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Micro-scale dynamics of oil droplets at a permeable surface GUY RAMON, GALI FUX, TECHNION, WETLAB TEAM — Microscopic imaging was used to quantify the deformation of droplets at the surface of a permeable membrane during separation of oil/water micro-emulsions. The shape of individual droplets was imaged in 3D, using confocal microscopy, as a function of the permeation rate through the membrane (V), droplet radius (R) and membrane permeance (k). These parameters, along with the water viscosity (μ) and the water-oil surface tension coefficient (σ), were used to construct a modified capillary number, accounting for the proximity to the membrane surface. The results demonstrate a clear correlation between drop deformation from a sphere to an approximate hemisphere in response to increases in the capillary number. Furthermore, the reversibility of droplet deposition was assessed through image analysis of membrane surface coverage. The results demonstrate that droplets deposited at low permeation are easily removed by axial shear flow (applied in the absence of permeation), leaving a clean surface, whereas at a high permeation deposition is mostly irreversible. A wetting transition, dependent on the stability of a thin film separating the droplets from the membrane, is proposed as a mechanism for explaining the observed irreversible oil deposition.

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