DYNAMIC SURFACE ELASTICITY OF DISPERSIONS OF OVALBUMIN FIBRILS

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Proteins and fibrils obtained from them have recently been frequently used as stabilizers of foams and emulsions. They reduce the surface and interfacial tension by forming viscoelastic layers around oil droplets in water and air bubbles in foam thereby preventing coalescence. At the same time, the relatively high concentrations of native proteins are often required for effective stabilization of foams and emulsions. The use of fibrils makes it possible to reduce the total protein concentration in the system and thus reduce the cost of the products obtained. The determination of surface properties in particular the surface tension and surface viscoelasticity provides information on the structure of adsorption layers and helps to develop effective stabilizers of foams and emulsions.

In this work, the methods of surface rheology are applied to the adsorption layers of worm-like ovalbumin (OVA) fibrils on the surface of water in order to determine the mechanism of their formation and their structure. The morphology of the fibril layers as well as the shape and size of the fibrils were determined by atomic force microscopy. It has been shown that short worm-like OVA fibrils form a continuous loose adsorption layer on the water surface consisting of clusters of fibrils of different sizes and individual fibrils and is characterized by significantly lower values of the surface elasticity and surface pressure as compared with native protein layers. The admixtures of polypeptides formed as a result of the hydrolysis of OVA during the synthesis of fibrils cannot be completely removed by single purification of the dispersion by centrifugation. In addition, the centrifugation and the subsequent re-dispersion of the ovalbumin fibrils lead to the destruction of large OVA fibrils with high persistence and contour length. After the twice purification, a significant induction period appears on the kinetic dependences of the surface properties after which the properties change slower than in the case of native protein solutions due to an increase in the average size of kinetic units in the system. Thus ovalbumin belongs to a group of relatively rare proteins for which the native molecules can be better stabilizers of liquid-phase systems than fibrils. At the same time, it can be assumed that flexible and relatively short OVA fibrils will effectively interact with oppositely charged polyelectrolytes leading to the formation of complexes with high surface activity.

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