Comparing Two Experimental Techniques and Modeling to Validate Mixing Time in a Dual Impeller Agitated Vessel

Olli Visuri[1], Elina Nauha[1] and Ville Alopaeus[1]
[1]Department of Biotechnology and Chemical Technology, School of Science, Aalto University, Espoo, Finland; e-mail Olli.Visuri@tkk.fi.

Abstract

Mixing times and flow fields for a two-impeller system was investigated experimentally and modeled with CFD. Mixing times as a function of vessel height were analyzed by using a digital imaging method, with reactive and non-reactive tracer, and with conductivity probes using KCl as tracer. These methods can provide local data about the mixing time. To validate the flow fields PIV experiments were done.

The experiments were conducted in two different vessels. The mixing time experiments were conducted in a 400 liter vessel. The PIV experiments were conducted in a 28 liter vessel. Two different impeller setups were used, a rushton-rushton system and a pitched blade-rusthon system. The position of the upper impeller blade was 0.67T, T and 1.3T, where T is the diameter of the tank. Lower impeller was set to 0.3T.

The experiments were done by varying the distance between the impellers and the impeller speeds. The speeds were set to give the total power input of 0.5 W/kg and 1.25 W/kg, equaling the Reynolds number between $2.2 \cdot 10^5$ and $3.3 \cdot 10^5$ respectively.

A standard k-ε, Scale adaptive simulation (SAS SST) and large eddy simulation (LES) were tested with commercial program CFX12. By comparing various models the grid size dependence was also tested, because SAS SST and LES require much denser grid than standard k-ε. The effect of tracer with mass and without mass was and with initial speed vs. no speed was also tested.

keywords: Mixing time, CFD, PIV, Digital Imaging Method, Conductivity, Dual Impeller

Contact Author's Information:

Name: Olli Visuri
Address: P.O. Box 16100, Aalto, FI-00076, Finland
Phone number: +358 9 451 25813
e-mail address: Olli.Visuri@tkk.fi

Presenting Author's Information:

As above: Yes

Please specify whether you wish to be considered for an oral **X** or poster □ presentation.

Do you anticipate submitting a full paper to the special Mixing issue of the Canadian Journal of Chemical Engineering? Yes **Maybe** No