
Potassium	0.38

Fig.3. The content of chemical elements in the film, %

Conclusions

The polymer keratin films with the addition of glycerol demonstrated better mechanical properties and can be used in biomedicine.