Comparison of Different off Bottom Impeller Clearances to Investigate the Effect on Hydrodynamics in Rushton Turbine Stirred Tank

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Abstract

Flow fields and turbulence quantities are important considerations in the design of stirred tanks for many industrial processes. A series of Computational Fluid Dynamics (CFD) simulations have been conducted in present work to investigate the flow hydrodynamics of fully baffled Rushton turbine stirred tank at various impeller clearances ranging from C/T = 0.33 to C/T = 0.15. It is well known that double circulation loop flow pattern changes to single circulation loop flow pattern at lower impeller clearances in baffled stirred tanks [1, 2]. But the exact clearance at which flow pattern transition occurs is not clearly known. Thus the main objective of the present study is to determine exact location of flow pattern transition as well as to analyse the changes in flow hydrodynamics with impeller clearance. The double to single loop transition occurs exactly at C*= C/T = 0.18 and sharp decrease in power number and pumping number were obtained. Further, power number, pumping number and radial velocity fields decreased, while axial velocity fields increased below the impeller centre plane beyond the C*. The turbulent kinetic energy also reduced as the impeller clearances reduced. Thus radial as well as turbulent action of Rushton turbine changes to axial nature as impeller clearance reduces below C*.

References:

1. *G. Montante, K. C. Lee, A. Brucato and M. Yianneskis, Canadian Journal of Chemical Engineering, 77 (1999) 737-747.*
2. *G. Montante, K. C. Lee, A. Brucato and M. Yianneskis, Chemical Engineering Science, 56 (2001) 3751-3770.*