

## **EFFECT OF INTERRUPTIONS OF AERATION ON THE ACTIVATED SLUDGE SYSTEM**

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### **ABSTRACT**

A bench scale activated sludge reactor was operated to treat low strength wastewater and to study the effect of aeration interruption. The reactor was operated at HRT of 18 hours as actual hydraulic retention time. COD, SS, BOD, SVI and F/M ratio were determined during the experimental work. Aeration interruption was performed at 2:15, 4:30, 6:15, 24 and 28 hours. The performance of the reactor was affected only when interruption time was increased to 28 hours. Thus the aeration interruption can be done but not more than the actual HRT.

**Keywords:** *Aeration interruption, Activated sludge, Operation cost, Sludge volume index*

### **INTRODUCTION**

Small activated sludge treatment plants are available in many places, such as small communities, industrial plants and resorts [1]. Those plants are operated as extended aeration activated sludge treatment plants for domestic or industrial wastewater or both. Operation cost, electric current supply (private or public) and maintenance of some components have been considered operational problems. If the extended aeration can be interrupted for hour or hours from day to day, the operational cost would be less [2]. Also, the power consumption during peak time is avoided and

regular maintenance could be done.

The aim of this research is studying the effect of interruption of aeration on the efficiency of plant through COD removal efficiency, suspended solids (SS) and food to Microorganisms ratio (F/M).

## EXPERIMENTAL SYSTEM

Bench scale activated sludge reactor was fed with actual wastewater from the influent of Eastern Treatment plant at south east of Alexandria. The reactor tanks were fabricated to simulate an extended aeration system. The volume of each tank is 40 liters. First tank was operated as activated sludge extended aeration tank and second was operated as a settler. Arrangements of sludge recycling were considered. Figure (1) shows the flow diagram of the reactors. The reactor was operated with hydraulic retention times of 6, 12, 18, 24, and 28 hours. The optimum performance was evaluated at 18 hours. Aeration was adjusted at suitable rate from air compressor to submerged air diffusers in the bottom of aeration tank.

The reactor was operated hydraulically with flow rate of  $0.11 \text{ m}^3/\text{d}$  at hydraulic retention time (HRT) of 18 hours.

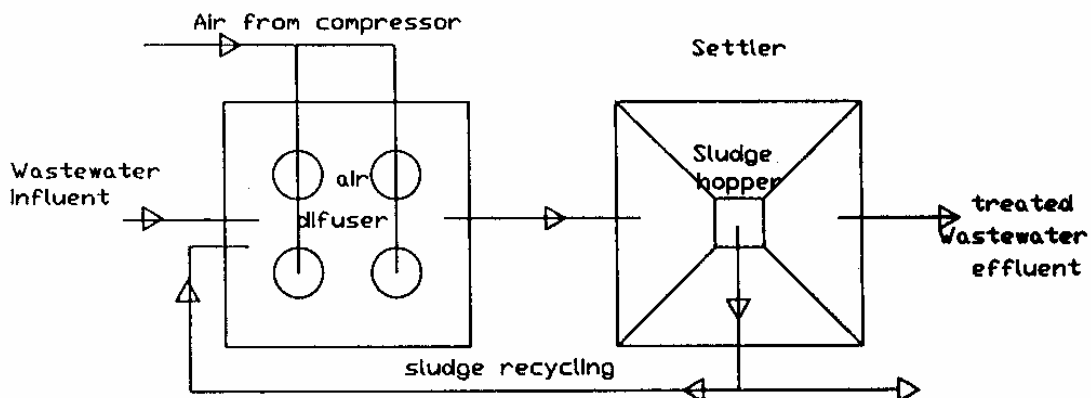


Figure (1) Flow diagram of the experimental reactor

## **ANALYTICAL METHODS**

The performance of the reactor was monitored by COD, SS, and also by BOD. All determinations were carried out by using the procedure described in standard Methods [2]. Mixed liquor suspended solids (MLSS) were determined gravimetrically using a 0.45  $\mu\text{m}$  filter. The settling properties were evaluated using the sludge volume index (SVI). F/M ratio was calculated as explained in Metcalf and Eddy [4].

