PROTEIN-SPECIFIC EMPIRICAL MODEL OF PROTEIN ADSORPTION ON SURFACES

Dan V. Nicolau, McGill University
dan.nicolau@mcgill.ca

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Predicting protein adsorption from solution to a surface is an important problem in biomedicine and related fields. Despite constant attention in the literature, it is not currently possible to predict quantitatively the amount of adsorbed protein given environment, protein and surface parameters. We present a purely empirical approach to predict protein adsorption using a linearly piecewise model with breakpoint, based on progress in the understanding and quantification of physico-chemical properties on protein molecular surfaces. This model is capable of accounting for over 90% of the variance in the data, despite the fact that the adsorption data spans over three orders of magnitude. We fitted and validated this model using the Biomolecular Adsorption Database, an online collection of protein adsorption data collected from the literature freely available at http://bad.molecularsense.com. Of particular interest is that the prediction is required to be tailored differently for hydrophilic and hydrophobic surfaces. The model can be used for the designing of the materials and surfaces for single use devices, in particular considering protein adsorption in non-equilibrium conditions.

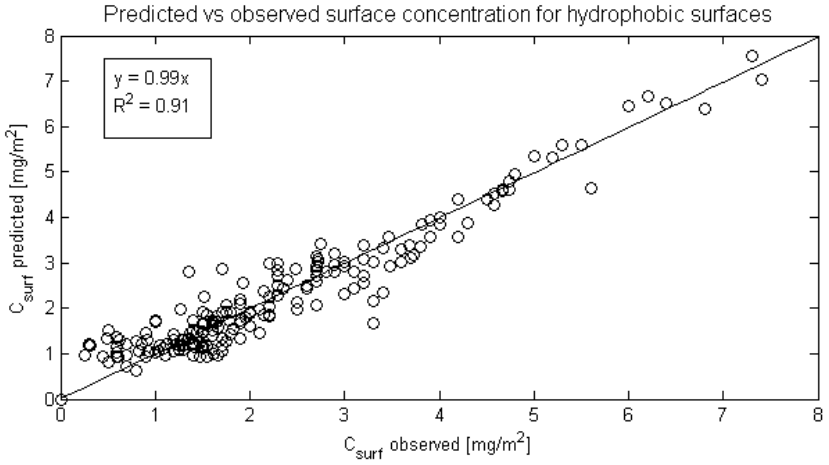

Figure 1 – Predictive power of the empirical model for hydrophobic surfaces

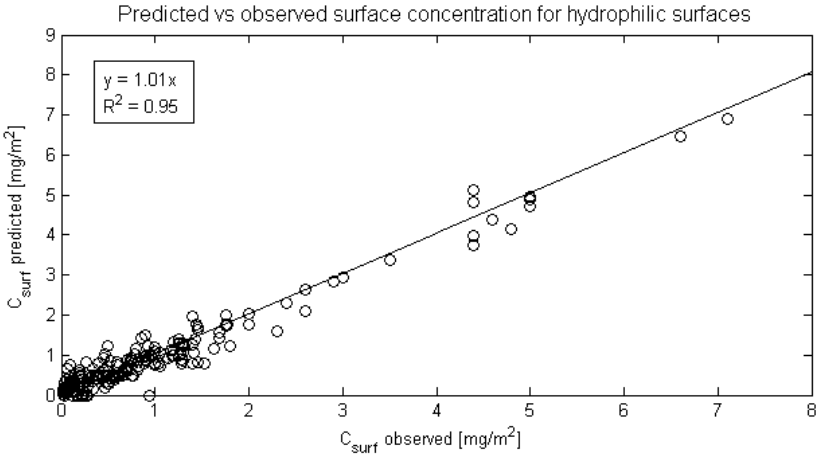

Figure 2 – Predictive power of the empirical model for hydrophilic surfaces