Chapter IV

EXPERIMENTAL RESULTS

Comparative tests were carried out with three different types of aeration rotors, each 40 cm. in length. A total of 34 experiments were undertaken in this research: 5, 14 and 15 sets of operational conditions for Rectangular Rotor NO 1,2 and 3 respectively.

All the data so obtained are shown in Table A-1 to Table A-34 in the Appendix A. The water temperature during the experiments ranges from 21.8 to 28.3°C.

The overall oxygen transfer rate constants for different blade immersion of Rectangular Rotor NO 1 are shown in Table 1 and Figure 7, with a range from 2.15 to 3.78 per hour for speeds between 30 and 60 RPM.

The overall oxygen transfer rate constant for different blade immersion of Rectangular Rotor NO 2 is shown in Table 2 and Figure 8, with a range from 0.647 to 10.692 per hour for speed of 30 to 100 RPM.

Table 3 and Figure 9 show the variation in overall oxygen transfer rate constant from 2.907 to 34.366 per hour for different blade immersion of Rectangular Rotor NO 3 and rotor speed from 45 to 120 RPM.

Table 4 shows the variation in net power consumption from 0.060 kilowatt to 0.190 kilowatt for different blade immersion of Rectangular Rotor NO 2 and rotor NO 2 and rotor speed from 30 to 100 RPM.

TABLE 1

Overall oxygen transfer rate constants for specified aeration operational conditions (RPM and depth of immersion) for Rectangular Rotor No. 1

Rotor Speed (RPM)	Blade immersion (cm.)	Temp.[1] °C	K_{LaT} ($min.^{-1}$)	$K_{La\ 20°C}$ ($hr.^{-1}$)
60	5.0	26.6°	0.0737	3.782
45	7.5	27.0°	0.0714	3.628
45	5.0	25.9°	0.0681	3.553
30	7.5	24.7°	0.0521	2.796
30	5.0	26.1°	0.0414	2.149

[1] Average water temperature during experiment.

