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PHARMACEUTICAL INDUSTRY WASTEWATER TREATMENT USING ATMOSPHERIC AIR AND PURE OXYGEN

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ABSTRACT

This research focus is to reduce the reduction of BOD, COD, nitrogen and phosphorous level in the pharmaceutical effluent. There is 79.3% reduction in the BOD and 72.6% reduction in the COD using atmospheric oxygen. In the case of pure oxygen. There is 89.6% in the BOD reduction and 90.5% in the COD reduction. The pH, dissolved oxygen, conductivity, total suspended solids, mixed liquor suspended solids. Activated sludge process is an efficient method to treat the industrial effluent. Based on the comparison study on the treatment of atmospheric oxygen and pure oxygen, the pure oxygen is proved efficient. There is 79.3% reduction in the BOD and 72.6% reduction in the COD using atmospheric oxygen. Whereas in the case of pure oxygen. There is 89.6% in the BOD reduction and 90.5% in the COD reduction. Regarding the electricity cost for the atmospheric oxygen and pure oxygen, atmospheric oxygen treatment is found to be very economical compared to pure oxygen.

KEYWORDS: *Waste Water, Oxygen Demand, pH, Nitrogen, Phosphorus*

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INTRODUCTION

Industrial pollution management is thus one amongst the many issues that environmental biotechnology addresses to. For a long time, the point of discussion in environmental pollution as an issue has been symptoms rather than causes of pollution. This naturally influenced and began to give emphasis on measurement and treatment technologies.

Activated sludge is a process of dealing with the treatment of sewage and industrial wastewaters. Atmospheric air or pure oxygen is bubbled through primary treated sewage (or industrial wastewater) combined with organisms to develop a biological floc which reduces the organic content of the sewage. The combination of raw sewage (or industrial wastewater) and biological mass is commonly known as Mixed Liquor. In all activated sludge plants, once the sewage (or industrial wastewater) has received sufficient treatment, excess mixed liquor is discharged into settling tanks and the treated supernatant is run off to undergo further treatment before discharge. Part of the settled material, the sludge, is returned to the head of the aeration system to re-seed the new sewage (or industrial wastewater) entering the tank. This fraction of the floc is called Return Activated Sludge (R.A.S.). Excess sludge which eventually accumulates beyond what is returned is called Waste Activated Sludge (W.A.S.). W.A.S is removed from the treatment process to keep the ratio of biomass to food supplied (sewage or wastewater) in balance. This is called the F: M ratio. W.A.S is stored away from the main treatment process in storage tanks and is further treated by digestion, either under anaerobic or aerobic conditions prior to disposal.

The wastewater was mainly contributed by pharmaceutical origin. These wastes were characterized to be containing high COD and a high COD: BOD ratio and require effective aerobic biological treatment systems to ensure safe disposal. The present study is carried out by varying F/M ratio. For each F/M ratio considered the performance is evaluated at three MLSS concentrations of 2000 mg/L, 3000 mg/L and 4000 mg/L. The studies are carried out at two different HRT's. The efficiency of the treatment is determined in terms of % COD, BOD reduction and SVI values. The studies revealed that COD reduction at an HRT of 5.0 days ranged between 63%-78% while SVI values ranged between 43-62 for all the F/M ratios studied*Raj D S.S. et al* (2004).

Dold, PL et al (1978)**,** modifications to the basic kinetic relationship in a dynamic model for the aerobic activated sludge process are described, and the model is applied to aerobic single and series reactor configurations under steady and cyclic loading conditions. Changes made in the classic model (Ekama and Marais, 1978) include replacing the energy requirement for adsorption by a bi-substrate hypothesis. Also, the extracellular growth-limiting reaction in modeled by an active site theory and replaces the modified Blackwell (1971) equation for the synthesis of the stored particulate substrate. A death-generation concept replaces the classical endogenous respiration concept. The modified model satisfactorily predicts the behavior of the activated sludge process operating over a long range of process configurations under constant and cyclic loading conditions. When used to predict the dynamic behavior of the single sludge denitrification process, different values are required for the kinetic constants defining the carbonaceous and ammoniacal substrate utilization rates. Also, when contact stabilization processes are modeled, a reduction in the maximum soluble substrate utilization rate at 20 deg is necessary. (Small-FRC).

Daigger GT et al (2003) said that diffusion of dissolved oxygen through activated sludge flocs was studied, as it represents a potential mechanism for simultaneous nitrification and denitrification in activated sludge systems. Dissolved oxygen profiles through six floc particles collected at different times from a full-scale activated sludge plant. A different dissolved oxygen decline pattern was exhibited for the smaller floc particles characterized. Implications of these results regarding the occurrence of simultaneous nitrification and denitrification include consideration of the factors that affect floc size and distribution.

Khan F et al (1996) said that high organic load and fluctuation in organic load in terms of total phenols is fed into an SBR of higher height and diameter ratio (H/D 20) and operated at 4 h cycle and a constant HRT of 8 h. Maximum phenol concentration of 650 mg/l is treated efficiently in 4 h which is equal to an organic load of 3.9 kg m(-3) d (-1). After granulation, the effluent phenol and COD concentrations were 3 mg/l and 41 mg/l respectively. Phenol removal efficiency and COD removal efficiency of 94% and 95% were achieved. Effluent O.D.(600) stabilizes at 0.15 which corresponds to the minimum loss of biomass, which is the main advantage of SBR.

