

Elucidation of Mechanism of Bio-compatibility on the basis of the Direct Analysis of Interaction between Materials Surface and Biological Components

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The n-octadecyltrichlorosilane (OTS, $\text{CH}_3(\text{CH}_2)_{17}\text{SiCl}_3$), the [2-(perfluorooctyl)ethyl] trichlorosilane (FOETS, $\text{CF}_3(\text{CF}_2)_7\text{CH}_2\text{CH}_2\text{SiCl}_3$) and their mixed monolayers were used as the model surfaces for the study of protein adsorption mechanism. The ATR-FT IR flow cell study on protein adsorption behavior revealed that the adsorption amount of bovine serum albumin (BSA) onto each OTS and FOETS monolayer increased remarkably in an initial stage of adsorption experiment and attained an equilibrium within a few minutes at $\text{pH}=7.5$. In the case of the (OTS/FOETS) mixed monolayer, the amount of protein adsorption was apparently suppressed in comparison with the case for the OTS and the FOETS monolayers. The atomic force microscopic (AFM) observation of BSA adsorption behavior onto monolayer surface in a BSA solution at $\text{pH}=7.5$ showed that BSA was preferentially adsorbed onto the FOETS phase of the (OTS/FOETS) mixed monolayer. In contrast, the selective adsorption of BSA onto the FOETS phase was not observed at the isoelectric point of BSA ($\text{pH}=4.7$). The interaction between BSA and the surface of (OTS/FOETS) mixed monolayer was evaluated on the basis of the adhesion force measurement by AFM. When the gold-coated tip was used as a control experiment, the adhesion force between tip and surface was less than 1 nN. In the case of the BSA immobilized tip, the adhesion force was ca. 5 nN and showed multiple minima in retract curve because of the multi-point contacts of BSA with the monolayer surface or the chain unfolding of BSA.