Electronic Supplementary Information (ESI) for Lab on a Chip

Electronic Supplementary Information

A simple and reusable off-the-shelf microfluidic devices for versatile generation of droplets

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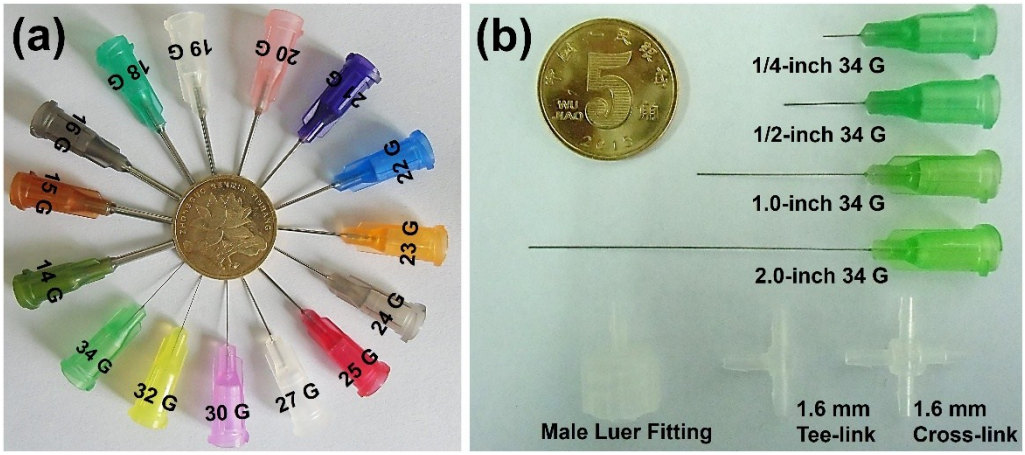

Figure S1. Digital photograph of the off-the-shelf components. (a) 1/2-inch dispensing needles. (b) 34 G dispensing needles, cross-link, tee-link and male luer fitting.

