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Thin Films of Trimeric Surfactant as Boundary Lubricants

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Surfactants are widely used to modify surfaces and interfaces properties. Unique cationic trimeric surfactant was found to form liposome-like aggregates in solution (1, 2). The surface structure of the trimeric surfactant tri(dodecyldimethylammonioacetoxyl)-diethyltriamine trichloride (DTAD) on mica, and the interactions between two such DTAD-coated surfaces were determined using atomic force microscopy and a surface force balance. In an aqueous solution of 3 mM, five times the critical aggregation concentration (CAC), the surfaces are coated with worm-like micelles or hemi-micelles and larger (ca. 80 nm) bilayer vesicles (3). This surface coating is strongly lubricating up to some tens of atmospheres, attributed to the hydration-lubrication mechanism acting at the exposed, highly hydrated surfactant headgroups. Moreover, on replacing the DTAD solution by surfactant-free water, the surface structures have changed to a smooth and hydrophobic monolayer. Surprisingly, this trimeric surfactant monolayer, which is highly hydrophobic, is at the same time positively charged under water. These monolayers are stable over days even under salt solution (3). The stability is attributed to the several stabilization pathways available to DTAD on the mica surface.

References

- (1) Hou et al., *Langmuir*, 24, 10572 (2008).
- (2) Wu et al., *Langmuir*, 26, 7922 (2010).
- (3) Kampf et al., *Langmuir*, 26, 7922 (2016).

Author: Dr KAMPF, Nir (Weizmann Institute of Science)

Co-authors: Dr WU, Chunxian; Prof. WANG, Yilin; Prof. KLEIN, Jacob

Presenter: Dr KAMPF, Nir (Weizmann Institute of Science)

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