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Peculiarities of thermal aggregation of bovine serum albumin in the presence of strong polyelectrolytes

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Abstract

The influence of temperature on bovine serum albumin (BSA) aggregation in aqueous solutions in the presence of poly-*N,N*-dimethyl-*N,N*-diallylammonium chloride (PDMDAAC) and the sodium salt of carboxymethylcellulose (CMC) was studied. It was shown that protein-polyelectrolyte complexes (PPC) form because of macromolecular reactions that are stabilized mainly by electrostatic forces. To characterize the PPC composition the φ parameter was used. This parameter is defined as the ratio of the concentration of ionic groups of polyelectrolyte per protein molecules. It was studied that when in an interpolyelectrolyte reaction, a sufficiently high degree of transformation occurs the polymer electrolyte initiates aggregation of protein molecules. As the temperature increases, the initiating role of the polymer electrolyte increases due to an increase in the intensity of hydrophobic interactions. Using the method of spectrophotometry, it was found that, depending on the nature of the polymer electrolyte, insoluble complexes of bovine serum albumin are formed when the pH parameter is above or below the isoelectric point of the protein, when its macromolecules are negatively or positively charged. In the presence of poly-*N,N*-dimethyl-*N,N*-diallylammonium chloride, the intensive formation of aggregates and their rapid precipitation in the form of flakes at pH > 7.0 was observed when the temperature increased to 60 °C. The maximum yield of the product of the interpolyelectrolyte reaction bovine serum albumin – sodium salt of carboxymethylcellulose was detected at pH ≤ 4.0. A temperature increase up to 60 °C, in this case, was not accompanied by intensive flocculation. Under optimal composition and interaction conditions, the degree of transformation in the BSA – PDMDAAX and BSA – CMC reactions is ~0.93 and 0.9, respectively, and decreases by ~5-7% with an increase in temperature to 60 °C. It was shown that for the same BOD composition (the ratio of components in the [CMC]/[BSA] complex = 0.1 g/g), an increase in temperature from 25 to 60 °C leads to the formation of particles that increase in size from 1 mcm to 5 mcm. The temperature increase leads to a change in composition of BOD, corresponding to its maximum output as a interpolyelectrolyte reactions product: for complex with PDMDAAC at T = 25, 40 and 60 °C, the φ value is 70, 60, 15; for the complex with the CMC – 60, 50, 20.

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