83e Liquid-Liquid and Gas-Liquid Laminar Dispersion in a Smx Static Mixer

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The SMX mixer is among the most suitable mixers to execute very difficult mixing or dispersion tasks. Laminar dispersion is one of those, especially when the viscosity of the dispersed phase is higher than of the continuous phase. In this research, the SMX mixer was used to disperse gas and liquids into Newtonian and non-Newtonian matrices. The investigation covered the effects of the dispersed phase volume fraction, the viscosity ratio between the phases, the mixer's length and the power consumption. The method used for size measurement is based on video recordings and manual measurement of the drops and bubbles. Special visualization section of the experimental bench allowed for direct recordings of the flow inside the pipe, without using off-line samples. The flow regime was kept laminar in all the experiments. To our knowledge, no available public data exist for this type of mixer, these types of fluids, and conditions of dispersion. The dispersion of gas was performed in both Newtonian and non-Newtonian phases using between 1 and 7% gas. We used the “process viscosity” in order to get rid of the non-Newtonian behavior in our calculations. It was possible to collapse all the experiments on a single curve by using the energy consumption in the mixer as the common variable between the experiments. It is demonstrated that elongation is the major contributor to size reduction. The SMX is shown to have three times the reduction capacity of the Kenics mixer due to its internal structure. The size reduction process is presented as a kinetic process for which the general kinetic expression encompasses parameters that can be taken as a direct characterization of the mixer geometry to lead to dispersion The dispersion of liquids of higher viscosity than the continuous phase was performed up to a dispersed phase content of 25% and viscosity ratios ranging from 1.0 to 700. The effect of the dispersed phase viscosity and volume fraction on the average drop size was measured. It was again possible to collapse on a single curve all the experiments by means of the total energy consumption in the mixer. It is also demonstrated that, in addition to the conclusions obtained with gas, the SMX is weakly sensitive to the viscosity ratio when studied from the effective shear point of view. The size reduction process in the SMX static mixer, and in any other static mixer, is favored by the minimum diameter that can be used in the application. This conclusion arises from the combination of the various relations for volume fraction of the dispersed phase, viscosity ratio, residence time, required time for break-up,.. developed in this work.