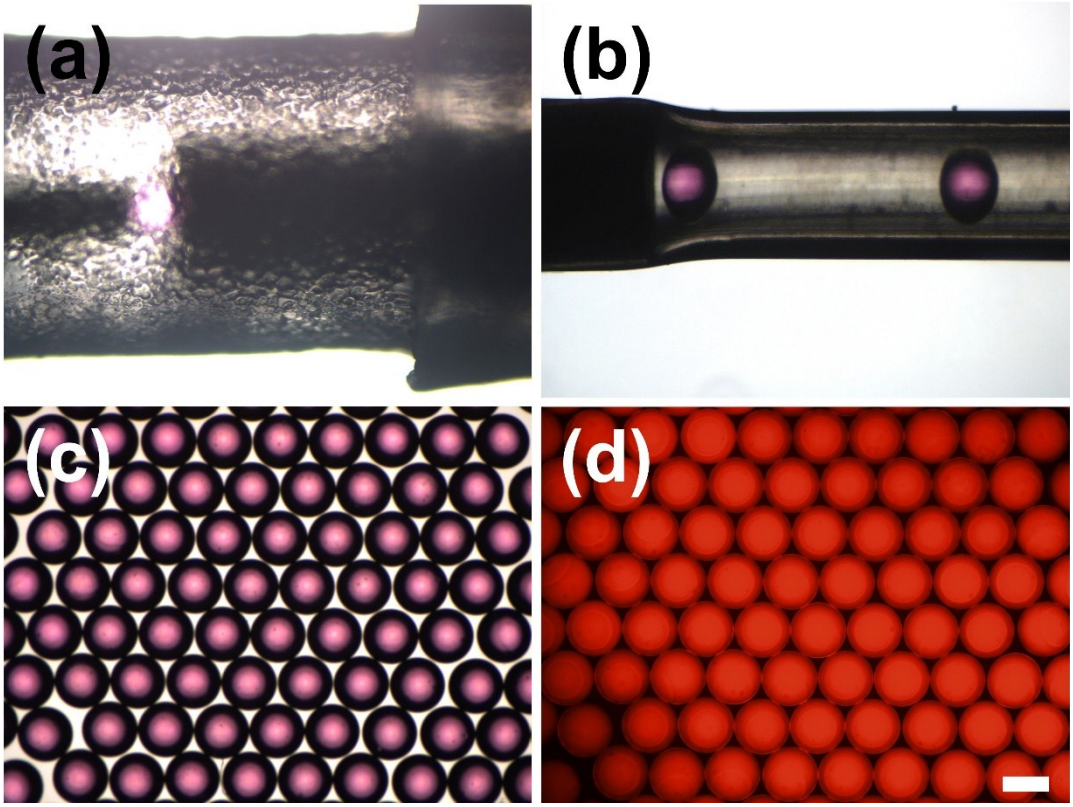

Figure S2. Microscopy photograph of the 27-21 G coflow microfluidic device for fabrication of ETPTA droplets. (a) Microscopy image of the coflow section. (b) Microscopy image of the outlet. (c) Microscopy photograph and (d) corresponding fluorescence microscopy photograph of the highly monodisperse ETPTA droplets. The scale bars are 300 μm.

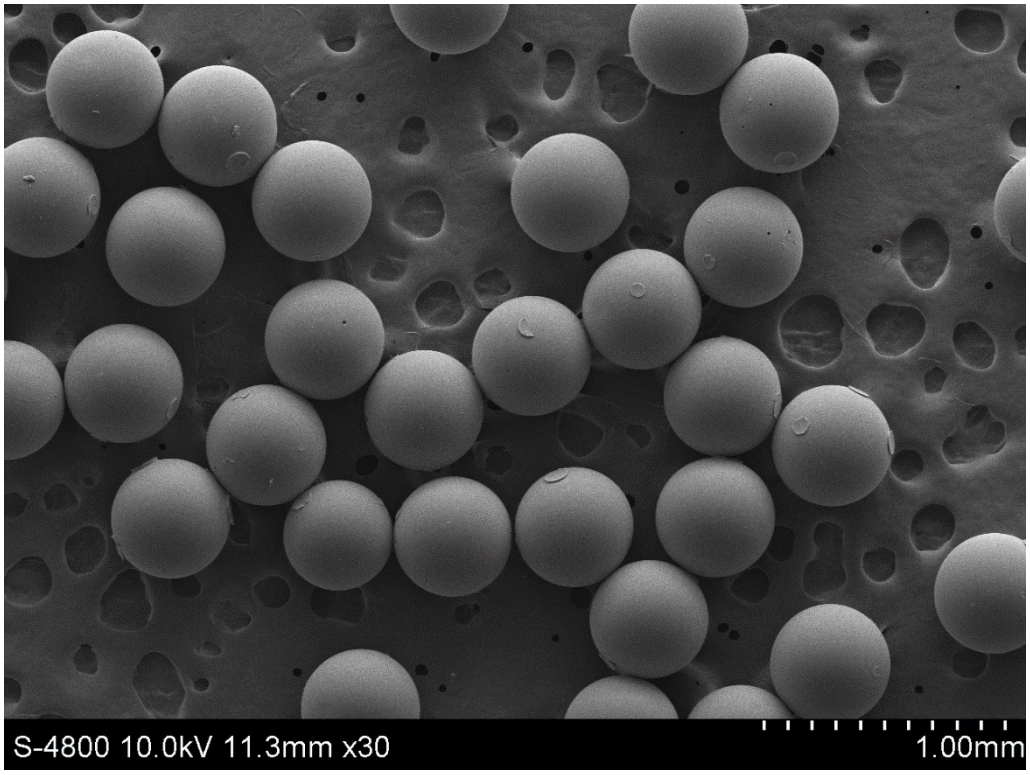

Figure S3. SEM photograph of poly(ethoxylated trimethylolpropane triacrylate) microspheres templated from monodisperse ETPTA droplets.

