Liquid-Liquid Dispersion: Short Time Effects

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Abstract

Studies by Kolmogorov (1941) and Hinze (1955) have been used to explain the phenomenon of droplet dispersion. Other authors, such as Baldyga (1998), developed a concept of droplet breakup to an equilibrium drop size, which can be obtained after several hours of agitation.

The breakage rate process has always been seen as one to obtain the equilibrium drop size, but there appear to be two different time constants: the initial breakup rate into several million droplets that could take a few minutes, and the breakup of the droplets to achieve an equilibrium drop size.

A system of silicone oil in water at 10% volume fraction was used to investigate the influence of speed on the initial breakup rate. One tank size and an A310 impeller were utilized to perform the experiments. A Mettler-Toledo® FBRM probe measured in situ time to get dispersion and drop size.

Similar to the results obtained by Sathygal (1996), breakage rate has been found to increase with the stirrer speed. It can also be concluded that two time constants can be identified, and for the speeds tested it takes less than 5 minutes to go from one drop to more than nine million drops.