

A study on the mixing behaviour of different densities liquids in a stirred tank by passive and reactive tracers

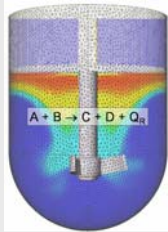
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Objectives and model development

- Theoretical assessment of the stirred tank reactor performance via CFX.

- Development of CFD codes coupled with chemical reaction and multiphase flow models for

- Scale-up
- Optimisation
- Hazard analyses



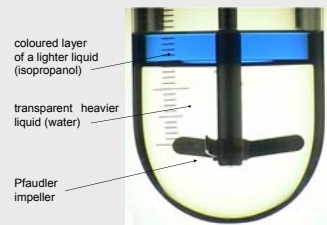
General modelling approach

- full three dimensional approach
- impeller delay in reaching the target
- rotating speed modelled
- gas phase involved

CFX Numerical models

- Free Surface Model
- Multicomponent Model
- Buoyant Flow
- Sliding Mesh
- Fluid dependent k-Epsilon turbulence model

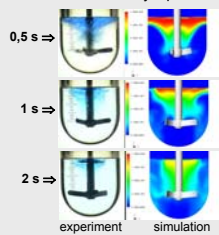
Experimental set-up



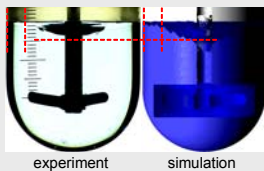
Simulation results

Passive tracer mixing

Dynamic mixing of Initially stratified different density liquids

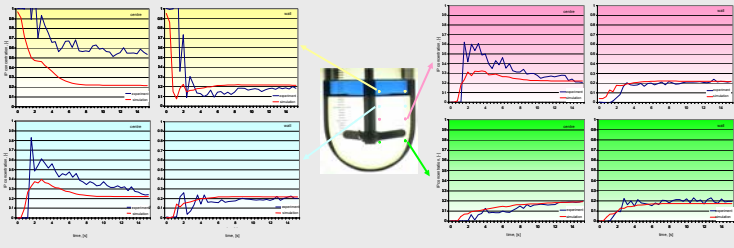


Free surface deformation

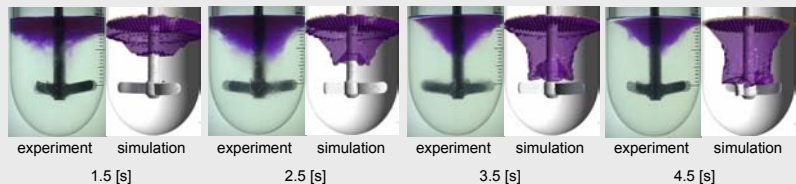
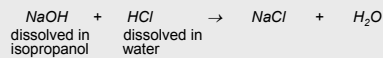


Integral mixing curves at different positions

The experimental ones were obtained by digitally processing the video images. The averaged concentration values at the given points were used for the theoretical mixing curves.



Reactive tracer mixing



Conclusions and further work

Conclusions

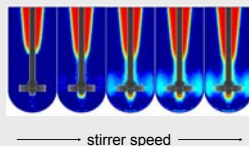
- Good agreement between the experiments and the simulations

Mixing curves
Free surface

- Higher mixing rates predicted
- Improvements of the experimental technique are required
- Good agreement for up to 2.5 s in the case of reactive tracer mixing

Further work

- numerical simulation of gas-liquid mixing
- example: experimental observation using X-Ray cone beam tomography



- introduction of reaction kinetic models of complex reactions into CFD model
- precondition: investigation of reaction pathways and setup of complex kinetic models using reaction calorimetry and chemical online analytical instruments

