RESEARCH AND DEVELOPMENT OF COLLAGEN OF POLYMERIC COMPOSITIONS BASED ON WASTE OF RAWLEATHER

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Abstract: *Polymer compositions were created on the basis of leather raw materials (collagen) with acrylic aldehyde, hydrolyzed polyacrylonitrile, and their properties, characteristics, texture and structure were investigated in this work.*

Keywords: *collagen, golio, hydrolysis, tanning, retanning, destruction.*

Introduction. In leather and fur production, raw materials of biological origin are used, the main component of which are protein substances, or proteins - collagen of the dermis and keratin of the hair [1].

Collagen in the animal body is very common: its content is 25-35% of all proteins. Therefore, it is natural that scientists of different specialties deal with the structure of collagen. Collagen as an integral part of a living organism should be of interest to medical histologists, surgeons, rheumatologists, dermatologists, etc., biologists and biochemists [2].

Recently, physicists have been paying much attention to collagen as a fibrillar protein and a high-molecular compound. Finally, collagen is also of industrial importance. The dermis of the skin of animals is the main substance for the production of a technical product - skin. Glue and gelatin are prepared from collagen. Consequently, technologists are no less interested in studying the structure and properties of collagen than other specialists. This explains the large number of papers devoted to the study of this protein [1].

Materials and methods. Collagen is an integral part of connective tissue. In addition to the fibrous material, cells and the basic substance were also found in the connective tissue. In this regard, of course, special comprehensive studies were carried out. The main part of the leather fur raw materials are proteins. These proteins are read by natural polymers. During the processing of leather raw materials, some waste is generated.

Waste from tanneries in the form of peripheral sections of hides, mezdra, minnow trimmings, substandard sawn-off can be used for the manufacture of gelatin, feed flour and protein hydrolysis.

In this regard, it was interesting for us to study the possibility of creating polymer compositions based on waste leather raw materials (collagen) with acrylic aldehyde, hydrolyzed polyacrylonitrile and to investigate their properties, structure and structure.

A characteristic analogue of model collagen compounds is a collagen film, thread, gelatin, char powder and mezdra glue containing not only the reaction-specific groups characteristic of collagen, but also amino acid residues located in the same initial sequence. In this regard, we conducted a study and identified the possibility of chemical modification of collagen with acrolein. From this point of view, it is of great interest to study the interaction of collagen with acrylic aldehyde, the resulting product of collagen modification, which has a number of valuable properties.

Results. The initial collagen for modification was obtained as follows. The minnow waste was watered in a special glass container, held for 1.5-2.0 hours, then crushed in a meat grinder and the pH of the crushed mass was adjusted to a value of 10.5-11.0 with the addition of caustic soda, and the processing solution was saturated with sodium sulfite. After that, the mass was held at 23-250C for 30 hours. The treated mass was washed in running water to remove salt. Then neutralized with 3.0% boric acid. The resulting mass was dissolved in 1 M acetic acid solution, the solution

was forced through a nylon sieve, filtered, collagen was precipitated with acetone and dried.

Acrolein (acrylic aldehyde) - CH_2=CHCHO (2-propenal) was used as another component for collagen modification.

Due to the poor solubility of acrylic aldehyde in water, the reaction was carried out in an aqueous alcohol solution of collagen (ethanol: water = 2:5). The process of modification of collagen with acrylic aldehyde was carried out as follows. Initiators (sodium sulfate - 0.3 g/l and potassium sulfate - 0.5 g/ l) were first introduced into the 5.0% collagen solution system, after 40-60 seconds acrylic aldehyde was introduced in an amount of 3.0% of the mass (system) of solvents.

In such a system, grafted copolymerization of acrylic aldehyde to collagen is expected. At the same time, it is impossible not to take into account the formation of a certain amount of acrolein homopolymer. Therefore, the final product of the grafted copolymerization process was carefully extracted with dimethylformamide in order to remove the homopolymer.

The turbidimetric titration method was used to study the interaction of acrylic aldehyde with collagen. Acetone, which is a selective collagen precipitator, was chosen as a titrating agent. When acetone is added to the polyacrolein solution, turbidity does not occur. Turbidity of solutions was determined on a turbidimeter in conventional units. Titration was carried out in portions of 0.2 ml.The addition of acetone to a dilute (collagen-acrolein) composite solution does not cause any significant change in turbidity, therefore, the precipitator used can practically be considered selective for collagen.

