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How the Curvature and the Hydrophilic/Hydrophobic Nature of the Container Walls Affect the Drainage of Wet Foams

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Wet foams are encountered in many food applications with proteins and polysaccharides being the most common foaming agents and stabilizers. For industrial applications the drainage process is usually of more interest since coarsening and collapse are much slower processes. In this work, the drainage of a typical food wet foam is investigated by a combination of three simultaneous measuring techniques: an electrical, an optical and a volumetric. Instantaneous values of the foam liquid fraction are registered by electrical measurements which are performed by non-intrusive ring type electrodes, flush mounted on the inner wall of a cylindrical test-vessel at different heights. For comparison, measurements are taken also with intrusive disk and rod type electrodes submerged in the foam. In addition, high resolution close-up photos yield the evolution of the bubble size distribution in the foam near the wall. Finally, instantaneous values of the foam volume and the drained liquid volume are determined volumetrically. Tests are performed with three vessels of varying diameter having either hydrophobic or hydrophilic walls. As expected, hydrophilic walls cause a faster foam decay than hydrophobic walls. However, the role of the test-vessel walls in promoting drainage is more complex: the highest drainage rates are observed in the vessel with the largest diameter whereas the lowest drainage rates are observed in the vessel with the intermediate diameter. This not monotonous dependence of drainage rate on container diameter is attributed to the interaction between the curvature of the foam bubbles and the curvature of the cylindrical wall.

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