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Adsorption of α -chymotrypsin onto mica in laminar flow conditions. Adsorption kinetic constant as a function of tris buffer concentration at pH 8.6

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Abstract

We examined the adsorption kinetics of α -chymotrypsin (pH 8.6, 10^{-2} to 0.5 M Tris buffer) on muscovite mica in conditions of laminar flow through a slit. The range of buffer concentrations is between two limits: (i) no adsorption in 1 M Tris and (ii) no desorption in 10^{-3} M Tris. Studying the dependence of adsorption kinetics on the wall shear rate leads to the determination of the interfacial adsorption kinetic constant k_a and the diffusion coefficient. The obtained value for the diffusion coefficient is close to the one expected from the molecular size of α -chymotrypsin. The interfacial adsorption kinetic constant of α -chymotrypsin decreases when ionic strength increases, while the initial desorption constant (over a part of all the adsorbed population) shows the contrary. Although α -chymotrypsin is almost at its isoelectric point, the effect of ionic strength on the adsorption kinetics suggests the importance of electrostatic interactions between the protein and mica. We observed an increase in the adsorption rate, at a surface coverage near 0.14 ug cm^{-2} , for adsorption in 10^{-2} M Tris and the low wall shear rates (300 s^{-1}). This change in the adsorption rate suggests a structural transition, that we assume again to be due to electrostatic interactions, but between proteins. The large dipole moment of the protein may induce this transition, illustrated here by the ferroelectric/antiferroelectric pattern. The variation of the ζ potential with interfacial concentration seems to be in agreement with such a model.

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