

Volumetric mass transfer coefficient from liquid free surface in reciprocally shaking cylindrical vessels

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Shaking flasks are widely used as screening and pre-fermentation in biochemical processes. For cell cultures by shaking flasks, it is very important to estimate the oxygen transfer rate from the liquid free surface and the mass transfer rate from the liquid to the cell surface. The oxygen transfer rate from the liquid surface in a reciprocal shaking cylindrical vessel was studied. The volumetric mass transfer coefficient from the liquid free surface was measured and correlated by using the power consumption. The power consumption in the reciprocally shaking vessel was not proportional to the shaking frequency and the effects of the shaking frequency on the power consumption was quite complicate. The power consumption of the reciprocally shaking vessel in the rotational flow region can be correlated with the power correlation reported for the rotational shaking.

$$N_p = 934 Fr^{-3/2} Re^{-1/4} (d/D)^{3/2} (N_{tr2} tr3)$$

The of the reciprocal shaking was larger than that of the rotational shaking and can be correlated by the following equation.

$$k_{L,a} = 1.43 \times 10^{-4} P_V^{0.54} D^{0.97} H^{-1.3} \quad (N_{tr2} < N < N_{tr3})$$