The velocity flow field in the radial distances (x) between the shaft and the impeller vertical blades is shown in Figs. 5.108-a and b at anchor velocity from 150 to 400 rpm. The radius of the cyclohxane eddy at anchor velocity of 150 rpm is about x = 0.03 m. It is wide and occupies the space in the upper side between the two vertical arms of the impeller. This eddy contains a small vortex caused by the shear forces near the tip of the anchor moves from the free surface of the cyclohexane eddy at x = 0.02 m near the impeller to the lower part of the eddy at x = 0.0045 m near the shaft.

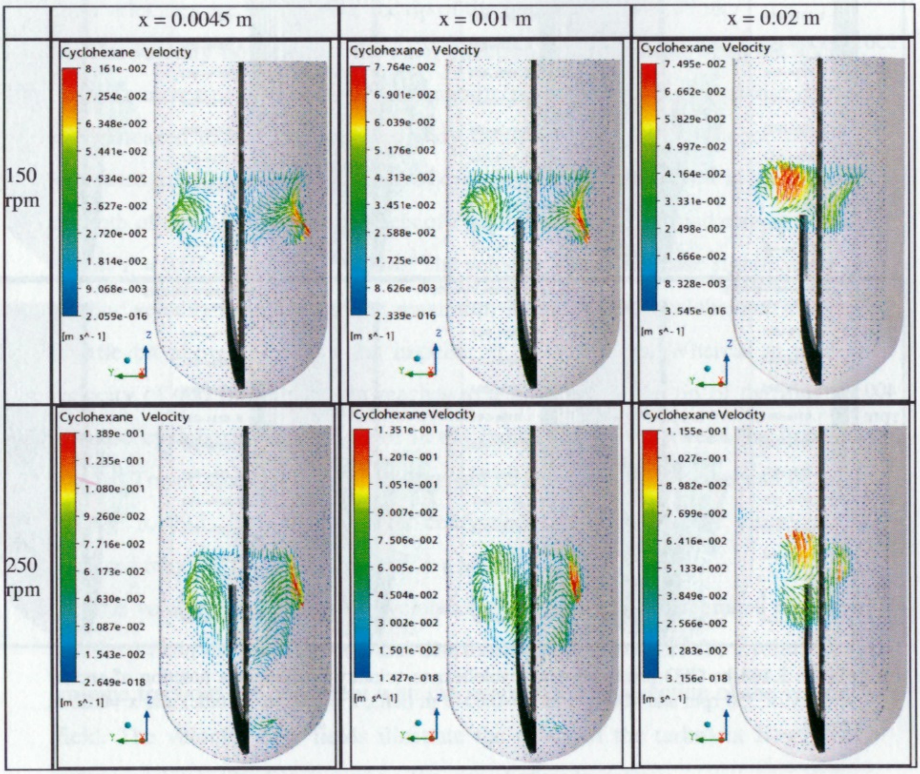

Figure 5.108-a: CFD predicted axial cyclohexane velocity profiles as a function of anchor velocity of 150 rpm and 250 rpm at x = 0.0045 m (left), x = 0.01 m (middle) and x =0.02 m (right).

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Increasing the anchor velocity to 250 rpm increases the centrifugal forces that push water out to the walls of the vessel upwards to a higher distance. Cyclohexane eddy enlarges and moves downwards around the shaft. The flow of cyclohexane is from the inside to the outside of the eddy, leading to roll cells at the interface which have the highest velocity in the eddy, see Fig. 5.108-a.

