Supporting Information

Direct Three-dimensional Visualization of Membrane Fouling by Confocal Laser Scanning Microscopy

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Image calibration

An axial distortion was observed in 3D images acquired by confocal laser scanning microscopy (CLSM). The distortion results from the lower optical resolution in the z direction compared to that in the x-y plane, leading to the extension after convolution. Therefore, calibration was performed with fluorescent polystyrene microspheres of diameter of ~2 μm, purchased from Spherotech Inc. The microspheres were excited at 405 nm and detected at 400-500 nm. The ratio of lateral diameter to axial diameter of the microspheres was used to calculate the calibration factor, which was then applied to the 3D images of oil-fouled membranes. For the air objective, the calibration factor was $2/2.64 = 0.76$, while the calibration factor for the oil objective was $2/2.7 = 0.74$.

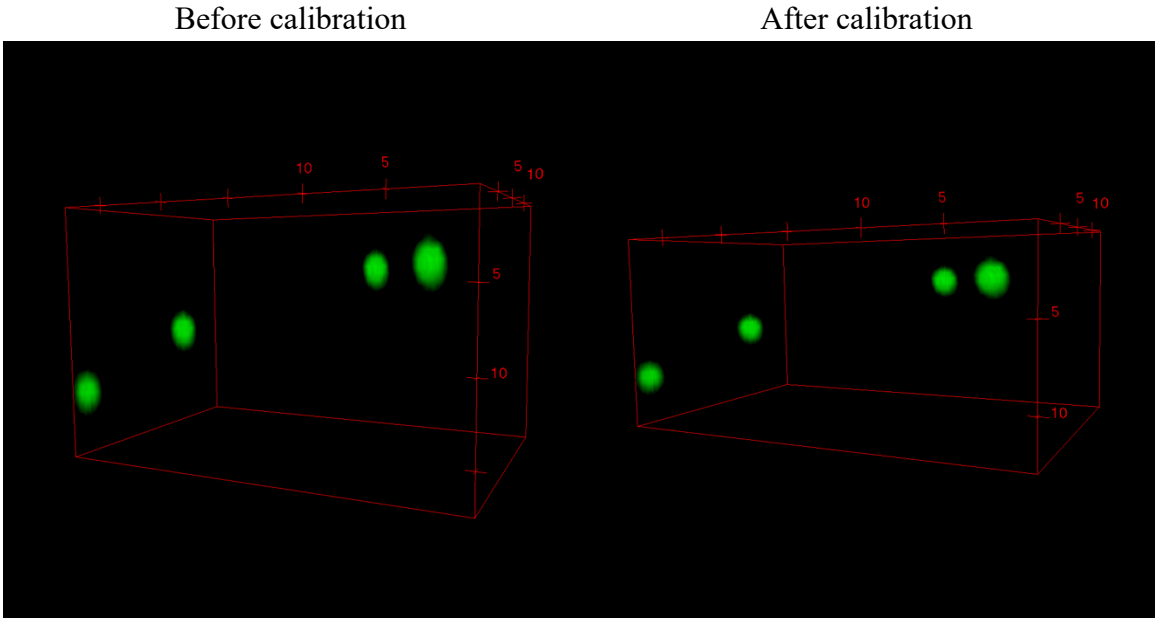

Figure S1. Images of polystyrene microspheres before and after calibration

Images of feed emulsion and permeate acquired from optical microscope

Drops of feed dodecane emulsion (100 ppm) and permeate were dispensed on a glass slide and observed by the optical microscope (Zeiss Axioplan 2) with an objective of 50×. As shown in Figure S2, there are no observable oil droplets in the permeate under current image resolution.

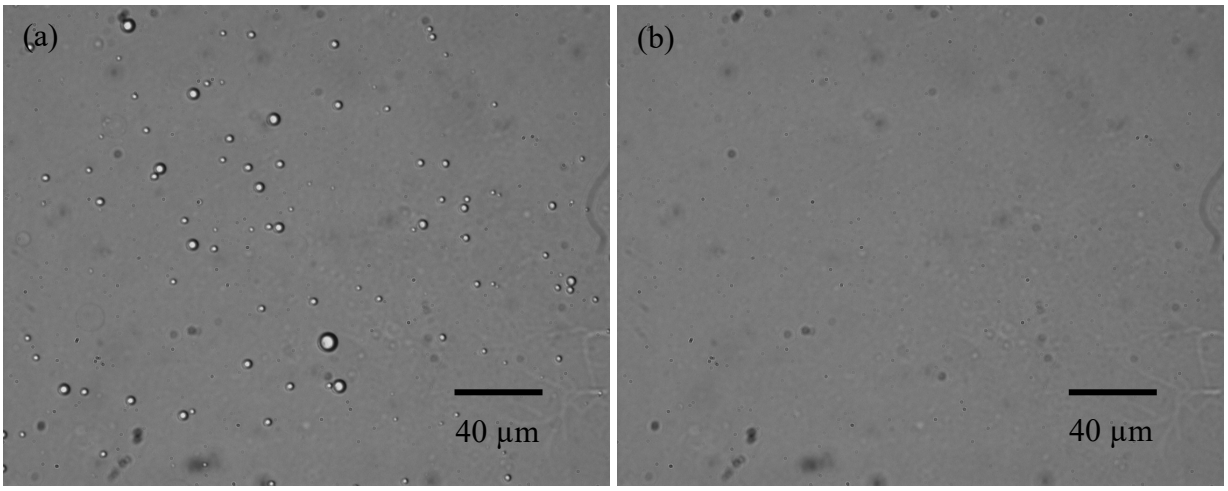

Figure S2. Images of the (a) feed solution and (b) permeate