PREDICTING THE DROPLET SIZE DISTRIBUTION OF EMULSIONS PRODUCED IN A SONOLATOR

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The Sonolator is a type of high pressure homogeniser used to produce formulated products such as emulsions. The droplet size distribution (DSD) is an important characteristic of an emulsified product since it determines both product quality and stability. It this study, oil/water emulsions were created using the Sonolator and the resultant DSDs measured using the Malvern Mastersizer 3000. The flow rate through the Sonolator orifice and the size of the orifice were altered to investigate their effect on the DSD. The viscosity and the concentration of oil was also varied from 10 cSt to 2760 cSt and 1% to 10 % wt/wt respectively. The oil used was Silicon Oil. All emulsions contained 0.1% surfactant (SLES). The results showed that the drop size decreased with flow rate or pressure across the orifice and increased with SiOil viscosity. The DSDs were predominantly bi-modal, with each part of the DSD being log-normal. The DSD of each emulsion could therefore be modelled using the sum of two-lognormal distributions. The mode of the daughter droplets can be predicted fairly well using theory. The volume fraction of the satellite droplets was found to be a function of the pressure across the orifice and also the dispersed phase viscosity. The blade of the Sonolator, which is supposed to contribute to the droplet break-up via cavitation, was found to have no effect on the DSD. Neither did the volume fraction of SiOil. The correlation developed in this study using both the experimental data and theory allows us to accurately predict the entire DSD of emulsions produced in a Sonolator. We are therefore able to more easily tune the stability and quality of our emulsified product without having to use trial-and-error.

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