

Supplementary

Effect of pH on Electrochemical Impedance Response of Tethered Bilayer Lipid Membranes: Implications for Quantitative Biosensing

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The admittance Bode plots of pristine membranes, VLY and MEL affected membranes are presented in Figures S1, S2 and S3 respectively. The EIS spectra fitted for different assumptions in Hypotheses 1, 2 and 3 are presented in Figures S4, S5 and S6, respectively. In Figure S4 (B), two defect density distribution functions for pristine and melittin (MEL) damaged tBLMs are displayed with solid and dotted lines, respectively. Hypothesis 1 assumes that the pH has no significant effect on the organization of bilayer lipids, and therefore, the average defect density (N_{def}) and probability density ($P(N_{def})$) do not rely on pH. Thus, one distribution function is used for both pH 7.1 and pH 4.4 spectra during fitting, and only ρ_{sub} is adjusted to account for the shift in f_{min} . The results in Figure S4 indicate that pH-dependent effects can be represented by a change in the single parameter ρ_{sub} . In contrast, Hypothesis 2 assumes that ρ_{sub} is independent of pH, and any changes in spectra are addressed by modifying and shifting $P(N_{def})$, as demonstrated in Figure S5 (B). Similarly to Hypothesis 1, Hypothesis 3 assumes that average N_{def} does not depend on pH and ρ_{sub} is a main parameter responsible for pH-dependent f_{min} shift. However, $P(N_{def})$ is allowed to vary freely as shown in Figure S6 (B).

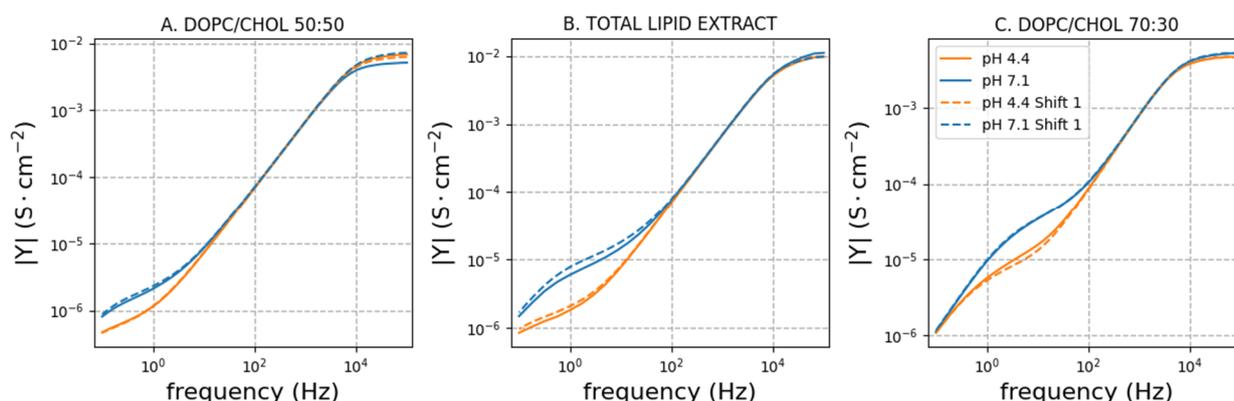


Figure S1. Admittance Bode magnitude plots of pristine membrane corresponding to Figure 4.

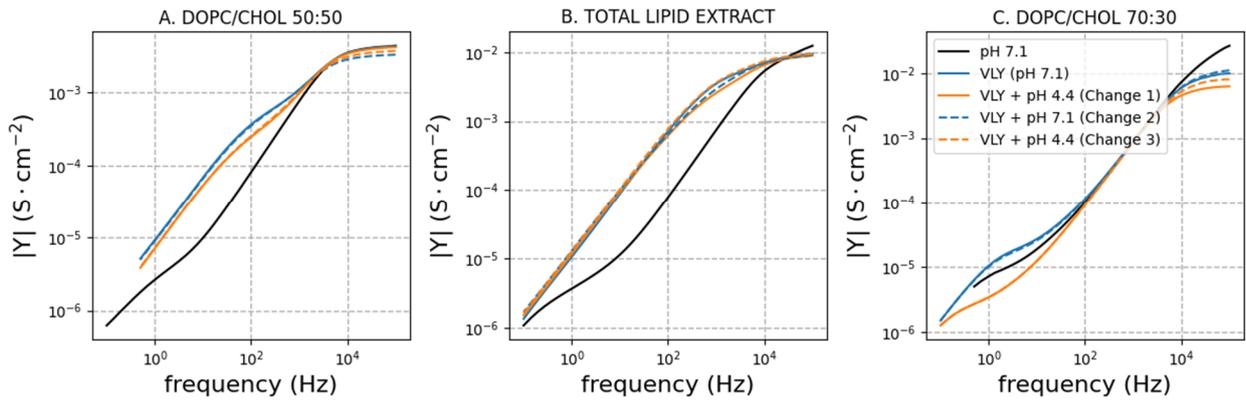


Figure S2. Admittance Bode magnitude plots of VLY affected membrane corresponding to Figure 5.

