



Advantage of Biox Tank Technology over Aeration Tank in Secondary Biological Treatment

D. D. Banerjee & T. K. Bose, India



Introduction

The above case study was conducted at a Soft Drink Plant at Uttar Pradesh where Effluent Treatment Plant was stabilized using Biox Tank methodology. Biox Tank is a substitute for normal Activated Sludge Process where special type of plastic media is normally used to decrease the capacity of the Aeration Tank with increase in reduction of biological matter. The above plastic media is completely submerged inside the Aeration Tank with air being introduced by the help of Air Blower underneath the media bed.

The above soft Drink Industry is in the process of making different types of syrups & mineral water of good quality with production rate of 600 bottles/min. The raw effluent discharge from the factory, designed for 550 Cum/day contains mainly sufficient suspended solids (TSS) with high BOD & COD load.

The treatment plant was designed with the following raw influent characteristics. The influent characteristics were measured after 24 hours composite sampling and the outlet quality measured at the end of 20th day from the start up of the plant.

	Raw Influent	Treated Effluent
pH	= 9.2	7.42
BOD, mg/l	= 630	15.0
COD, mg/l	= 1456	156.0
TSS, mg/l	= 212.4	21.2
Oil & Grease, mg/l	= 22.5	1.3

Objective of the study

The objective of the present study is to establish a commercially viable Effluent Treatment Plant by the Biox Tank methodology. Here, the infrastructure facility of local authority i.e., drainage system for the collection of industrial wastewater is not present except discharging it to the surrounding lands for gardening purposes. Thus, waste-water generated from the said Soft Drink industry can not be discharged as such, in the surrounding land except proper treatment for maintaining ecology. The free-floating oil & grease has been separated primarily and thereafter wastewater is taken into the Biox Tank for the secondary treatment. After Biox Tank second

stage aeration system is incorporated to take care of the additional biological load. The implementation of Biox Tank reduces the detention time to two-stage activated sludge process whereby decreases the capacity of the Aeration Tank. The initial cost including civil & mechanical cost as well as the operating cost for the Biox Tank technology is much less compared to double-stage aeration tank system.

The Treatment Process

The treatment process consists of a manually cleaned Bar Screen Chamber where initial removal of coarse solids is done followed by an Oil & Grease Trap, where the free floating oil & grease floats to the top and is skimmed off manually to a side pit. Water then overflows to two Equalisation Tanks placed in parallel for flow collection & homogenisation. As the effluent is highly alkaline in nature, acid (dilute HCl) is dosed in both the Equalisation Tanks. In the Equalisation Tanks air is introduced with the help of Air Blowers for proper mixing of chemicals.

The biological process consists of two-stage aeration followed by settling. In Biox Tank, the organic matter is removed by micro-organisms attached to the plastic PVC media underneath the water level in the Biox Tank. Air is provided in the Biox Tank for necessary oxygenation and mixing with the help of Air Blowers. Coarse bubble Diffusers are provided in the Biox Tank for proper aeration.

The overflow effluent from Biox Tank gravitate to Aeration Tank, where further removal of BOD & COD is achieved. The same Air Blower is used for oxygenation & mixing inside the Aeration Tank. In the Aeration Tank fine bubble Diffuser membrane is provided for developing bacteria culture. From Aeration Tank effluent gravitates to the Settling Tank for removal of suspended solids.

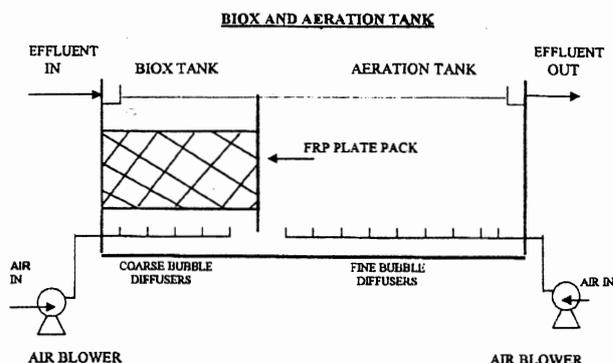
The underflow sludge from the Settling Tank is recycled back to the Biox Tank with part being discharged periodically to the Sludge Drying Beds. The overflow from the Settling Tank is collected in a Treated Water Holding Tank from where it is being used for gardening purposes. For proper flow measurement V-Notch Chamber is installed at the final discharge point.