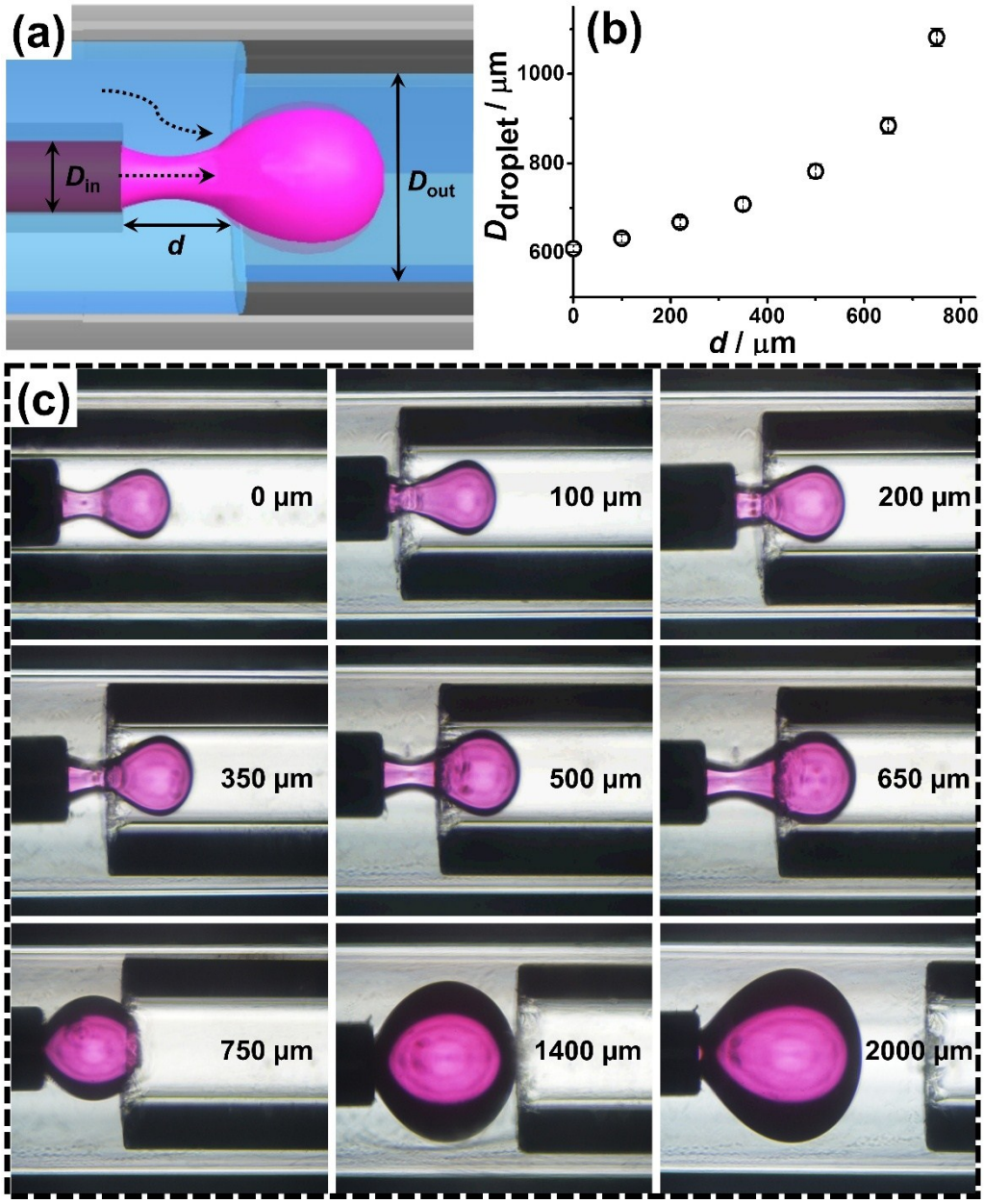

Figure S4. Effect of interneedle distance (d) on the diameter of the droplets ($D_{droplet}$). (a) Schematic diagram of the microfluidic emulsifier. (b) The relationship between d and $D_{droplet}$ in distance range of 0 to 750 µm. (c) Real-time images of the microfluidic fabrication of single droplet at different distance conditions. The device was fabricated by a 1-inch 23 G dispensing needle (inlet), a glass capillary (ID = 0.7 mm, OD = 1.4 mm, outlet), a glass capillary (ID = 1.6 mm, OD = 2.4 mm, holder) and a 2.4 mm straight cross-link (ID = 1.6 mm, OD = 2.4 mm). For each configuration, disperse and continuous phase flow rates were maintained at 6.0 and 120 µl min^{-1}, respectively.