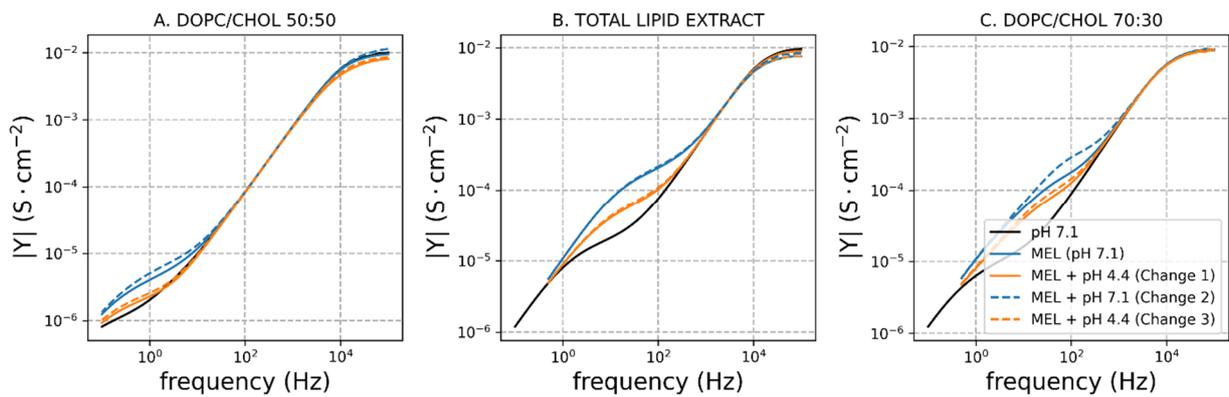


Figure S3. Admittance Bode magnitude plots of MEL affected membrane corresponding to Figure 6.

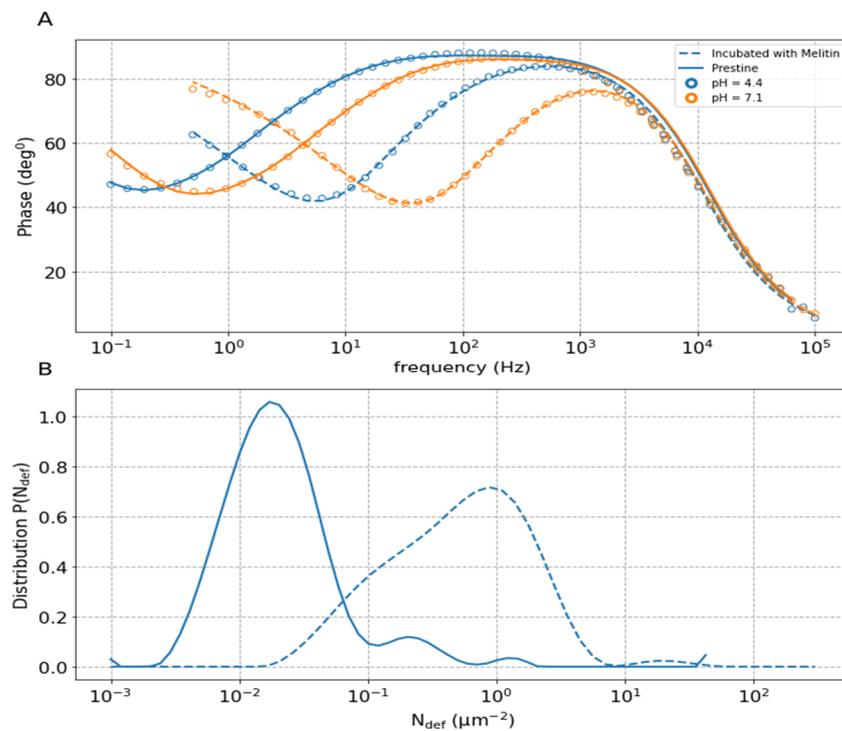


Figure S4. (A) EIS bode diagram of tBLM prepared from total lipid extract (TLE), pristine tBLM (solid line) and tBLM damaged by MEL (dashed line). Lines are fitted to the data obtained by assuming a negligible change in N_{def} and $P(N_{def})$. Orange color signifies pH 7.1; blue pH 4.4. (B) Defect density distribution functions obtained by fitting EIS spectra.

