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Break-up of droplets in a concentrated emulsion flowing through a narrow constriction MINKYU KIM, LIAT ROSENFELD, SINDY TANG, Stanford Univ, TANG LAB TEAM — Droplet microfluidics has enabled a wide range of high throughput screening applications. Compared with other technologies such as robotic screening technology, droplet microfluidics has 1000 times higher throughput, which makes the technology one of the most promising platforms for the ultrahigh throughput screening applications. Few studies have considered the throughput of the droplet interrogation process, however. In this research, we show that the probability of break-up increases with increasing flow rate, entrance angle to the constriction, and size of the drops. Since single drops do not break at the highest flow rate used in the system, break-ups occur primarily from the interactions between highly packed droplets close to each other. Moreover, the probabilistic nature of the break-up process arises from the stochastic variations in the packing configuration. Our results can be used to calculate the maximum throughput of the serial interrogation process. For 40 pL-drops, the highest throughput with less than 1% droplet break-up was measured to be approximately 7,000 drops per second. In addition, the results are useful for understanding the behavior of concentrated emulsions in applications such as mobility control in enhanced oil recovery.

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