

Foam Disinfection Mechanisms

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Foam-based disinfection is a promising sustainable alternative to conventional cleaning methods for contaminated solid surfaces, as it enables significant reductions in water and detergent consumption [1]. However, despite extensive studies on foam stability and interfacial properties, the relationship between foam structure and cleaning efficiency is not clarified.

This study aims to elucidate, with a multiscale approach, how interfacial tension, foamability and thin liquid film dynamics influence detergency. Three model surfactants are selected, with the same alkyl chain length but different hydrophilic groups, to vary interfacial effects. The study includes two non-ionic surfactants, C12E6 and sugar based β -C12G2, and a cationic benchmark, C12TAB.

Surface tension measurements are performed using Wilhelmy plate tensiometry. Foaming properties are tested using a commercial FoamScan, which allows direct observation of foam collapse and measurement of bubble size distributions. These macroscopic observations are correlated with the dynamics of freestanding thin liquid films at the microscale, probed using the dynamic thin film balance technique [2]. Comparisons between the two experiments, performed at the same capillary pressure, provide a link between microscopic film dynamics and macroscopic foam response.

Finally, detergency is evaluated by investigating the wetting behavior of the different surfactant systems at the scale of thin liquid films formed between a single bubble and a hydrophobic substrate (*Fig. 1*) [3]. This approach provides insights into how surfactant structure governs wetting, film stability and cleaning performance.

Keywords:

Foam, hydrophobic surface, wetting film, cleaning

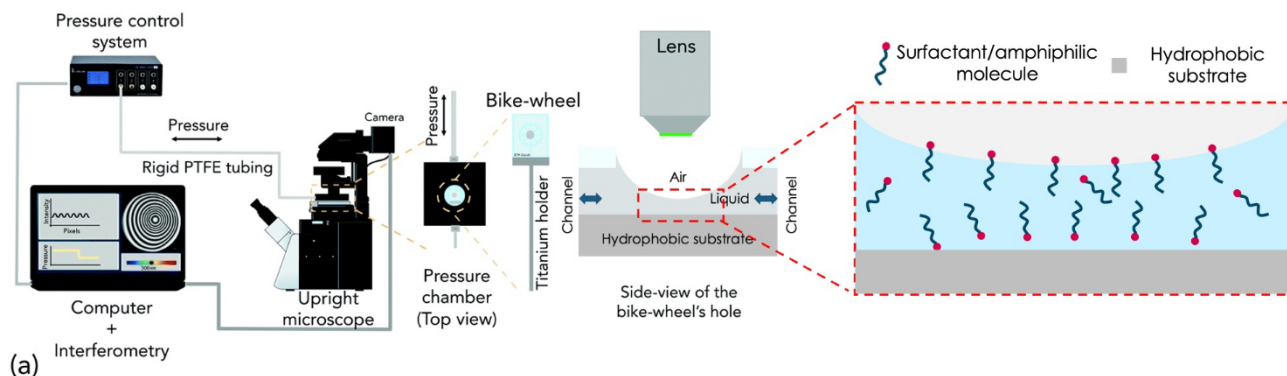


Figure 1: Schematic of the dynamic thin film balance setup and a zoom in the cross section of the thin liquid film formed between a single air bubble and a hydrophobic substrate.

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