Description of droplet coalescence and breakup in emulsions through a homogeneous Population Balance Model

Simone Castellano, Nida Sheibat-Othman, Daniele Marchisio, Antonio Buffo, Sophie Charton

PII: S1385-8947(18)31426-8
DOI: https://doi.org/10.1016/j.cej.2018.07.176
Reference: CEJ 19574

To appear in: *Chemical Engineering Journal*

Received Date: 14 May 2018
Revised Date: 4 July 2018
Accepted Date: 26 July 2018

Please cite this article as: S. Castellano, N. Sheibat-Othman, D. Marchisio, A. Buffo, S. Charton, Description of droplet coalescence and breakup in emulsions through a homogeneous Population Balance Model, *Chemical Engineering Journal* (2018), doi: https://doi.org/10.1016/j.cej.2018.07.176

Description of droplet coalescence and breakup in emulsions through a homogeneous Population Balance Model

Simone Castellano[1,2], Nida Sheibat-Othman[2], Daniele Marchisio[3], Antonio Buffo[3] and Sophie Charton[1]*

[1] CEA, DEN, Research Department on Mining and Fuel Recycling Processes, SA2I, FR-30207, Bagnols-sur-Cèze, France

[2] Université Claude Bernard Lyon 1,CNRS, UMR 5007, LAGEP, 43 bd 11 Novembre 1918, FR-69622 Villeurbanne, France

[3] Politecnico di Torino, Dipartimento di Scienza Applicate e Tecnologie, Corso Duca degli Abruzzi 24, IT-10129, Torino, Italy

* *Corresponding author:* sophie.charton@cea.fr

Abstract

A zero-dimensional homogenous Population Balance Model (PBM) based on the evaluation of the volume-averaged coalescence and breakup rates is here adopted for the first time to fit the model parameter values through experiments carried out on a water-oil emulsion. The method accounts for the spatial inhomogeneities in mixing, namely for the probability density function of the turbulent kinetic energy dissipation in the apparatus, but avoids the use of coupling the PBM with computational fluid dynamics (CFD) or compartmentalization, thus ensuring fast computational time. In order to demonstrate the advantage of the proposed model over traditional ones based on the volume-averaged turbulent kinetic energy dissipation rate, the operating conditions were varied, including the mixing rate, the disperse phase fraction as well as considering inverse emulsions (water in oil and oil in water). The new model was found to be more generalizable to different operating conditions.