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WATER, SANITATION AND HYGIENE: CHALLENGES OF THE MILLENNIUM

Oxidation ditch with bubble aeration

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OXIDATION DITCH IS a well known modification of activated sludge process and comes under extended aeration. The use of oxidation ditches for wastewater treatment is not new. In recent years, however there has been considerable renewed interest in the use of oxidation ditches. Much of the work has been done by different research workers. In this process, aeration is one of the governing parameters. Oxygen transfer rate of rotor aerators can be increased with rotor speed (Stephenson et al , 1985) and using draft tube turbine aerators (Boyle W.C , 1989)

In this paper an attempt has been made to improve the oxygenation capacity of aeration system by supporting bubble aeration to the conventional aerators and laboratory study has been made on the performance of oxidation ditch with bubble aeration with reference to domestic wastewater treatment.

Methodology

The oxidation ditch model was used to carry out this laboratory study. Figure 1 shows the schematic diagram of oxidation ditch model. The brush type rotors were used as surface aerators. The bubble aeration was also provided in addition to rotors. Oxygen transfer coefficient (Kla) has been computed for both the cases i.e without bubble aeration and with bubble aeration. Comparative performance of oxidation ditch was studied with domestic wastewater.

Results

Table 1 shows the dissolve oxygen test readings for the rotor performance without bubble aeration with following conditions.

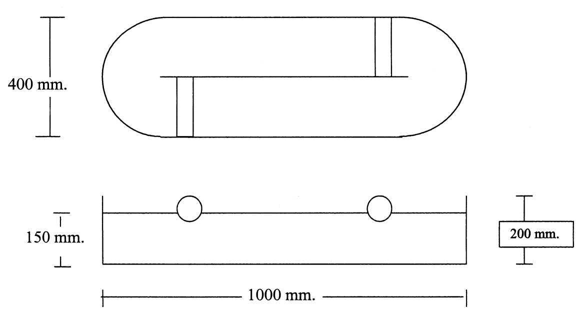

Figure 1. Schematic diagram of oxidation ditch model

Rotor speed – 70 rpm, Room temperature – 31.5 °C, Water temperature – 27 °C, Dissolved oxygen of tap water – 7.0 mg/l

Table 2 shows the dissolve oxygen test readings for the rotor performance with bubble aeration at two points in the ditch with following conditions.

Rotor speed – 70 rpm, Room temperature – 33.00 °C , Water temperature– 30.5 °C , Dissolved oxygen of tap water – 7.0 mg/l

Figure 2 shows the graphical representation of dissolve oxygen test results for both the cases.

Table 1. Performance of brush aerator

Time in minute	Dissolved oxygen in mg/l
00	0.9
15	1.2
30	1.5
45	1.9
60	2.2
75	2.6
90	3.0
105	3.6
120	3.9
135	4.2
150	4.6
165	4.8
180	5.0
195	5.2
210	5.4
225	5.6
240	5.7
255	5.8
270	5.8
285	5.8
300	5.8

Table 3. shows the abstract of performance of oxidation ditch and Figure 3 shows the efficiency of the oxidation ditch process.

Discussion

From the result of dissolved oxygen test, it is clear that oxygen transfer rate can be increased with supporting bubble aeration. Oxygen transfer coefficient (Kla) for brush aerator was found to be 1.15 / hr. and with combination of bubble aeration it was - 1.7 / hr. This results to oxygenation capacity of eration system as 1.02 g/hr. and 1.41 g/hr. respectively. Regarding performance of oxidation ditch with reference to domestic wastewater treatment, COD removal efficiency was observed as 100 per cent for influent COD of 270 mg/l and 95 per cent for influent COD of 600 mg/l.

Limitations

- Due to practical difficulties it was not possible to have aeration period of 24 hrs., hence aeration was carried out in working hours only i.e for 8 hours.
- Model was of fill and draw type.

Table 2. Performance of brush aerator with bubble aeration

Time in minute	Dissolved Oxygen in mg/l
00	1.0
15	1.4
30	1.7
45	2.2
60	2.7
75	3.1
90	3.6
105	4.3
120	4.9
135	5.4
150	5.8
165	5.9
180	6.1
195	6.1
210	6.1
225	6.1
240	6.1
255	6.1

Concluding remarks

Oxygen transfer rate of the conventional aeration system of oxidation ditch can be improved by supporting bubble aeration and ultimately COD removal efficiency may be achieved to its maximum value.

