Spectral demonstration of structural transitions in albumins

Svetlana Tankovskai¹, Karina Abrosimova¹, and Sofia Paston¹

¹ Department of Molecular Biophysics and Polymer Physics, Faculty of Physics, Saint-Petersburg State University, Ulyanovskaya, 3, St.Petersburg 198504, e-mail: Russia.tasva-ara1@yandex.ru

Proteins functions are determined by their structure. Environmental conditions, chain modifications, interaction with co-factors and ligands caused changes in proteins structure and activity. The development of new approaches to experimental analysis of protein structure and dynamics continues incessantly. In the present study the different spectral techniques (FTIR, UV and fluorescent spectroscopy) and zeta potential measurements are used to reveal structural transitions in human serum albumin (HSA) and ovalbumin (OVA) during the changes in pH, and also electrolyte and aliphatic alcohols content in solution.

IR spectroscopy is a very sensitive method for proteins secondary structure analysis. To determine the percentage of α-helix, β-sheets, β-turns, random regions and intermolecular bindings in HSA and OVA we applied the decomposition of Amid I band (1700–1600 cm⁻¹) in the proteins IR spectra [1]. Spatial organization of protein globule affects the distance between amino acid residues and their accessibility for the solvent. Both these factors manifest in electronic absorption and fluorescent spectra of the protein. Protonation and deprotonation of amino acids side groups at pH variation lead to “native state – molten globule” transition of the protein, when chromophores Tyr and Trp become available for contact with the solvent, that shifts protein absorption and emission spectra. Comparing the results of titration curves, spectral parameters, zeta potential and secondary structure data enable the researcher understand what kind of structural changes take place in different conditions. Native states of studied albumins occur in the vicinity of their isoelectric point and distinguish maximum content of α-helices and partial aggregation of protein molecules. In the presence of electrolyte (NaCl) the aggregation decreases. Aliphatic alcohols destabilize the native state of albumins.

Keywords: albumins; FTIR spectroscopy; UV spectroscopy; fluorescence; zeta potential

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References