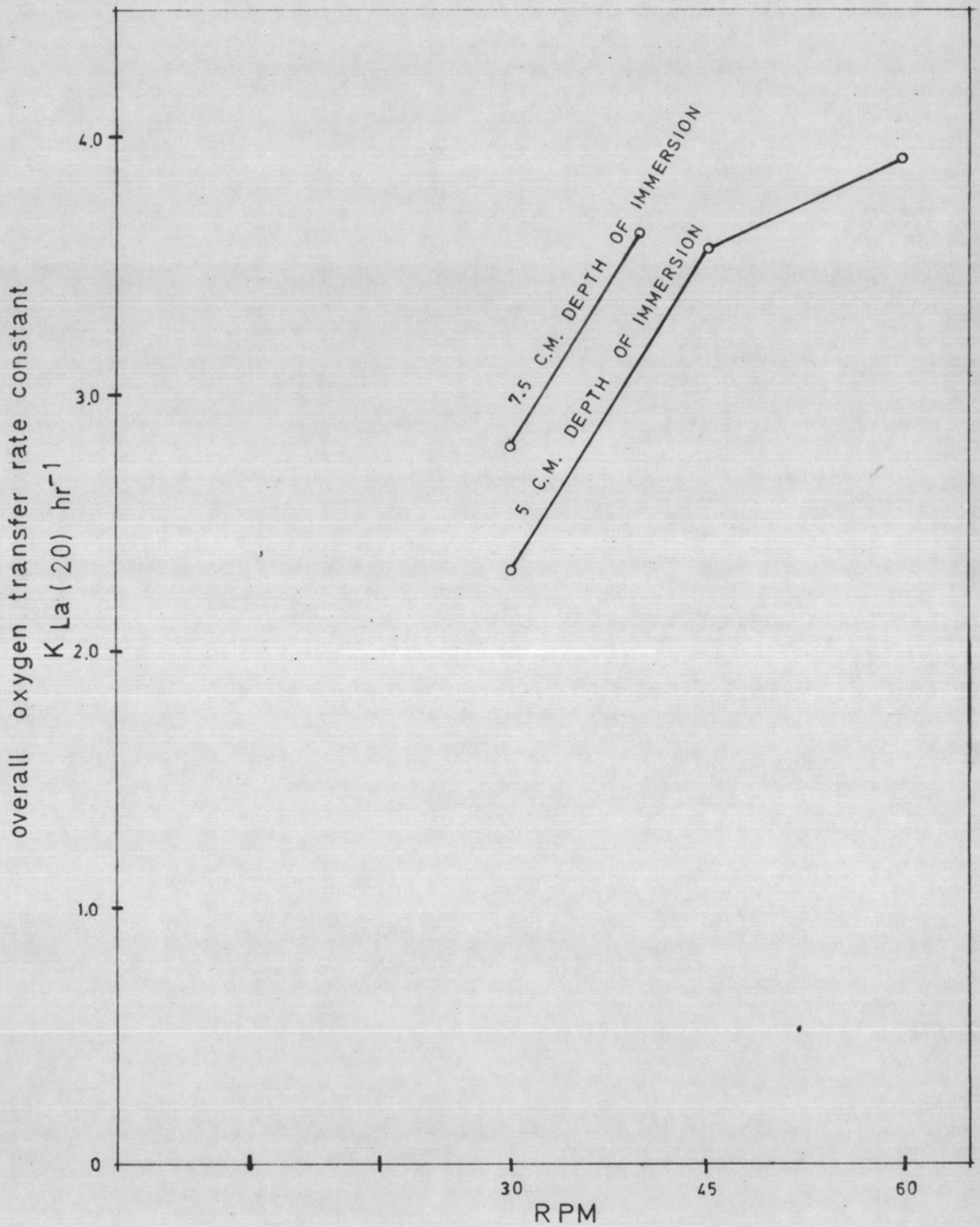

FIGURE 7 Relationship between overáll oxygen transfer rate constant $K_{La(20)}$ and RPM for indicated depth of immersion of rotor blade of Rectangular Rotor Nº 1

TABLE 2

Overall oxygen transfer rate constants for specified aeration operational conditions (RPM and depth of immersion) of Rectangular rotor No 2.

Rotor Speed (RPM)	Blade immersion (cm.)	Temp' °C	K_{LaT} (min^{-1})	$K_{La\ 20°C}$ ($hr.^{-1}$)
100	7.5	28.5	0.2174	10.692
100	5	28.0	0.1963	9.746
80	10	27.0	0.1928	9.802
80	7.5	28.0	0.1709	8.483
80	5	28.0	0.1548	7.686
60	10.0	26.4	0.0715	3.686
60	7.5	27.5	0.0578	2.903
60	5.0	27.5	0.0499	2.507
45	10.0	26.5	0.0471	2.422
45	7.5	27.7	0.0366	1.831
45	5.0	28.3	0.0174	0.870
30	10.0	28.0	0.0224	1.111
30	7.5	27.5	0.0192	0.964
30	5.0	25.9	0.0124	0.647

' Average water temperature during experiment.

