Mixing in Stirred Vessels with Low Height-to-Tank Diameter Ratio Using Computational Fluid Dynamics and Particle Image Velocimetry

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Abstract

In many industrial applications mixing vessels have liquid height-to-tank diameter ratio H/T equal to, or larger than, 1. However, there are many instances where this ratio is lower than 1, as in all those cases in which the vessel is emptied, Even when H/T<1, sufficient agitation must still be provided in order to attain process objectives. In such cases, the fluid dynamics of even a single-phase stirred liquid can become quite complex, with different regimes possibly existing depending on the geometric characteristics of the system (such as impeller clearance, liquid height, or liquid head above the impeller). The objective of this work is to obtain a minimum liquid level, for standard impeller off-bottom distance (C/T=1/3), where adequate mixing process can still be achieved in a single liquid phase. Computational Fluid Dynamic (CFD) simulation as well as Particle Image Velocimetry (PIV) was used here to study the velocity profile in the flat-bottom baffled vessels equipped with a single Ruston Turbine (RT) in different height-to-tank diameter ratios when liquid level is lover than tank diameter. A comparison of the experimental and computation work is presented.