Chapter IV

Results

Under non-steady state aeration of a deoxygenated water, an overall transfer coefficient (K_{La}) can be determined by:-

1. the graphical method and
2. the method of least squares

By graphical method, K_{La} is determined from the slope of a semilogarithmic plot of the concentration deficit ($C_s - C_l$) versus time as inllustrated in Apendix B.

$$K_{La} = 2.3 \log_{10} \frac{(C_s - C_l)_{t_1}}{(C_s - C_l)_{t_2}} \Big/ t_2 - t_1 \quad \text{min.}^{-1}$$

The method of least squares as suggested be Fair and Geyer (1954) is also illustrated in Apendix B, where K_{La} is determined by the equations stated below:-

$$n.A + \Sigma x.B = \Sigma y \quad \ldots\ldots\ldots\ldots\ldots (1)$$

$$\Sigma x.A + \Sigma x^2.B = \Sigma xy \quad \ldots\ldots\ldots\ldots\ldots (2)$$

where n = number of samples taken

x = elapsed time in minutes

y = $\log (C_s - C_l)$

B = overall oxygen transfer rate constant with base 10

$K_{La} = \frac{B}{0.4343}$ = overall transfer coefficient

K_{La} is corrected to standard conditions at 20°C temperature and one atmospheric pressure.

$$K_{La(20°C)} = K_{La(T)} \cdot \theta^{(20-T)}$$

On bubble aeration the value of θ varies from 1.016 to 1.037 (Eckenfelder and Barnhart, 1960)

A value of 1.024 was applied to this study.

A straightline relationship between log $(C_s - C_l)$ and time (t) was tested by Pearson (r) and the significance of Pearson r, as suggested by Downie and Heath (1970).

$$\text{Pearson (r)} = \frac{n.\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{[n.\Sigma x^2 - (\Sigma x)^2][n.\Sigma y^2 - (\Sigma y)^2]}}$$

t, the significance of Pearson (r) is equal to

$\frac{r}{(1-r)^{\frac{1}{2}}} \times (n-2)^{\frac{1}{2}}$ with (n-2) degrees of freedom.

Downie & Heath presented values of (r) for different levels of significance and degrees of freedom to simplify significance test for Pearson (r).

Since the present of chloride in tap water observed, varied from 18 to 38 mg/l, the correction for chloride of 0.008 mg/l at 25°C per 100 mg/l chloride as suggested by Fair & Geyer (1954) determined in this study is very small (0.003 mg/l), it may be negligible when compare to the accurate reading of only one decimal observed from the oxygen meter.

All the so obtained results are shown in Appendix C.