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Polynucleotide Adsorption onto Negatively Charged Surfaces HAO CHENG, JOSEPH A. LIBERA, KAI ZHANG, MICHAEL J. BEDZYK, MON-ICA OLVERA DE LA CRUZ — Though DNA adsorption onto negatively charged surfaces such as mica in divalent salt solution has long been studied by atomic force microscope (AFM), the adsorption process is poorly understood. We develop a mean filed theoretical model which includes the pH effect on surface charge density and also the reaction between divalent ions and silanol groups at silica surface. When polynucleotides approach the nearly neutralized surface, the electrostatic field variation promotes reactions and results in polynucleotide adsorption. The equilibrium constant difference of the second reaction for varied divalent metal ions is the main reason for why not all the divalent counterions can mediate DNA adsorption onto like charged surfaces. The variation of polynucleotide adsorption amount with divalent salt concentration and pH value is consistent with what were found in AFM study. In our experiment, we use long-period X-ray standing wave (XSW) to measure in situ mercurated polynucleotide adsorption onto a negatively charged silica amorphous surface in ZnCl₂ solution. The most advantage of XSW measurement is that it can show atoms distribution quantitatively in the direction perpendicular to the surface. Our calculation results are in excellent agreement with the quantitatively experimental results. More generally, the effects of polyelectrolyte line charge density and monovalent salt on adsorption are also analyzed theoretically.

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