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The glass transition temperature and temperature dependence of activation energy of viscous flow of ovalbumin

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The paper presents the results of viscosity determinations on aqueous solutions of ovalbumin at a wide range of concentrations and at temperatures ranging from 5^{o}C to 55^{o}C. On the basis of these measurements and three models of viscosity for glass-forming liquids: Avramov's model, free-volume model and power-law model, the activation energy of viscous flow for solutions and ovalbumin molecules, at different temperatures, was calculated. The obtained results show that activation energy monotonically decreases with increasing temperature both for solutions and ovalbumin molecules. The influence of the energy of translational heat motion, protein-protein and protein-solvent interactions, flexibility and hydrodynamic radius of ovalbumin on the rate of decrease in activation energy with temperature has been discussed. One of the parameters in the Avramov's equation is the glass transition temperature T_g. It turns out that the T_g of ovalbumin solutions increases with increasing concentration. To obtain the glass transition temperature of the dry ovalbumin, a modified Gordon-Taylor equation is used. Thus determined the glass transition temperature for dry ovalbumin is equal to (231.8 ± 6.1) K.