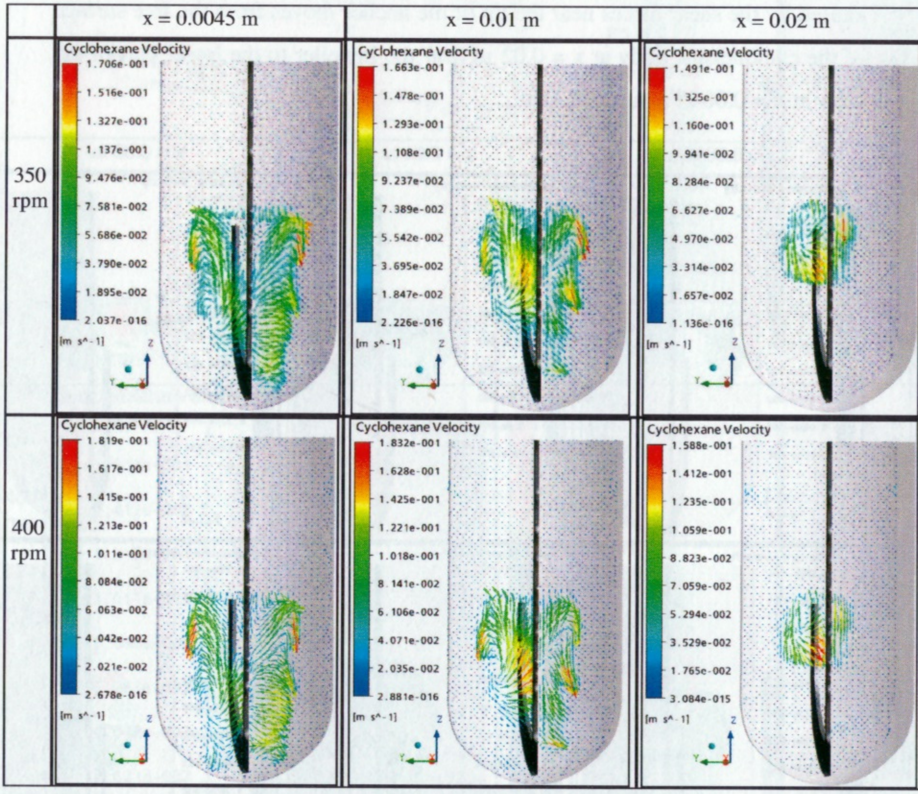

Figure 5.108-b: CFD predicted axial cyclohexane velocity profiles as a function of anchor velocity of 350 rpm and 400 rpm at x = 0.0045 m (left), x = 0.01 m (middle) and x =0.02 m (right).

Further increase of the anchor velocity increases the turbulence and vortices in the large cyclohexane eddy, which reaches to the bottom of the vessel at anchor velocity of 400 rpm. This eddy starts near the tip of the impeller as a one large circulation, and swirls in a conical form down towards the shaft of the impeller as can be seen in Fig. 5.108-b. The development of the roll cells at the interface affects the velocity distribution as found by Sylvia et al. [56].

The radial velocity profile of cyclohexane is represented on horizontal (x,y) coordinate planes at different axial distances (z) in Fig. 5.109-a and b at anchor velocity from 150 to 400 rpm. Initially at t = 0, the total height of the liquid phases is 0.11 m. At anchor velocity of 150 rpm, the cyclohexane is pulled down to a height of about z = 0.07 m, below the tip of the impeller. Two vortices with high velocities are formed near the tip of the impeller at z = 0.09 m.

The velocity flow field in the axial direction (z) is identical when the anchor velocity increases to 400 rpm. The magnitudes of the velocities increase due to the increased turbulent forces and eddy dissipation. When the anchor velocity increases to 250 rpm, more amount of cyclohexane is pulled down in the eddy to a depth of z = 0.08 m. Few droplets of cyclohexane can be found also at a level below z = 0.07 m, see Fig. 5.109-a. The velocity values increase significantly at anchor velocity $\geq$ 350 rpm. The maximum height of the cyclohexane eddy is a little bit above the tip of the impeller at z = 0.095 m. Whereas at anchor velocity of 400 rpm, its height reaches to a level below the tip of the impeller because cyclohexane spread more in the radial distances between the impeller blades. Tracer amounts of cyclohexane can be seen at z = 0.09 m as can be seen in Fig. 5.109-b. This behaviour is confirmed experimentally by visualization with red tracer in chapter 5.1 (Fig. 5.1-a and b).

The velocity flow fields of cyclohexane are in a good agreement with that obtained from the visualization and distribution profiles of CHVF. Cyclohexane volume fractions are consistent with the magnitude and direction of the velocity field. The velocity flow fields illustrate the effect of the turbulent flow, flow pattern and velocity distribution on the rate of mass transfer.