Supplementary Information: Pinch-Off Dynamics of Emulsion Filaments Before and After Polymerization of the Internal Phase

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1. Emulsion droplet size characterization

We characterize the emulsion droplet size of fine emulsions using dynamic light scattering, Figure S1a. The droplet size distribution is relatively narrow, with most droplets falling within the 0.7–1.2 μm range. The frequency distribution remains consistent across the measurement times of 1 hour, 6 hours, and 24 hours, indicating the stability of the droplet size over time. In **Figure S1b**, the size distribution of coarse emulsion droplets measured through microscopic images is presented. Unlike the fine emulsions, the coarse emulsions have a much larger droplet size, primarily between 40 and 60 μm. Similar to the fine emulsions, the distribution shows little variation over time, further confirming the stability of the droplet sizes after 1, 6, and 24 hours. These measurements highlight the stability of both fine and coarse emulsions over the 24-hour period, with no significant change in the average droplet size or distribution.

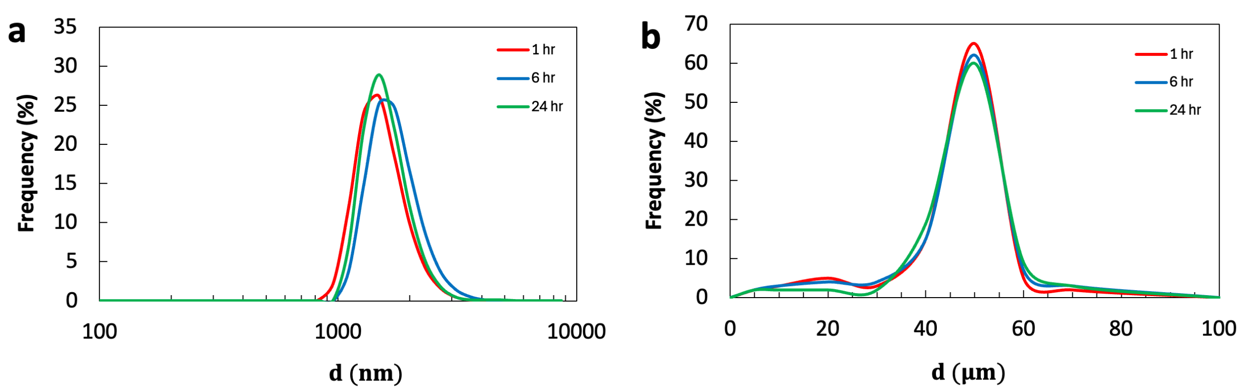

Figure S1. **a)** Droplet size distribution of fine emulsions characterized using dynamic light scattering (DLS) at 1 hour (red), 6 hours (blue), and 24 hours (green). The distribution is narrow, with droplet sizes primarily between 700 and 1200 nm, demonstrating stability over time. **(b)** Droplet size distribution of coarse emulsions, measured at 1 hour (red), 6 hours (blue), and 24 hours (green). The coarse emulsion droplets are significantly larger, with sizes predominantly in the 40–60 μm range. Similar to the fine emulsions, the size distribution remains stable over the 24-hour period.

2. Particle-Particle Interactions

We conducted flow experiments in a glass capillary tube with an inner diameter of 400 µm, injecting emulsions into the channels. **Figure S2a** presents high-resolution images of the droplets before and after polymerization. To analyze this behavior in greater detail, we processed the images using ImageJ, where we binarized them and isolated the interfaces to track droplet movement and interactions along the flow direction. The results show that as polymerized droplets flow through the channels, they tend to form aggregates that move collectively. This observation is further supported by our cluster size analysis. The aggregation behavior highlights the strong interactions between polymerized droplets within the confined space of the capillary, significantly influencing the overall dynamics of the flow, **Movies S1-2**. **Figure S3** provides images of the emulsion droplets before and after polymerization, where the results for (a) 25% liquid droplets and (b) a mixture of 12.5% polymerized and 12.5% liquid droplets inside the channels are shown. The presence of polymerized droplets increases the likelihood of particle aggregation during flow.

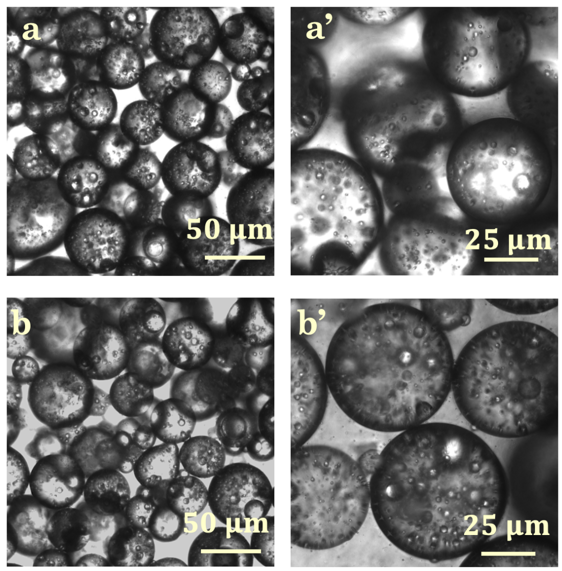

Figure S2. Microscope images of the droplets (a and a') before polymerization and (b and b') after polymerization.

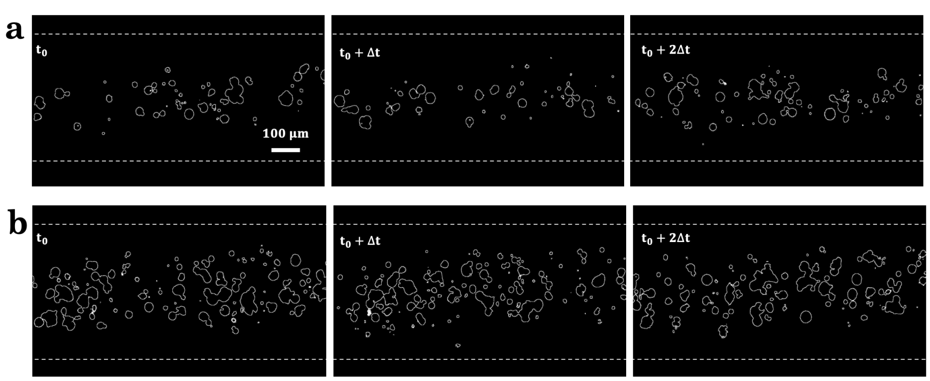

Figure S3: Formation of aggregates, (a) liquid droplets and (b) 12.5% liquid droplets-12.5% polymerized droplets.