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Physico-chemical analysis of collagen and its mixtures with water-principles of microcapsular therapeutic systems

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At present, the attention of producers of medicinal preparations is focussed on therapeutic systems of microcapsular type the manufacture of which is based on nanotechnologies. As a polymer base of microcapsules, natural polymers such as collagen and gelatin are used and besides, they are subjected to special treatments that lead to the change in their structure. Therefore, the detection of interconnection between the structure and physico-chemical properties of natural polymers is an urgent problem. We have determined temperatures of physical transitions by differential thermal analysis for collagen extracted from cattle (I) and fowl (II) as well as the limit of water solubility in the above proteins.

Examinations of anhydrous collagen showed that several relaxation transitions of endothermic character (γ-, β- and α-) appear on the protein thermograms. This is directly related to a complex molecular and supermolecular structure of the collagen. The irradiation exercises influence on the temperatures of physical transitions of the collagen. γ-transition disappears while temperatures of β- and α-transitions increase. As a result of the cross-linking of the protein macromolecules induced by irradiation, its structure becomes more rigid and side groups lose an opportunity to vibrate. Water has a plasticizing effect on the collagen, decreasing temperatures of its physical transitions.

The comparison of concentrations of saturated solutions of water in collagen I ($30.1 \pm 0.7\%$ H_2O, mass fraction) and in collagen II ($32.8 \pm 0.5\%$ H_2O(mass, fraction) shows that the solubility of water in collagen I is somewhat lower. Samples of mixtures of collagen I with 82.6% (mass fraction) H_2O and of II with 72.0% H_2O(mass fraction) display the endothermal peak at 298 K and 304.7 K, respectively, which is classified as a spiral⇔coil transition. In the same temperature interval the "fusion" of gel takes place.

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