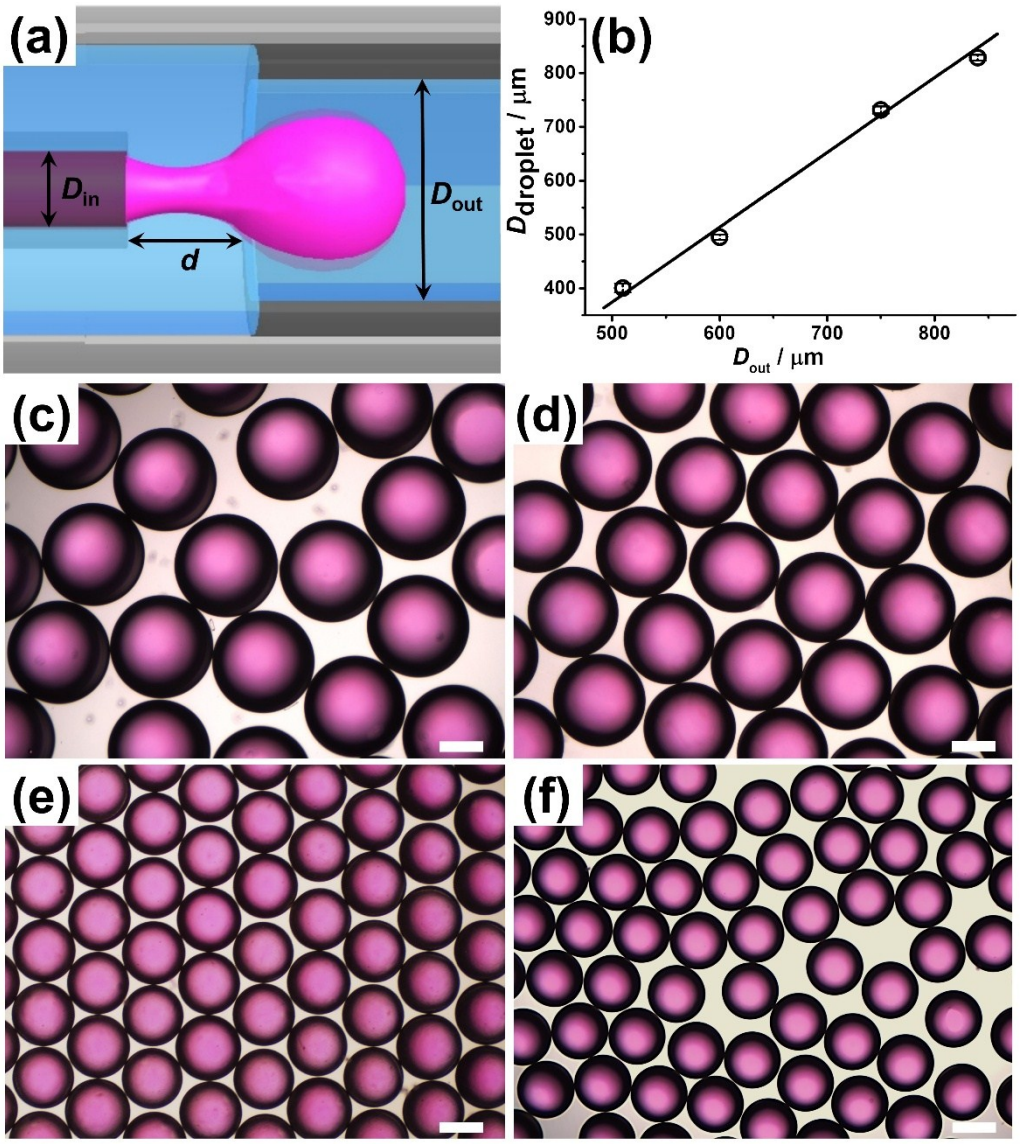

Figure S5. Effect of the size of outlet (D_{out}) on the diameter of the droplets ($D_{droplet}$). (a) Schematic diagram of the microfluidic emulsifier. (b) The relationship between $D_{droplet}$ and D_{out}. (c-f) ETPTA droplets were prepared by the 23-18 G, 23-19 G, 23-20 G and 23-21 G coflow microfluidic devices, respectively. The scale bars are 300 μm. In all experimental conditions, the flow rates of the disperse phase and the continuous phase were Q_d = 6.0 μL min^{-1} and Q_c = 120 μL min^{-1}. The inter-needle distance (d) was fixed at 500 μm.