MATERIALS AND METHODS

The pH of the mixture was determined using the pH meter. The pH should be around 7-7.5 because the bacterial growth will be effective only at this pH. If the pH below is 7, sodium hydroxide is added and if it is above 7.5 hydrochloric acids should be added to get the required pH range. The mini-motor with a fan like an arrangement is made to run inside the mixture. This set up resembles an aeration tank. The aeration process should be carried out for 5 days. The sample should be taken for every 24 hrs filtered and then ammonia level should be checked every day. The average values of the 5 days observation were taken for the calculation of design purpose.

Diffused Aeration System

Compressed air is introduced into the aeration tank through porous diffusers, non-porous diffusers, jets or static mixers. Compressed air is forced out of porous diffusers and form small bubbles. Non-porous diffusers have less oxygen transfer efficiency. Jets in which compressed air and water are mixed and discharge through nozzles to produce fine bubbles. Jets are reported to have oxygen transfer efficiency similar to porous diffusers. The air and water intensely mix the tubes causing bubble breakup and high rate of oxygen transfer. Static mixers have transfer efficiency similar to porous diffusers. Diffusers are placed on one side of the tank and the rising air bubbles cause the tank contents to rotate in a circular fashion, thereby keeping the mixed solid liquor solids in suspension. Tank depth is generally between 4.5 and 7.5 m. The width to depth ratio is generally 1.0 to 1 and 2.2 to 1 with 1.5 to 1 is being generally used. Static mixers and jet are more appropriate for tanks in which complete mixing is the goal.

Mechanical Aeration Systems

Mechanical aerators are generally grouped into four different types: radial flow low speed, axial flow high speed, horizontal rotors, and aspirating devices. Radial flow low-speed aerators are the ones generally used in aeration tanks in activated sludge process. Slow speed aerators are known for good oxygen transfer efficiency, mixing capabilities and reliability. Low-speed mechanical aerators generally work best in tanks that are square or circular.

RESULTS AND DISCUSSIONS

The main objective of the project is to reduce the amount of COD and BOD, nitrogen and phosphorous by ASP based on the atmospheric oxygen and pure oxygen. This resulted in designing of the aeration tank, clarifier. The basic parameters for the design –concentration, time

In ASP, the process is done for 5 consecutive days and made analysis and determined the COD and BOD level.This analysis was mainly based on time internal after every 24 hours the analysis was made and the observations were tabulated.As the time increases the microorganisms consumed on the organic matter and decreased the BOD and COD level.The growth of bacteria is decreased after 3 days. This determination helped us to feed the sample and the mixture with some sludge after 3 days to continue the process in an effective manner. The biochemical tests revealed that the mixed culture consists of *pseudomonas* species, *E.coli, Shigellasp, Klebsiellasp, Mycobacterium sp., Bacillus sp., and fungal species like Aspergillussp, Mucor sp.* There is appreciable reduction in the COD and BOD level. There is 79.3% reduction in the BOD using atmospheric oxygen. There is 72.6% reduction in the COD using atmospheric oxygen. Whereas in the case of pure oxygen. There is 89.6% in the BOD reduction. There is 90.5% in the COD reduction.

Values Obtained using Atmospheric Oxygen

Table 1

S. No	pH	CDS	TDS	MLSS	%COD	%BOD	% N	%P
1	8.43	4260	2982	5630	-	-	-	-
2	8.38	4190	2933	4760	24	37	25	72.6
3	8.35	4350	3045	4060	23	25	23.6	23.6
4	8.3	4560	3192	4410	18	41	18.7	18.7
5	8.32	4421	3094.7	4298	41	23	41	37.7

Values Obtained using Pure Oxygen

Table 2

S. No	pH	CDS	TDS	MLSS	%COD	%BOD	% N	%P
1	8.48	4980	3486	4870				
2	8.55	4530	3171	5110	38	33	38	38
3	8.52	4750	3325	4998	42	41	42	42
4	8.56	5080	3556	4896	43	43	43	43
5	8.54	4896	3427.2	4532	50	53	53	53

SUMMARY AND CONCLUSIONS

There is 79.3% reduction in the BOD and 72.6% reduction in the COD using atmospheric oxygen. In the case of pure oxygen. There is 89.6% in the BOD reduction and 90.5% in the COD reduction. The pH, dissolved oxygen, conductivity, total suspended solids, mixed liquor suspended solids. Activated sludge process is an efficient method to treat the industrial effluent. Based on the comparison study on the treatment of atmospheric oxygen and pure oxygen, the pure oxygen is proved efficient. There is 79.3% reduction in the BOD and 72.6% reduction in the COD using atmospheric oxygen. Whereas in the case of pure oxygen. There is 89.6% in the BOD reduction and 90.5% in the COD reduction. Regarding the electricity cost for the atmospheric oxygen and pure oxygen, atmospheric oxygen treatment is found to be very economical compared to pure oxygen.

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