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Table 3. Performance of oxidation ditch with bubble aeration

Sr no	Influent COD mg/l	Effluent COD mg/l	MLSS	COD Removal Efficiency %
1	120	0.00	2400	100
2	170	0.00	2500	100
3	190	0.00	2500	100
4	236	0.00	2600	100
5	270	0.00	2800	100
6	300	18.18	2800	93..94
7	360	18.18	2800	94..95
8	395	18.18	2900	95..39
9	450	18.18	2900	95..96
10	475	36.36	2800	92..34
11	500	36.36	2800	92.72
12	560	36.36	2900	93.50
13	585	36.36	2900	93.78
14	590	18.18	3000	96.91
15	630	18.18	3000	97.11

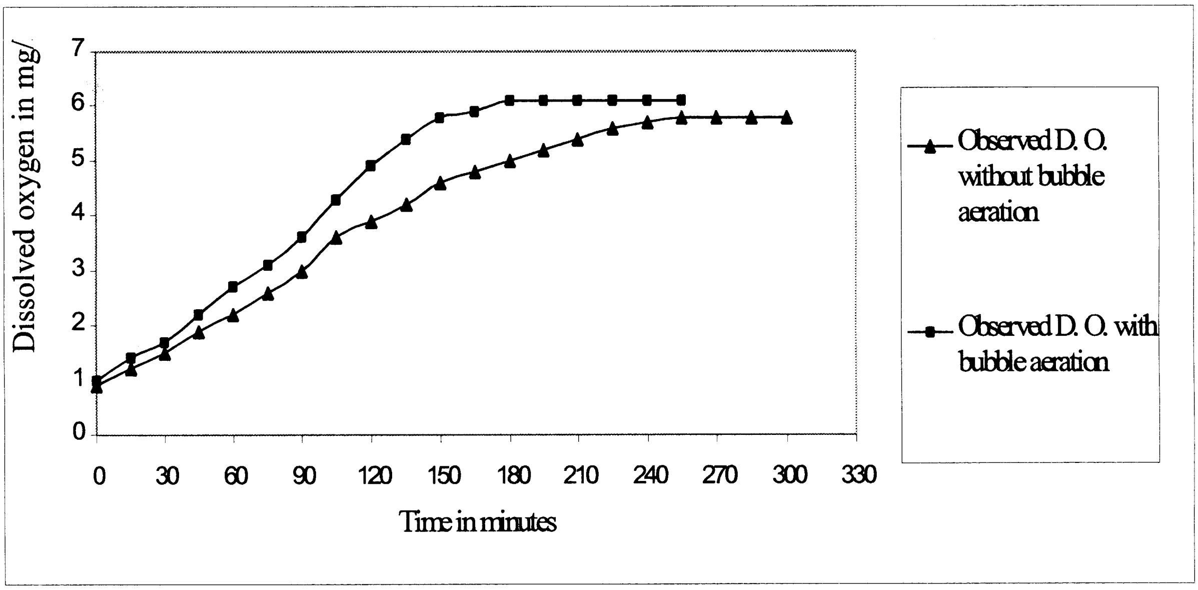

Figure 2. Dissolved oxygen (D.O.) for aeration system

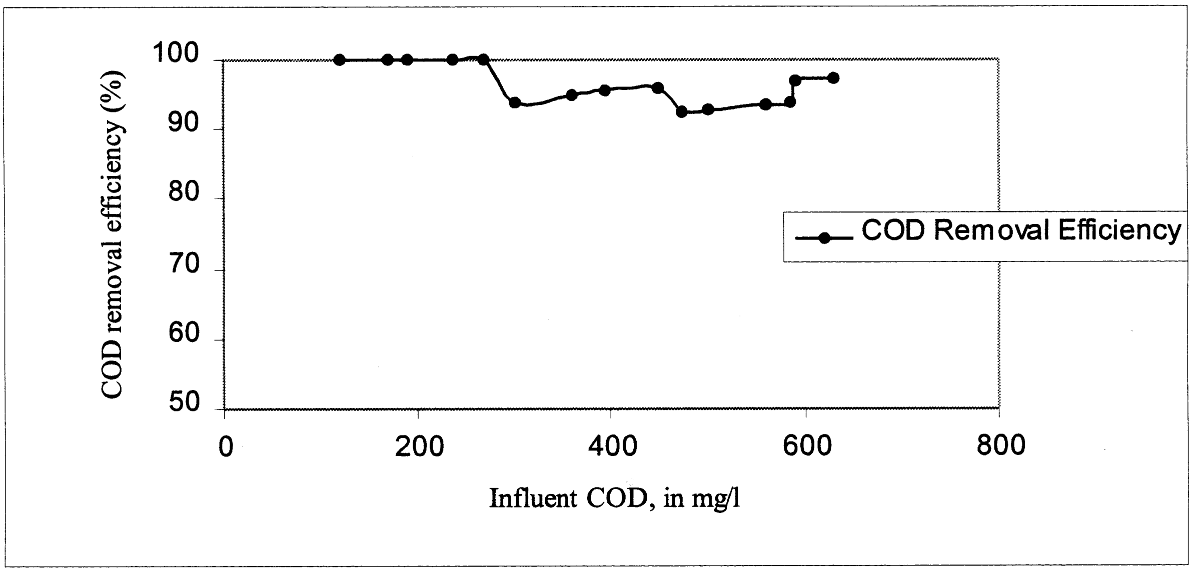

Figure 3. Performance of oxidation ditch with bubble aeration