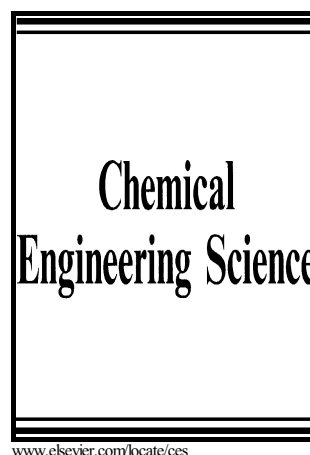


Experimental and Computational Study of a High Speed Pin Mixer via PEPT, Visualization and CFD

Anne K. Konz, Erich Windhab



PII: S0009-2509(16)30429-8
DOI: <http://dx.doi.org/10.1016/j.ces.2016.08.007>
Reference: CES13104

To appear in: *Chemical Engineering Science*

Received date: 19 January 2016
Revised date: 15 June 2016
Accepted date: 5 August 2016

Cite this article as: Anne K. Konz and Erich Windhab, Experimental and Computational Study of a High Speed Pin Mixer via PEPT, Visualization and CFD, *Chemical Engineering Science*, <http://dx.doi.org/10.1016/j.ces.2016.08.007>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Experimental and Computational Study of a High Speed Pin Mixer via PEPT, Visualization and CFD

Anne K. Konz^{a*}, Erich Windhab^{b1}

^aLaboratory of Food Process Engineering, Institute of Food, Nutrition and Health, ETH Zurich, Schmelzbergstrasse 9, CH-8092 Zurich, Switzerland

^bLaboratory of Food Process Engineering, Institute of Food, Nutrition and Health, ETH Zurich, LFO E18, Schmelzbergstrasse 9, CH-8092 Zurich, Switzerland.

*Corresponding author. Phone (mobile): +41 77 418 47 17. E-mail address: anne.konz@gmx.ch. Present address: Oleanderstrasse 14, CH-8050 Zurich, Switzerland

Abstract

Continuous high speed pin mixers have been successfully implemented industrially to mix high fractions of powders into highly viscous non-Newtonian liquids. However, they have not been described in the literature yet. This work presents a multi-method approach, consisting of conventional torque and throughput measurements to calculate average residence times and dimensionless Reynolds/power numbers for suspension mixing, Positron Emission Particle Tracking (PEPT) to gain information on particle trajectories and velocities in the investigated opaque model system, high speed film visualization and CFD simulations. By the combination of these methods, valuable information on the influence of variable process parameters, particularly on the influence of pin configuration, pin shape and inclination of semi-cylindrical pins on mixing mechanisms and efficiency, could be gathered for a broad range of viscosities and powder fractions in Newtonian and non-Newtonian fluids. Flow patterns such as a “Split-and-Recombine” convection pattern at the pins, axial mixing mechanisms and beneficial process conditions to reduce particle sedimentation caused by centrifugal forces in the mixer were retrieved from the results. The PEPT methodology was successfully implemented for a high-shear continuous mixing process of suspensions for the first time. As the combined methodology shows reasonable and reliable results that were also applicable at industrial scale, the work

¹ Phone: +41 44 632 53 48, Fax: +41 44 632 11 55, E-mail address: erich.windhab@hest.ethz.ch.

Download English Version:

<https://daneshyari.com/en/article/4764014>

Download Persian Version:

<https://daneshyari.com/article/4764014>

[Daneshyari.com](https://daneshyari.com)