

On the impedance of a lipid coated Hg surface at very negative potentials

J. O. Agak, R. Stoodley, U. Retter*, and D. Bizzotto
Dept. of Chemistry,
University of British Columbia
2036 Main Mall, Vancouver, BC V6T 1Z1
and

* Federal Institute for Materials Research and Testing,
Berlin, Germany.

Impedance measurements of a Hg electrode coated with a DOPC monolayer was investigated over a wide frequency range at adsorption (-0.4V) and desorption (-1.85V) potentials. The interface was modelled with a simple series RC circuit. A surprising increase in solution resistance was measured in the presence of DOPC as compared to the DOPC free interface. This was observed for both the adsorption and desorption potentials. At very negative potentials, the capacitance of the interface in the presence and absence of the monolayer were the same within our measurement error indicating that the DOPC monolayer was displaced by water. The character of the lipid monolayer was modified with the addition of Ca^{2+} ions and the impedance measured. At adsorption potentials, the lipid monolayer was slightly lower in capacitance due to the increase in monolayer order by Ca^{2+} . At the desorption potential, the capacitance was lower than for the same system without DOPC indicating an incomplete desorption of the lipid monolayer. From impedance analysis, in the presence of DOPC, the solution resistance decreased as the Ca^{2+} concentration increased, and a difference between the desorption and adsorption potentials was observed. This difference reached a plateau at high Ca^{2+} of about 40 Ω . Possible explanations of the origin of this difference in resistance are given. In addition, the impedance of a DOPC monolayer formed from liposome adsorption was also analyzed. A similar increase in solution resistance was measured. Results from modelling the impedance with a Debye equivalent circuit are described. The traditional Frumkin picture of molecular desorption in light of these results is discussed.