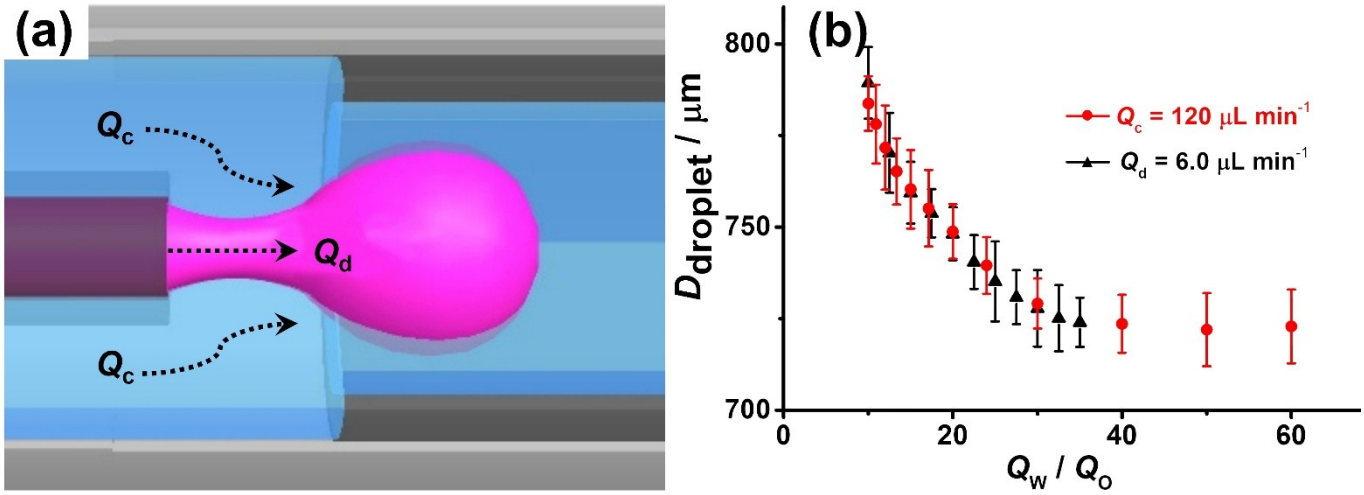

Figure S6. Effect of flow rate on the diameter of droplets ($D_{droplet}$). (a) Schematic diagram of the microfluidic emulsifier. (b) $D_{droplet}$ versus the flow rate ratio Q_c/Q_d. The 23-19 G coflow microfluidic device was used in this experimental. The inter-needle distance was fixed at 500 μm.

