The effect of viscosity and elasticity on the droplet generation in branched microchannel

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The droplet generation in microchannel flow has been studied in the past decade. It is important to characterize the size and the input flow rate in order to manipulate the small volume (pico/nanoliter size) of droplets for chemical and biological applications. In this study, we characterized the droplet generation process and investigated the effect of viscosity and elasticity. The droplets were generated with aqueous phase and oil phase in branched microchannel. When we plotted the dimensionless droplet length (l/d, l: droplet length, d: channel width) as a function of the dimensionless flow rate (the ratio of aqueous and oil phase flow rate), it showed a power-law correlation. Using the scaling method, we could investigate the effect of viscosity ratio on droplet size (width and depth is 75μm). Increasing the viscosity ratio by adding glycerin to water, the power index n decreased. Also when we input the elastic solution as an aqueous phase, the threads were observed between the droplets. Increasing the elasticity by adding PEO, the phenomenon becomes much clearer. We expect this characterization method facilitates tuning the design of the T-junction and deciding the flow rate for the desired droplet size required for specific applications.