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Droplet Breakup in Asymmetric T-Junctions at Intermediate to Large Capillary Numbers REZA SADR, Texas AM University, WAY LEE CHENG, Texas AM University at Qatar — Splitting of a parent droplet into multiple daughter droplets of desired sizes is usually desired to enhance production and investigational efficiency in microfluidic devices. This can be done in an active or passive mode depending on whether an external power sources is used or not. In this study, three-dimensional simulations were done using the Volume-of-Fluid (VOF) method to analyze droplet splitting in asymmetric T-junctions with different outlet lengths. The parent droplet is divided into two uneven portions the volumetric ratio of the daughter droplets, in theory, depends on the length ratios of the outlet branches. The study identified various breakup modes such as primary, transition, bubble and non-breakup under various flow conditions and the configuration of the T-junctions. In addition, an analysis with the primary breakup regimes were conducted to study the breakup mechanisms. The results show that the way the droplet splits in an asymmetric T-junction is different than the process in a symmetric T-junction. A model for the asymmetric breakup criteria at intermediate or large Capillary number is presented. The proposed model is an expanded version to a theoretically derived model for the symmetric droplet breakup under similar flow conditions.

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