# Abstract

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**Title:** Detection of Highly Interrelated Interfacial pH and Polarity for Biologically Relevant Amphiphilic Self-Assemblies Using a Single Optical Probe Molecule

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This thesis demonstrates a convenient interfacial pH/polarity detection methodology for biologically relevant amphiphilic self-assemblies using optical probe molecule. By employing UV-Vis absorption and fluorescence spectroscopic methods, pH or/and polarity induced interconversion equilibriums between two molecular forms for the probe molecule were evaluated separately at the interface and the bulk phase to estimate interfacial pH/polarity and its deviation from the bulk phase value. We have synthesized interface interacting polarity sensing phenol-based Schiff-base molecular probe to estimate interfacial polarity value. In order to measure interfacial pH and polarity together, a Schiff-base molecule containing two identical phenol-conjugated-imine functional groups was exploited. Polarity induced conversion between non-ionic and zwitterionic forms, while pH induced deprotonation/protonation equilibrium for the probe molecule were evaluated individually to estimate interfacial polarity and pH value, respectively. Since the proton dissociation equilibrium of a pH-probe depends on the local polarity, an accurate estimation of polarity value at the probe localized environment is prerequisite for obtaining the interfacial pH value. However, the value of pH/polarity can alter significantly with a small change in depth at the interfacial cross-section. Thus, estimation of pH and polarity values using two separate probes localized at different interfacial depths can be erroneous. We have synthesized a glucose-pendant porphyrin molecule as a simultaneous interfacial pH and polarity detecting probe molecule. In this thesis, we have identified the interfacial pH/polarity changes during temperature-induced phase transition for anionic lipid membrane. Interfacial pH value for the lipid membrane was found to be more acidic in the gel phase than the liquid-crystalline phase. On the other hand, only a small increase of interfacial polarity value during the gel to liquid-crystalline phase transition was observed.

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