389g Adsorption Thermodynamics of Short-Chain Peptides on Charged and Uncharged Nanothin Polymer Films

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This contribution describes experimental measurements of submolecular-level interaction energies involved in the process of peptide adsorption on polymer films. The objective of this study was to use surface plasmon resonance spectroscopy to measure the Gibbs energy change on adsorption (ΔG_{ad})for a pair of di- and tri-homopeptides on highly uniform, nanothin polymer films, and to use these data, along with the principle of additivity, to predict ΔG_{ad} for a homologous homopeptide, as well as for a mixed-residue peptide. Using a graft polymerization methodology, nanothin films of poly(2-vinylpyridine), poly(styrene), and poly(1-benzyl-2-vinylpyridinium bromide) were prepared and adsorption energies were measured for a homologous series of tyrosine (Y) homopeptides on these films in order to determine submolecular-level interaction energies. Using SPR, adsorption isotherms were measured for YY and YYY peptides and combining the thermodynamic contributions for adsorption of individual tyrosine units allowed a predictive estimate for the adsorption energies for YYYYYY. To extend this approach to a mixed-residue peptide, measurements were made for glycine, phenylalanine, and tyrosine-leucine subunits found in leucine enkephalin. It was found that for short-chain biomolecules, where adsorption can be considered reversible, applying the principle of additivity to known submolecular-level interaction energies allowed predictive estimates within 9% of measured values for the adsorption energies on the uncharged surfaces. Contrary to the results for the uncharged surfaces, the adsorption energies were not found to be additive for the charged surfaces.