Fibrinogen Monolayers on Mica Studied via the Streaming Potential and Colloid Deposition Methods

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The streaming potential and the colloid particle deposition (referred to as colloid enhancement CE) methods were applied to characterize fibrinogen (Fb) monolayers on mica, produced by controlled adsorption under diffusion transport. The surface concentration of Fb was determined directly by AFM enumeration of single molecules adsorbed over the substrate surface. It was proven that Fb adsorbed irreversibly on mica for various pH with the rate governed by bulk transport. The electrokinetic properties of Fb monolayers produced in this way were studied using the streaming potential method. The dependence of the apparent zeta potential of Fb monolayers was determined as a function of the coverage. It was shown that for pH = 3.5 the initial negative zeta potential of the mica substrate was converted to positive for Fb coverage exceeding 0.16 (see Fig.1.).

On the other hand, for pH = 7.4 (see Fig.1.) the zeta potential a Fb covered mica remained negative for the entire coverage range. The charge distribution in Fb monolayers was additionally studied by the colloid deposition method, in which negatively and positively charged polystyrene latex particles (800 nm in diameter) were used. An anomalous deposition of negative latex particles on substrates exhibiting a negative zeta potential was observed. This proved that the classical DLVO theory was inadequate. Results of these experiments were quantitatively interpreted in terms of the fluctuation theory assuming that adsorption sites consisted of two and three Fb molecules, for pH = 3.5 and 7.4, respectively. These results suggested that for pH > 5.8 (isoelectric point), the distribution of charge on Fb molecules was heterogeneous, characterized by the presence of positive patches, whereas the average zeta potential remained negative, equal –19 mV. It was concluded that the CE method can be used for a sensitive determination of fibrinogen monolayer coverage for a broad range of pH and bulk concentration.

Acknowledgements: This work was supported by the COST D43 Action and POIG.01.01.02-12-028/09.