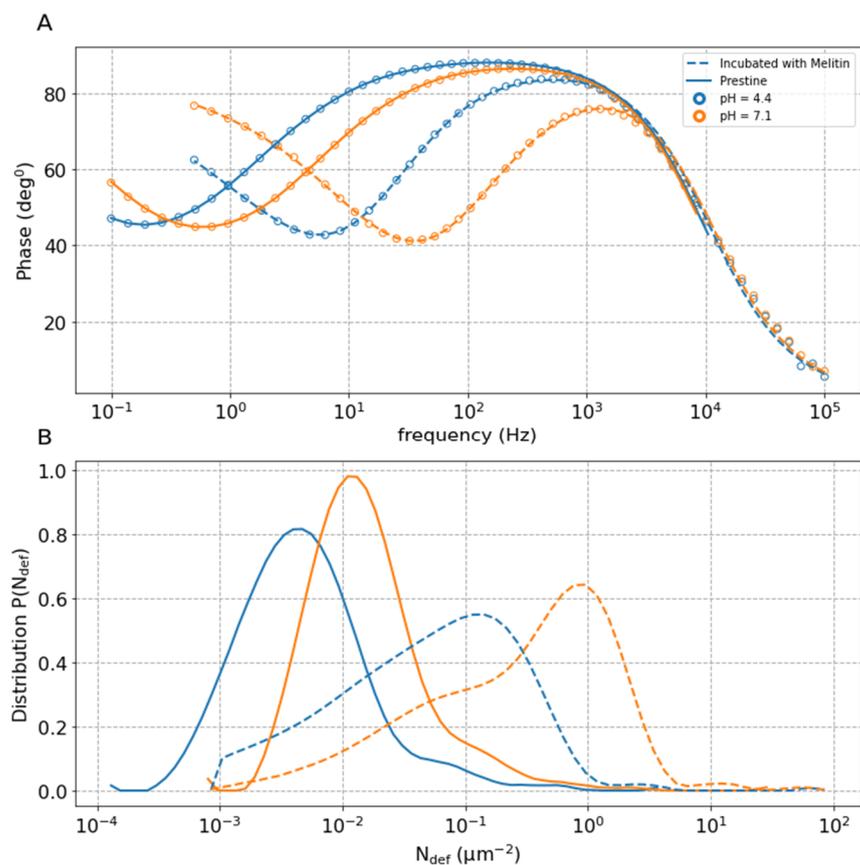


Figure S5. (A) EIS bode diagram of tBLM prepared from TLE, pristine tBLM (solid line) and tBLM damaged by MEL (dashed line). Lines are fits to the data obtained by assuming negligible change in ρ_{sub} , ρ_{sub} values used in all calculations was $31622 \Omega \text{ cm}^{-1}$. Orange color signifies pH 7.1; blue pH 4.4. (B) Defect density distribution functions obtained by fitting EIS spectra.

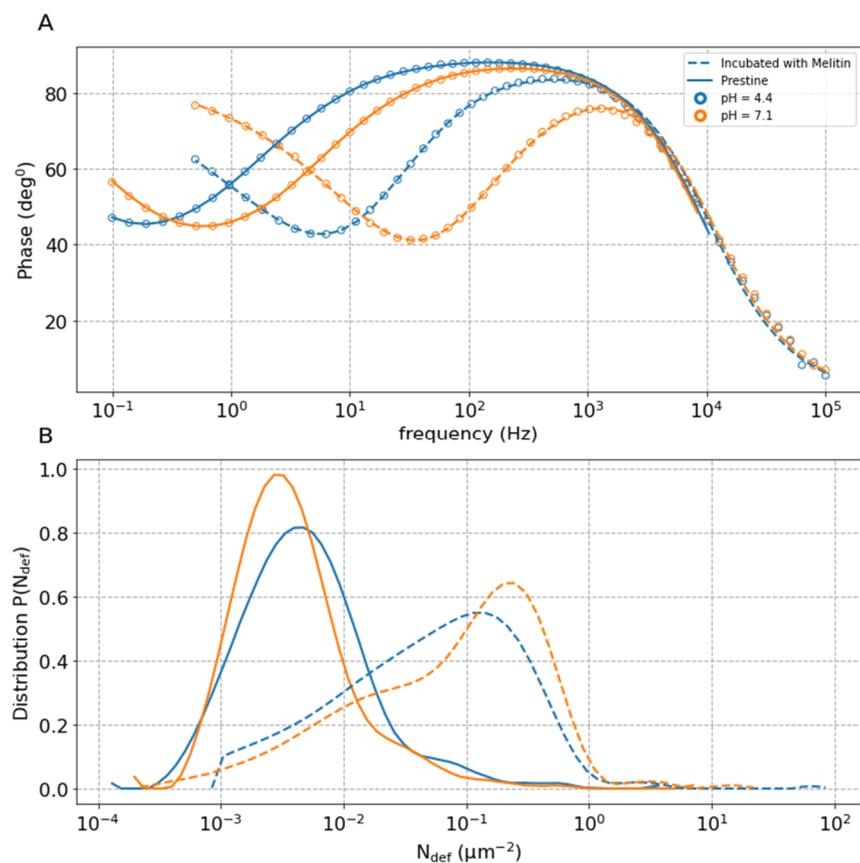


Figure S6. (A) EIS bode diagram of tBLM prepared from TLE, pristine tBLM (solid line) and tBLM damaged by MEL (dashed line). Lines are fitted to the data obtained by assuming that average N_{def} does not change, while $P(N_{def})$ is allowed to vary, ρ_{sub} value used in all calculations was 31622 Ω cm⁻¹. Orange color signifies pH 7.1; blue pH 4.4. (B) Defect density distribution functions $P(N_{def})$ obtained by fitting EIS spectra.