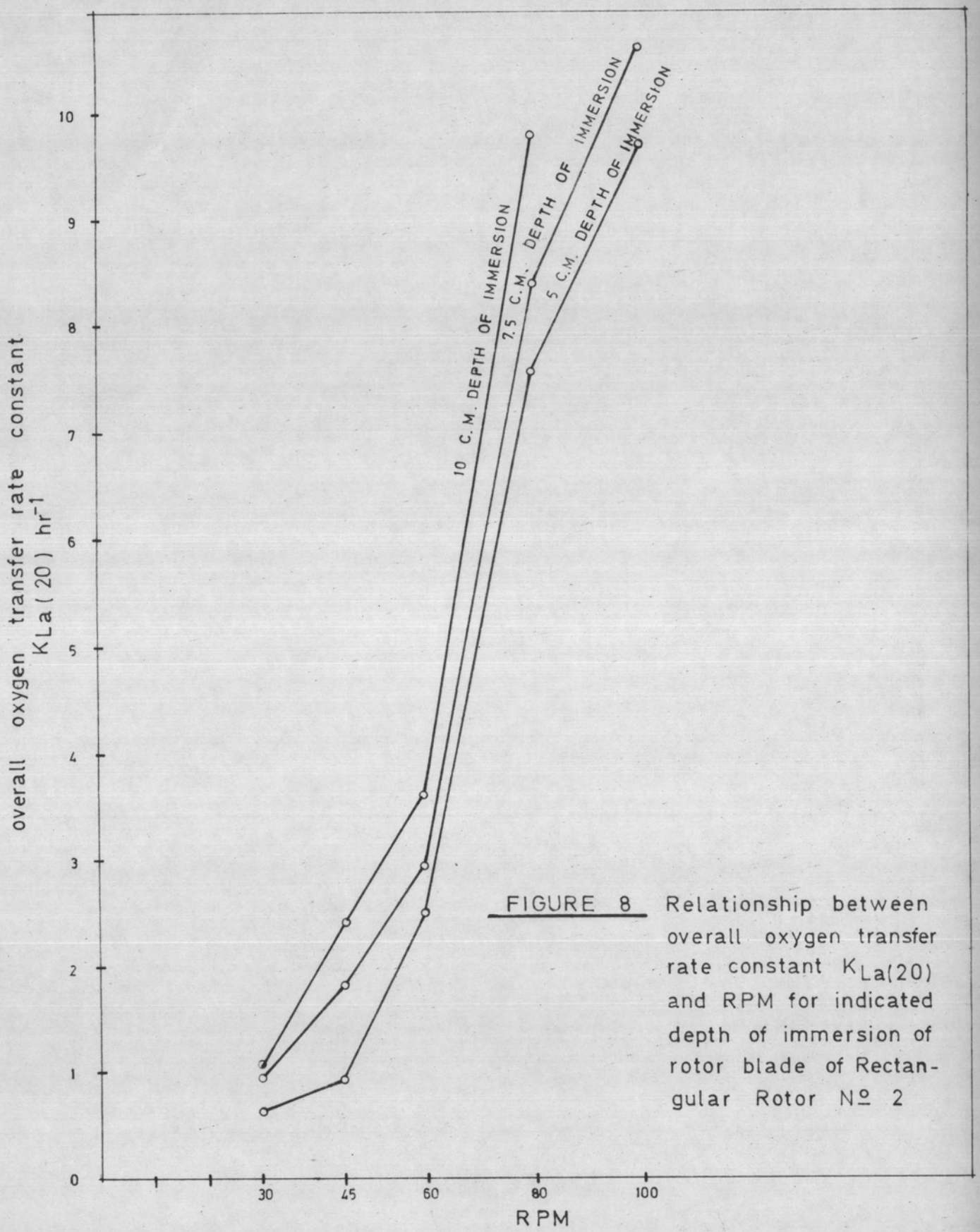

FIGURE 8 Relationship between overall oxygen transfer rate constant $K_{La(20)}$ and RPM for indicated depth of immersion of rotor blade of Rectangular Rotor No 2

TABLE 3

Overall oxygen transfer rate constants for specified aeration operational conditions (RPM and depth of immersion) for Rectangular Rotor No. 3

Rotor speed (RPM)	Blade immersion (cm.)	Temp' °C	K_{LaT} (min^{-1})	$K_{La20°C}$ ($hr.^{-1}$)
120	10.0	27.9°	0.6924	34.366
120	7.5	28.0°	0.4871	24.177
120	5.0	28.2°	0.3124	15.431
100	10.0	25.4°	0.3895	20.561
100	7.5	25.6°	0.3035	15.948
100	5.0	21.8°	0.2676	15.386
80	10.0	26.3°	0.3037	15.720
80	7.5	26.0°	0.3003	15.504
80	5.0	26.0°	0.1891	9.840
60	10.0	24.6°	0.1497	8.054
60	7.5	24.6°	0.0763	4.105
60	5.0	26.3°	0.0477	2.465
45	10.0	24.2°	0.0765	4.155
45	7.5	25.4°	0.0470	2.481
45	5.0	24.0°	0.0383	2.090

' Average water temperature during experiment.

