

Accepted Manuscript

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PII: S1385-8947(16)30322-9
DOI: <http://dx.doi.org/10.1016/j.cej.2016.03.070>
Reference: CEJ 14921

To appear in: *Chemical Engineering Journal*

Received Date: 30 December 2015
Revised Date: 14 March 2016
Accepted Date: 15 March 2016

Please cite this article as: J. De Bona, A. Buffo, M. Vanni, D.L. Marchisio, Limitations of simple mass transfer models in polydisperse liquid-liquid dispersions, *Chemical Engineering Journal* (2016), doi: <http://dx.doi.org/10.1016/j.cej.2016.03.070>

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Limitations of simple mass transfer models in polydisperse liquid-liquid dispersions

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Abstract

In this work the limitations of standard approaches, commonly used to describe mass transfer in fluid-fluid systems are critically discussed. Emphasis is placed on polydisperse systems, such as liquid-liquid dispersions. In the simplest possible approach the fluid-fluid system is assumed to be monodisperse: namely all the elements of the disperse phase have the same properties. This very simple (albeit inaccurate) approach is the one typically employed for design, scale-up and optimization of unit operations and of the corresponding equipments. The adequacy (or inadequacy) of this model depends on the competition between three phenomena: droplet coalescence, breakage and mass transfer (often enhanced by chemical reactions). When coalescence and breakage dominate, the only polydispersity that has to be accounted for is droplet size, whereas on the contrary, when mass transfer dominates the process, very often polydispersity with respect to both size and chemical composition must be considered. This can be efficiently done by solving the

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