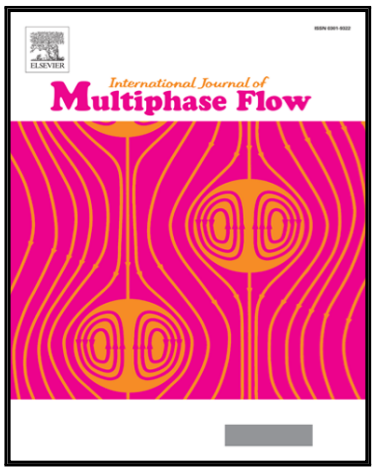

Controlled foam generation using cyclic diphasic flows through a constriction

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Controlled foam generation using cyclic diphasic flows through a constriction

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Abstract

Numerous industrial and academic applications of liquid foams require a fine control over their bubble size distribution and their liquid content. A particular challenge remains the generation of foams with very small bubbles and low liquid content. A simple technique which fulfils these different criteria, the "double syringe technique", has been exploited for decades in hospital applications. In this technique, the foaming liquid and gas are pushed repeatedly back and forth through the constriction that connects two syringes. After having motorised the technique we investigate here the influence of the different processing conditions on the obtained foam properties in a quantitative manner. We show that this technique is unique in producing foams with the same characteristic bubble size distributions over a wide range of processing conditions (tubing, fluid velocities,...), making it an ideal tool for controlled foam generation. In contrast to other techniques, the liquid fraction in the double syringe technique can be varied without impacting the bubble size distribution. Using high-speed imaging we show that bubbles are dispersed in the aqueous phase at two different places in the device. Through an analysis based on the estimation of the characteristic dimensionless numbers of the flow we bring some insights on the potential hydrodynamic instabilities at play in the dispersion process. We compare our experimental results with bubble size distributions predicted by hydrodynamic fractionation processes.

Keywords: Foam generation, Diphasic Flow, Bubble size distribution, Flow pattern, Hydrodynamic instabilities