Adsorption Processes and Enzymatic Transformations at Solid-water Interfaces: An Environmental Chemist's Perspective on Using Quartz Crystal Microbalance with Dissipation Monitoring

Michael Sander
Environmental Chemistry, Department of Environmental Systems Science, CH-8092 Zurich, Switzerland
michael.sander@env.ethz.ch

Solid-water interfaces are highly-reactive microenvironments and thus play key roles in diverse important processes in natural and engineered systems. These processes include the adsorption and desorption of (macro)molecules to and from the interfaces as well as abiotic and enzymatic chemical reactions and transformations at the interfaces. Among several analytical techniques employed to study these interfacial processes is Quartz Crystal Microbalance with Dissipation monitoring (QCM-D). This acoustic resonator technique is unique in that it allows to determine changes in the mass and viscoelastic property of adlayers at the solid-water interface at the nanometer scale, in real time, and at very high sensitivity (down to a few ng per cm^2). This contribution will have three parts. In the first part, I will briefly introduce the QCM-D technique and discuss its capabilities (but also allude to its limitations). The second part will illustrate the use of QCM-D to study the adsorption and desorption of molecules to and from interfaces, using bacteriophage viruses and natural dissolved organic matter as examples. The third part will address the possibilities of QCM-D to elucidate reactions at interfaces, which will be highlighted by the hydrolytic breakdown of synthetic polyesters by extracellular microbial esterases. While the illustrative examples presented in the talk center around environmental processes - reflecting the research interest and expertise of the speaker -, the contribution will allude to use of QCM-D to study comparable processes also in other research fields.