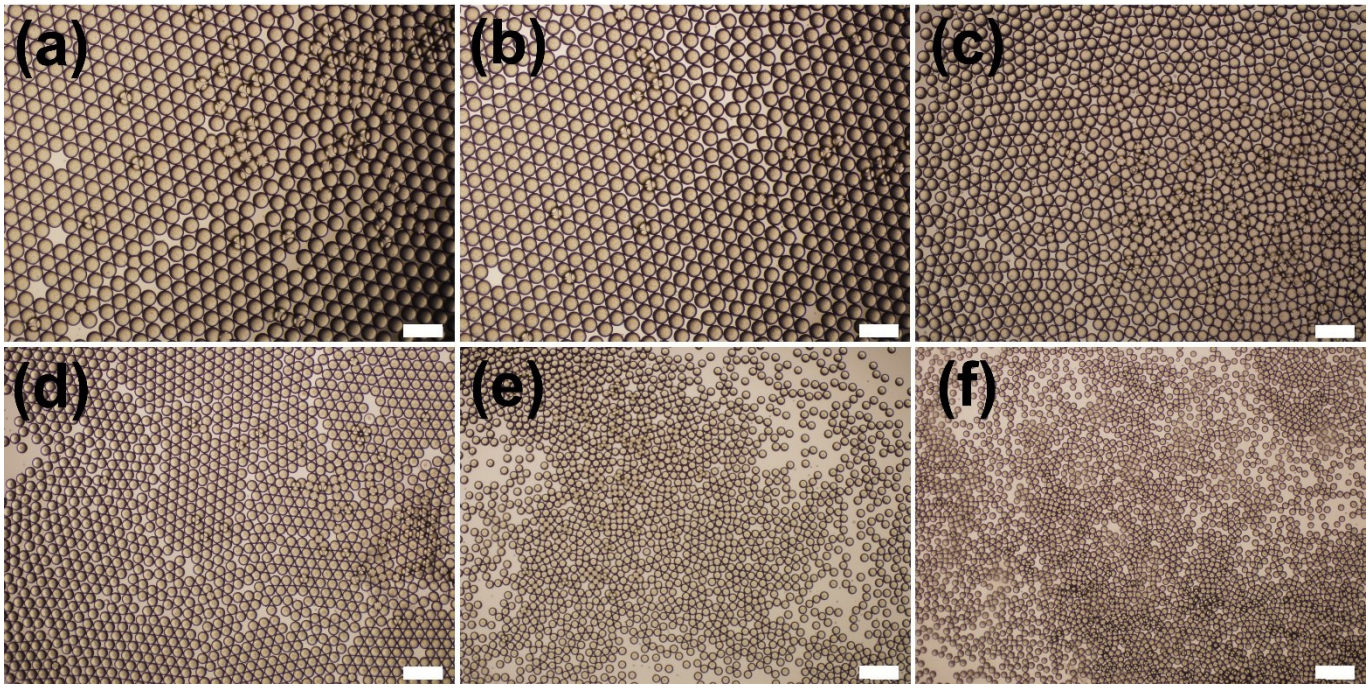

Figure S7. ETPTA droplets were prepared by the 34-30 G coflow microfluidic devices. The diameter of the droplets was 134.33 ± 2.45 μm (a), 126.93 ± 1.73 μm (b), 97.37 ± 5.72 μm (c), 86.47 ± 1.07 (d), 66.00 ± 4.78 (e), and 53.53 ± 1.88 (f), respectively. The flow rates of the disperse phase was 6.0 (a), 4.0 (b), 2.0 (c), 1.0 (d), 0.5 (e), and 0.3 (f) μL min^{-1}. In all experimental conditions, the flow rate of the continuous phase was Q_c = 120 μL min^{-1}. The inter-needle distance was fixed at 60 μm.

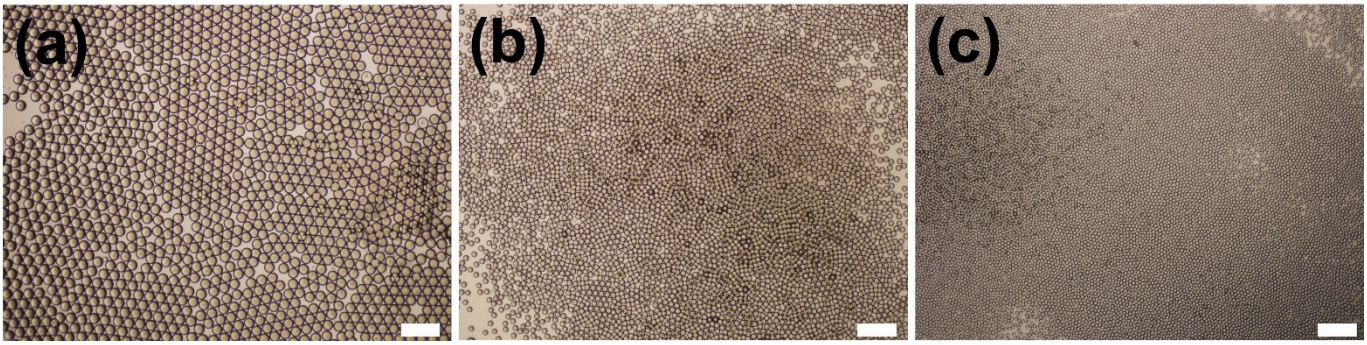

Figure S8. ETPTA droplets were prepared by the 34-30 G (a), 34-32 G (b), and 34-34 G (c) coflow microfluidic devices, respectively. The diameter of the droplets were 86.47 ± 1.07 μm (a), 46.05 ± 1.13 μm (b), and 24.27 ± 3.62 μm (c). In all experimental conditions, the flow rates of the disperse phase and the continuous phase were Q_d = 1.0 μL min^{-1} and Q_c = 120 μL min^{-1}. The inter-needle distance was fixed at 60 μm.