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M.P. Vasilev, R.Sh. Abiev

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Turbulent droplets dispersion in a pulsating flow type apparatus – new type of static disperser

M.P. Vasilev, R.Sh. Abiev*

* *Corresponding author, e-mail: abiev.rufat@gmail.com; tel. +7 (812) 494-92-76;*

St. Petersburg State Institute of Technology (Technical University), Department of optimization of chemical and biotechnological equipment; Moskovskii pr.26, 190013, Saint-Petersburg, Russia

Abstract

This paper presents an experimental study of the basic and most important characteristics of novel type of static disperser – a pulsating flow type apparatus (PFA) – the pressure drop for single-phase flow and droplets size distribution for emulsification process at turbulent flow regime (20 000 < *Re* < 120 000). Influence of flow rate, number of dispersing elements, apparatus diameter and physical properties of the phases on emulsification efficiency were studied. The Sauter mean diameter and the energy dissipation rate were used to characterize and compare different configuration of PFA: number of dispersing elements, two diameters of apparatus neck were used, two pair of liquids. On the basis of obtained experimental data correlation to predict the Sauter mean diameter in this new type of dispersing device as a function of the Weber number, viscosity of the phases as well as the number of dispersing elements was derived. A simplified equation to assess the Sauter mean diameter of droplets on energy dissipation rate $d_{32} = 575\varepsilon^{-0.45}$ was also proposed.

It was found that though from the first glance the number of PFA elements has not very significant influence on the droplets mean diameter (the exponent k in $d_{32} = A\varepsilon^{k}$ equation was in the range of –0.30 and –0.52), in fact the impact of the number of PFA elements is very essential. Deeper analysis has revealed that the size of droplets depends on both Reynolds