A Direct Observation of Surfactant Adsorption *Via* Raman Spectroscopy

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A surfactant (surface active agent) is a molecule which has a double affinity with lipophilic and hydrophilic parts. There have been many studies focusing on surfactant science with a variety of theories and experimental approaches such as interfacial tensiometry, zeta potential measurements, and other spectroscopic methods. However, a direct observation of surfactant adsorption has not yet been performed. In this study, a novel technique to visualize the adsorption behavior of surfactant molecules at solid-liquid interfaces was developed based on Raman spectroscopy. Before starting this work, the effect of a model ionic surfactant (cetylpyridinium chloride, CPC) on the interfacial tension of the water-decane system was tested over ten orders of concentration. Solution concentrations below the critical micelle concentration (CMC) threshold were then selected for further studies of adsorption behavior in a liquid-solid system. The system consisted of an aqueous surfactant solution and a sterling silver substrate, representing the hydrophilic and hydrophobic phases, respectively. Two-dimensional scanning with Raman spectra measurements at each location in the scan was conducted to quantify the spatial distribution of surfactant in the system. The resulting profile of surfactant molecule distribution generated by the Raman-image mapping represents a direct visualization of surfactant adsorption. Possible ways forward to measure surfactant adsorption at liquid-liquid interfaces will also be described.