## **RESULTS**

The COD removal performance in the reactor was observed during the whole period of investigation.

Suspended solids concentrations and BOD were also observed. Reactor was Fed without aeration (interruption, of aeration) for 2:15, 4:30, 6:15, 24 and 28 hours. Table 1 presents the concentrations of COD, S.S, and BOD in the influent and effluent of the reactor at different interruptions. Removal efficiencies of total sludge COD and BOD are calculated. The reactor was normally operated with aeration for 24 hours after each duration of interruptions.

**Table 1 Influent and effluent concentrations of COD, SS, and BOD during interruption of aeration**

Duration of Interruption hours	COD mg/L						S.S. mg/L		BOD mg/L		
	Inf.		Eff.		Removal %		Inf.	Eff.	Inf.	EfT	%
Without Interruption	151	89	25	17	83	72	162	86	142	11	92
2: 15 hrs	HO	110	20	20	86	82	43	20	132	10.5	92
1:30 hrs	120	90	30	30	75	67	202	67	92	10.6	88
6: 15 hrs	200	120	20	20	90	83	302	90	152	8.2	95
24	180	110	10	10	94	91	197	123	137	9.3	93
28	180	115	80	53	55	54	210	45	139	45	67

**T = Total/COD, S = Soluble COD mg/L**

Sludge volume index (SVI) and F/M ratio were measured and calculated just before and after the aeration interruptions and taken after aeration of the reactor for 15 minutes. Table (2) presents the values of SVI and F/M ratios at different interruptions.

**Table 2 Values of sludge volume index and F/M ratio before and after interruption and after 15 min of aeration**

Duration of Interruption	SVI mL/g			F/M ratio		
	Before Interr.	After Interr.	After 15 min.	Before Interr.	After Interr.	After 15 min.
2:15	33.70	14.40	19.0	0.129	0.096	0.117
4:30	33.70	21.09	20.51	0.129	0.046	0.048
6:15	33.70	21.37	22.12	0.129	0.081	0.092
24	33.70	19.10	20.37	0.129	0.079	0.092

## DISCUSSION

The study in laboratory scale has demonstrated that the aeration interruption was not effective on the performance of the reactor up to 24 hours duration.

The reactor was operated at actual HRT of 18 hours and duration of aeration interruption was in the time range of 2 to 24 hours. COD removal percentage increased with increasing duration time of interruption up to about 24 hours and dropped with increasing interruption to 28 hours.

Suspended solids concentration decreased with increasing time of aeration interruption. From the results in Table (2) it can be concluded that the SVI was not affected by the interruption of the aeration during different duration.

F/M ratio was affected with increasing the time of interruption, but after 15 minutes from aeration it increased again. Performance of the reactor shows that aeration can be interrupted for a continues time equal to

actual hydraulic retention time more or less by 20% without performance reduction. The performance of the reactor may not be affected because of low influent concentrations of COD and SS. The simplest way to evaluate the economy realized by the daily or weekly or even monthly aeration interruption is to consider that there is a good chance to reduce the power consumption and enough time to maintain the aeration system.

## **CONCLUSION**

Interruption of aeration of activated sludge reactor treats low strength wastewater did not affect the reactor performance if interruption time does not exceed the HRT. The aeration interruption from hour to hour or from day to day or even from week to week is important for maintenance and to avoid the peak times of energy consumption.

## **REFERENCES**

- [1] Marco Von Sperling, "Comparison among the most frequently used system for waste water treatment in developing countries", *Water Science and Tech.*, Vol. 33, No. 3, pp. 59-72, (1996).
- [2] Manoel Reis Neiva et al., Reduction of operational costs by planned interruptions of aeration in activated sludge plants. *Water Science and Tech*, Vol. 33, No. 3, pp. 17-27, (1996).
- [3] Standard Methods, For the Examination of water and wastewater, 19<sup>th</sup> Edition (1995).
- [4] Metcalf and Eddy, INC.: *Wastewater Engineering Treatment Disposal and Reuse*. Second edition, Tata Mc-Graw Hill (1983).