UDC 611.781: 616.594.1

KERATINS AS A POTENTIAL MATERIAL FOR BIOMEDICAL APPLICATIONS

V. V. Havrylyak[1], PhD, *H. M. Sedilo*[2]
Doctor of Agricultural Sciences
havvita@ukr.net

[1]Institute of Animal Biology NAAS, Lviv
[2]Institute of Agriculture of Carpathian region NAAS, Obroshyno village, Lviv region

Hair is a complex natural fiber with a heterogeneous morphological structure. The chemistry of the different morphological compartments of hair results in an unique physical and mechanical properties. Hair is composed of keratins, a group of insoluble protein complexes which form from 65 % to 95 % of hair composition by weight.

Keratins are the biopolymers with a strongly hierarchical organization of subunits, from the α-chains *via* intermediate filaments to the fibre. Nowadays keratins are considered as a starting material which can be used in biotechnological and biomedical fields. There are also numerous data about the possibility to design biocompatible nanomaterials on the basis of keratins because these proteins have ability to self-assembly and polymerization in complex three-dimensional structure. For this purpose, microfibrillar fraction or alpha-keratose preferably is used. However, the key issue is to find a suitable solvent, able to turn fibrillar proteins in solution. Typically, for this aim, a mixture of solvents with different functions is used, for example, one component of mixture breaks hydrogen bonds, while the other — disulfide bonds.

Therefore the goal of our research was analysis of keratin fibres structure and preparation of keratin solution.

For the analysis of the structural characteristics of human hair and wool fibers the methods of transmission and scanning electron microscopy with X-ray microanalysis were chosen. By X-ray microanalysis the elemental composition and their quantitative analysis in various structural components of human hair and wool fibers were obtained. The peculiarities of the content and composition of the intermediate filaments proteins and keratin-associated proteins in these fibers were revealed. The content of matrix proteins in these fibers was within 30 %, while the proteins of macro- and microfibrils account more than 60 %.

Degree of keratin extraction depends on its duration and the composition of the solvent. To compare the efficiency of keratin extraction from fibers we applied a solution which consists of thioglycollic acid and urea. Another solution contains thiourea, urea and 2-mercaptoethanol.

Obtained data has been shown that adding thiourea to buffer mixture with urea and 2-mercaptoethanol was accompanied by a doubling the content of protein extracted from the fiber. The content of keratin extracted under the action of thioglycollic acid and urea does not exceed 1 mg / g.

Dissolved keratins were analyzed by electrophoresis in PAGE-SDS. It has been established the presence of polypeptide bands in the range of molecular weights of 60-40 kDa, 30-10 kDa and 100 kDa, which correspond to low sulfur proteins or intermediate filaments, high sulfur proteins or keratin-associated proteins and high molecular weight proteins.

Obtained solution of keratins can be used to form thin films for attaching fibroblast and their proliferation, sponges for immobilization of biologically active substances, hydrogels for the regeneration of peripheral nerves, filters to bind heavy metals.