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**Size dependent droplet interfacial tension and surfactant transport in oily bilgewater systems**[1] YUN CHEN, CARI DUTCHER, University of Minnesota — Many liquid-liquid emulsions, including shipboard oily bilge waters, are chemically stabilized by surfactants and additives. The emulsion stability is determined by the interfacial tension (IFT) of surfactant-laden interface between the continuous and dispersed phase, as well as the size of the dispersed droplets. In the present work, the dynamic IFT of droplets at micron-scale (˜80 um) and milli-scale (˜2 mm) is measured with simulated bilge waters with soluble surfactant systems. It is found that the IFT of micron-scale droplets decays faster than that of the milli-scale droplets due to smaller diffusion boundary layer thickness. When surfactants are added into aqueous phase for both water-in-oil and oil-in-water condition, the IFT of micron-scale droplets decays faster when the surfactant is in outer phase than in the inner phase. In contrast, for the larger milli-scale droplets, the IFT decay rate does not depend on which phase the surfactant is added. The observations are explained by the change in diffusion limited to kinetic limited surfactant transport as the droplet size decreases. In addition, experimental results of droplet coalescence depending on the IFT using model system is also presented in this work.

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