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ע״ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Seminar

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The Effect of Minor Components on the Nanostructure and Macroscopic Properties of Amphiphilic Solutions

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PhD Final Seminar

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Amphiphilic molecules self-assemble in aqueous solution due to their hydrophilic and hydrophobic moieties. Surfactants, a prominent type of amphiphiles that reduce surface and interfacial tension, play a central role in industrial formulations, such as cosmetics, laundry, and personal care products. In aqueous solutions, surfactants self-assemble into different structures, including spheroidal or threadlike micelles, branched networks, and vesicles. The morphology dictates the macroscopic behavior of the formulation, and is governed by molecular properties, concentration, and the presence of additives. Additives, such as salts and fragrances, significantly change the surfactant self-assembly and viscosity, therefore, understanding their impact is essential.

In this seminar, I present a systematic investigation into how additives affect sodium lauryl ether sulfate (SLES) aqueous systems, combining cryogenic transmission electron microscopy (cryo-TEM) with rheology to correlate nanostructure and viscosity. Specimen preparation in this shear-sensitive system is addressed, demonstrating how blotting and relaxation prior to vitrification affect the native nanostructures and imaging artifacts formation. The central focus is the role of salts and fragrances as key modifiers of SLES self-assembly across a range of salt-to-surfactant molar ratios, revealing significant changes in nanoaggregation and viscosity as a result of additives incorporation.

The main objective of this research is to advance the understanding of how additives govern nanoaggregation and macroscopic properties, while establishing reliable methodologies. By linking nanostructural organization to rheological response, this work contributes to the characterization and optimization of surfactant-based systems for both research and applications.