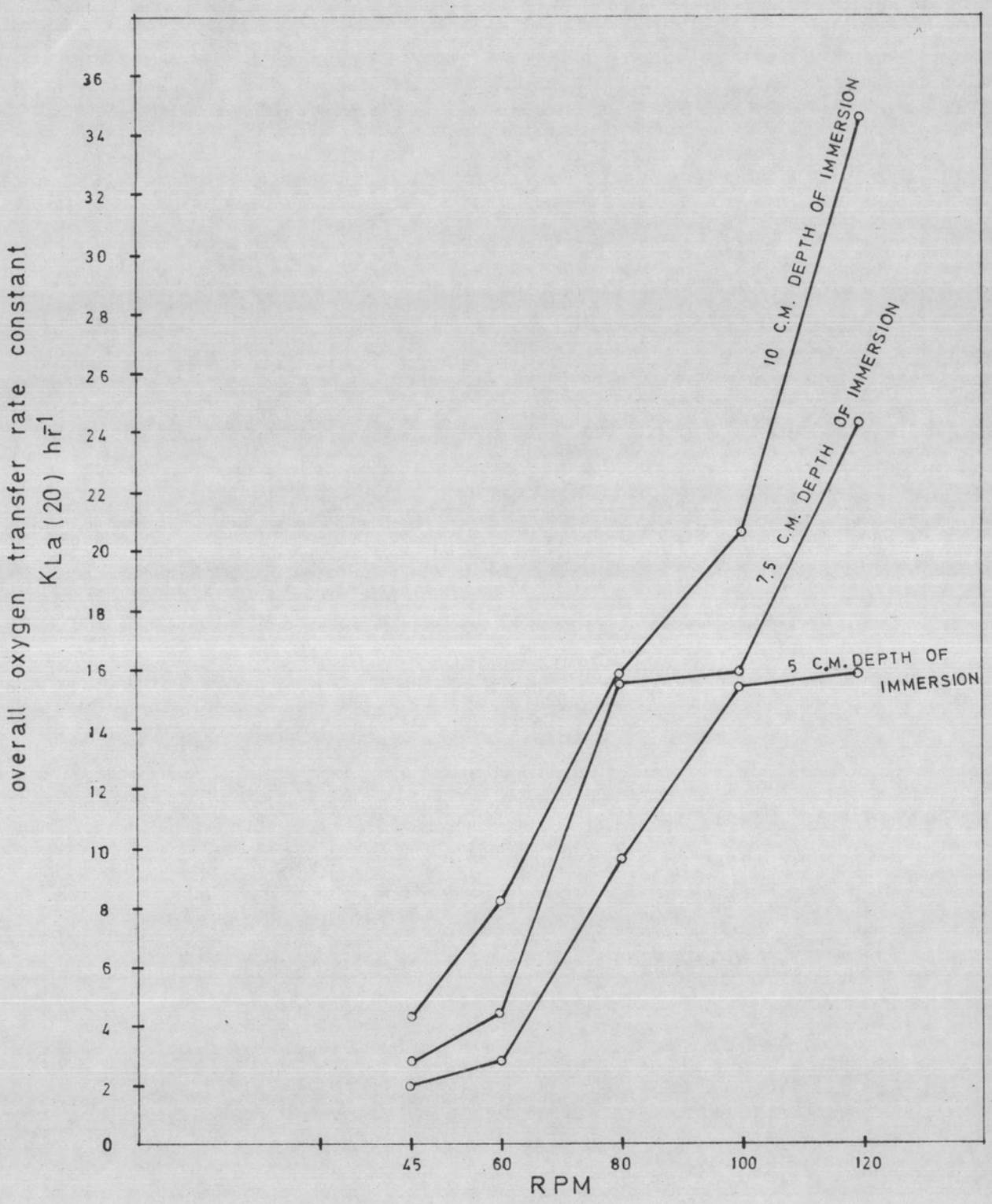

FIGURE 9 Relationship between overall oxygen transfer rate constant $K_{La(20)}$ and RPM for indicated depth of immersion of rotor blade of Rectangular Rotor No 3

TABLE 4

Overall oxygen transfer rate constants, net power Consumption and overall oxygen transfer rate constants per net power consumption for specified aeration operational conditions(RPM and depth of immersion) for Rectangular Rotor No. 2

speed (RPM)	depth immersion (cm.)	net Power (Kw.)	$K_{La(20)}$ ($hr.^{-1}$)	$\frac{K_{La(20)}}{Power}\left(\frac{1}{Kw\text{-}hr.}\right)$
100	5.0	0.180	9.746	54.14
100	7.5	0.190	10.692	56.275
80	5.0	0.070	7.686	109.80
80	7.5	0.110	8.483	77.11
80	10.0	0.120	9.802	81.687
60	5.0	0.070	2.507	35.81
60	7.5	0.080	2.903	36.29
60	10.0	0.100	3.686	36.86
45	5.0	0.060	0.870	14.50
45	7.5	0.070	1.831	26.16
45	10.0	0.085	2.422	28.49
30	5.0	0.060	0.647	10.78
30	7.5	0.070	0.965	13.79
30	10.0	0.075	1.111	14.80

Table 5 shows the variation in net power consumption from 0.060 to 0.545 kilowatt for different blade immersion of Rectangular Rotor NO 3 and rotor speed from 45 to 120 RPM.

Experiment with waste water

In an attempt to find out how the organic content in a waste water affect the value of K_{La} found with the three rotors, water from Klong Orachon was pumped into the oxidation ditch. The initial dissolved oxygen was then determined and was found to be higher than 4.5 mg/L due to the presence of algae. Immediately after the start of the rotors, the water was found to be supersaturated with dissolved oxygen. This meant that the photosynthesis of algae was responsible for this increase in dissolved oxygen during the day time and rotor action was unnecessary.

However further experiment was not carried out because of time limitation.

TABLE 5

Overall oxygen transfer rate constants, net power consumption and overall oxygen transfer rate constants per net power. Consumption for specified aeration operational conditions (RPM and depth of immersion) for Rectangular Rotor No 3.

Speed (RPM)	depth - immersion (cm.)	net Power (Kw.)	$K_{La(20)}$ ($hr.^{-1}$)	$\frac{K_{La(20)}}{Power}\left(\frac{1}{Kw.hr.}\right)$
120	5	0.310	15.431	49.78
120	7.5	0.415	24.177	58.26
120	10	0.545	34.366	63.06
100	5	0.150	15.386	102.57
100	7.5	0.160	15.948	99.68
100	10	0.300	20.561	68.54
80	5	0.110	9.840	89.45
80	7.5	0.150	15.504	103.36
80	10	0.160	15.720	98.25
60	5	0.080	2.465	30.81
60	7.5	0.100	4.105	41.05
60	10	0.140	8.054	57.53
45	5	0.060	0.870	14.50
45	7.5	0.080	1.831	22.89
45	10	0.090	2.422	26.91