Specifications of Biox Tank

- a) Biox Tank is constructed in RCC.
 Detention Time in Biox Tank : 3.82 Hrs
 Capacity of Biox Tank : 87.5 Cu.m

- b) It consists of special type of plastic, FRP corrugated plate pack media on which micro-organisms grow. The surface area of the above media is much higher compared to normal activated sludge process. The detail specification of the plate pack is given below:
 Volume of Plate Pack Media : 41.5 Cu. m
 Plate Pack Media Dimensions : 1000 (l) x 780 (w) x 600 (ht), mm
 Thickness of the media : 0.3 mm for the first two top layers
 : 0.4 mm for bottom (3rd) layer
 No. of Layers of Plate Pack : 3 (Three)

- c) Air is introduced into the Biox Tank through coarse bubble Diffusers.
 Diffusers : 36 Nos.
 Zone of influence of each Diffusers : 850 mm x 850 mm



Advantages of using biox tank technology

The *advantages* of using the Biox Tank technology include the following:

- 1) Detention time in Biox Tank is only 3.8 hours with BOD reduction of over 65% which in turn reduces the capacity of 1st Stage Aeration Tank.
- 2) Quick stabilisation of Effluent Treatment Plant. (In this Case Study it only takes 23 days for stabilisation compared to 35-40 days for conventional activated sludge process).

Table-I (Comparison of Biox and Aeration Tank)

Sl. No.	Parameters	Biox Tank	Aeration Tank
01	Detention Time, hrs	3.82	12-18
02	F:M Ratio	0.88	0.2-0.3
03	MLSS, mg/l	4500	3500-4000
04	Recycle Sludge Concentration, mg/l	10500	8000-10000
05	Stabilisation Period, days	23	35-40
06	Addition of external sludge	Minimum	Huge
07	Type of Aeration	Diffused	Diffused/ Surface
08	Capacity of Tank, Cu.m Dimensions (lxwxht), m Civil Cost, Rs.	87.50 4.8 x 4.8 x 3.8 1.9 Lacs	275.00 8.5 x 8.5 x 3.8 3.6 Lacs
09	Air Blowers Diffusers Volume of Plate Pack Mechanical Cost, Rs.	2 Nos. (3 HP each) Coarse (36 Nos.) 41.5 Cum 1.2 Lacs	2 Nos. (5 HP each) Fine (81 Nos.) Not Required 2.7 Lacs
10	Operating Cost, Rs./ Annum (@22 Hours/ day; 360 days/year & Rs. 4.5/KW-Hr)	0.64 Lacs	1.09 Lacs
11	Net Savings Initial Cost, Rs. Operational Cost, Rs./ Annum	3.2 Lacs (50% savings w.r.t. aeration tank) 0.45 Lacs/ Annum	

- 3) Less sludge generation & minimum sludge discharge/ day as the bacteria growth takes place in the submerged plate pack itself which in turn increases the concentration of bacterial population.
- 4) Reduction in the sizes of Aeration Tank itself, as these bacteria can develop MLSS as high as 5000 mg/l in the Biox Tank.
- 5) Diffused aeration is used for aeration in the Biox Tank, which needs minimum 3 m of liquid depth, which in turn reduces the cross-sectional area of the treatment plant.
- 6) Dissolved Oxygen (DO) concentration inside the Biox Tank can be increased/ decreased by throttling the delivery valve of Air Blower which is not possible in case of aeration system.
- 7) Less maintenance as no aerator is required compared to normal activated sludge process.

Acknowledgement

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