When comparing the titration curves (Fig. 1), it can be seen that the nature of the titration curves of the collagen - acrylic aldehyde composition system (1, a-d) varies depending on the concentration of collagen. On curves 1, a-b, a minimum is observed and the position of which depends on the concentration of collagen: with increasing concentration, the depth of the minimum decreases, and it itself shifts to the area of a lower content of the titrating agent acetone. The presence of a minimum is explained

by an increase in protein solubility in the presence of a small amount of acetone-water solvents, with an increase in protein concentration, the minimum is smoothed and shifted to the left. The maximum value corresponding to fully titrated collagen increases in proportion to the concentration of collagen, since precipitation was carried out by a selective collagen precipitator.

The large values of relative turbidity at the end of titration for curves 3, b, d, d in comparison with the corresponding curves 1 and 2 indicate the great completeness of the phase separation process. The appearance of characteristic fractures on curves 3 indicates in favor of the assumption that the interaction is carried out on the principle of heterogeneous aggregation.

Discussion. From the consideration of the titration curves, it can be seen that the position of curve 3 depends on the composition of the system: with a collagen content of 1:9 3:7, this curve lies below, and in the area of a large collagen content, the titration curve is above the freshly prepared freshly prepared mixture. This can be explained by the fact that with an increase in the collagen content, the interaction of the collagen - acrylic aldehyde type becomes prevalent. Based on the data of the turbidimetric study, the presence of a strong interaction of collagen with acrylic aldehyde with the formation of a modified polymer product was established.

The above experimental data show that there is an interaction between collagen and acrylic aldehyde, and not a simple mechanical mixing of the initial components. As a result of the interaction, a physicochemical change in the properties, in particular the rheology of the solution, occurs. In this regard, the viscosity of the resulting product was studied.

Conclusion. Viscosity was measured on an Ostwald viscometer with a capillary diameter of 0.5 mm at temperatures of 13, 20, 30 and 400C (since at t ≤ 150C collagen macromolecules have spiral confirmation, at t ≤ 350C - the shape of a tangle, at 15-350C there is both spiral and tangle shape of macromolecules). The data obtained are presented in Table 1.

Table 1. Specific viscosity of collagen and acrolein solutions (in the ratio of 1:1) at different temperatures

System	Specific viscosity at temperature, 0C			
	13	20	30	40
Collagen shell	0,26	0,35	0,32	0,18
Collagen + Acrylic Aldehyde	0,79	1,27	1,32	1,43
Acrylic Aldehyde	0,42	0,43	0,44	0,47

It should be noted that the non-additive increase in viscosity, indicating interaction, is observed only at temperatures of 20 and 300C, at which the collagen macromolecule has a more elongated shape, and therefore, the interaction of acrolein with the functional groups of collagen is easier to establish. At a temperature of 400C, sufficiently hydrophobic interactions occur, as a result of which the collagen macromolecule takes a more compact form and is in the form of a tangle, which is an obstacle to the interaction of acrylic aldehyde with the functional groups of collagen.

The conducted studies indicate that the reactive groups of collagen NH_2 and NH+3 actively react with the aldehyde groups of acrylic aldehyde, that acrylic aldehyde has a structuring effect on collagen. This will make it possible to use acrylic aldehyde in tanning and tanning processes as an independent tanning agent.

LIST OF LITERATURE

1. Kodirov T.J. "Means and methods of collagen research", Publishing House "Fan" of the Academy of Sciences Rep. Uzbekistan, Tashkent, 2014. 375 p.

2. Khaitov A.A. "Creation of new effective collagen - polymer compositions from leather waste for filling leather and development of their technologies". Dissertation. T. 2001.

3. Kodirov T.Zh. "Collagen nanostructure", Publishing House "Fan" of the Academy of Sciences of the Republic of Uzbekistan, Tashkent, 2015. 535 p.

4. Хайитов А. А., Отамуродов Ж. О. ЭФФЕКТИВНОЕ ПРОВЕДЕНИУ ПРОЦЕССА ДУБЛЕНИЯ И ЖИРОВАНИЯ КАРАКУЛЕВЫХ ШКУР В

ПРОИЗВОДСТВЕНЫХ УСЛОВИЯХ //Вестник науки. – 2021. – Т. 3. – №. 9 (42). – С. 45-50.

5. Хайитов А. А., Рустамов Б. И. Разработка технологии получения коллагеновых препаратов и мездровых клеев из отходов кож в производственных условиях //Вестник науки. – 2022. – Т. 3. – №. 4 (49). – С. 86-93.

6. Хайитов А. А., Тошпулатова М. Б. Исследование гидролиза дубленых кожевенных отходов и условия получения и свойства реакционно-активных белковых гидролизатов //Вестник магистратуры. – 2021. – №. 3. – С. 114.