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Treatment Of Effluent From Plywood Industry

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Abstract - — *Water is vital for sustaining all forms of life on earth. In our country natural water resources get polluted every day. Polluted water is a major source of many of the illness of human being. Plywood industries play an important role in the economical development of India. The effluent from the plywood industry affects the surface water and ground water adversely. The releasing of untreated effluents into the environment results in its pollution. To find out the extent of pollution tests were carried on effluent samples collected from the industry. The tests for COD, BOD, TSS, Ammonia, pH and phenol were conducted. Conventional activated sludge process was done in a rectangular tank at various air flow rates (1.5 L/min, 2.5 L/min, 4 L/min) at a constant time period of 4 days using air stones as diffuser. 2.5 l/minute found to be the optimum air flow rate. COD, BOD, TSS, ammonia and phenol found to be removed by 89%, 89.13%, 46%, 86%, and 49.3% respectively.*

***Key Words*: Plywood effluent, Activated sludge process, F/M Ratio, Aeration, Aeration tank.**

1. INTRODUCTION

The plywood industry involves the production of plywood from thin layers of wood veneer. The effluent from the plywood industry affects the surface water bodies and ground water adversely. All stages in the conversion of wood from the standing tree to the final veneer or plywood is accompanied by incidental waste in some form or other. During the process of plywood formaldehyde resin is used to stick the layers of thin sheet of wood. Liquid waste from plywood production is generally generated from the washing process of the glue spreader machine and the washing process of other production equipment. Formaldehyde residue/waste generated by many plywood units was being drained through a small outlet into a water channel. The presence of formaldehyde, even in traces, is highly toxic to human health and its long-term adverse impact could be deleterious.

The characteristics of liquid waste from plywood industry are generally dominated by the value of pH, BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand), phenol, ammonia and total suspended solids. Liquid waste treatment system will be determined by the parameters of the liquid waste generated. By knowing the types of the parameters in liquid waste, the treatment methods and the choice of the equipment types required for the treatment can be set.

Aerobic and anaerobic treatment methods can be used for the treatment of effluent from plywood industry. Aerobic decomposition requires a continuous supply of oxygen and proceeds more rapidly as dissolved oxygen concentration near saturation levels. The rate of degradation of organic matter is not as rapid as under aerobic conditions and the end products are organic compounds such as alcohols and foul smelling acids. In other words the decomposition is slower and less complete in anaerobic environments than in aerobic habitats were the primary end product of decomposition is carbon dioxide.

2. ACTIVATED SLUDGE PROCESS

The Activated Sludge Process is an aerobic suspended biological wastewater treatment process. This means that treatment occurs as pollutants are used as a food source by many different types of microorganisms. It is a suspended growth process, since the organisms are suspended in the wastewater.

The activated sludge process relies on the cultivation of a population of millions of microorganisms of many different types, mostly aerobic and facultative heterotrophic bacteria suspended in the wastewater, as it passes through a reactor (aeration tank). This suspension, referred to as mixed liquor (or Mixed Liquor Suspended Solids, MLSS), is supplied with oxygen and kept mixed by bubbling air through it. As the organisms feed on the organic pollutants in the wastewater, the pollutants are converted to biomass and some by products.

3. METHODS AND MATERIALS

3.1 Aeration

Aeration is the intimate exposure of water and air. It is a way of thoroughly mixing the air and water so that various

reactions can occur between the components of the air and the components of the water. Aeration removes or modifies the constituents of water using two methods-scrubbing action and oxidation. Scrubbing action is caused by the turbulence which results when the water and air mix together. The scrubbing action physically removes gases from solution in the water, allowing them to escape in to surrounding air. Oxidation is the addition of oxygen, the removal of hydrogen, removal of electrons from an element or compound. The suspended materials can then be removed later in the treatment process through filtration.

3.2 Fine bubble diffusion:

Fine bubble diffusion is a subsurface form of aeration in which air introduced in the form of very small bubbles. Aeration efficiency of fine bubble aeration is 6.6 times greater than that of coarse bubble aeration. Fine bubble aeration creates an effective vertical circulation. This continual upward motion of the fine bubbles de stratifies the water body. Fine bubble diffused aeration therefore effectively mixes water and thus reduces potential anaerobic sediment. This ultimately greatly improves water quality. Air stones were used as the diffusers.

3.4 Aeration tank:

Rectangular tank was used for aeration .Length to width ratio of aeration tank affects their performance on oxygen transfer and energy consumption while aerating the waste water. Rectangular tanks performs better and they are most energy efficient, hence provides better economy. Rectangular tank of length to width ratio equal to two (L/W=2) performs better than rectangular tank of L/W=1.5. Rectangular tanks are best for quick aeration, they consume more energy than other tanks. The sizing of aeration tank for diffused aeration restricted to certain minimum water depth, which is about 0.35m. Lower water depth will reduce the effectiveness of the system diffused aerators are popular choice of aeration system because of their simplicity, reliability and their competitive rate of oxygen transfer.

3.5 F/M Ratio:

The food to microorganism (F/M) ratio is one of the significant design and operational parameters of activated sludge systems. A balance between substrate consumption and biomass generation helps in achieving system equilibrium. The F/M ratio is responsible for the decomposition of organic matter. The type of activated sludge system can be defined by its F/M ratio.

4 RESULTS AND DISCUSSIONS

From the analysis of samples, it was found that BOD, COD, phenol, ammonia and TSS were exceeding their permissible limits suggested by CPCB.

Table-1: Determination of Optimum Air Flow Rate

Rate of air flow	1.5 l/min	2.5 l/min	4 l/min
Reduction in COD (%)	49.75	89	79.95
Reduction in BOD (%)	49.77	89.13	79.97
Reduction in TSS (%)	31.6	46	30
Reduction in phenol (%)	21.64	49.3	45.2
Reduction in ammonia (%)	37	86	75.5
Initial pH (7.49)	8.34	8.46	8.1

On aerating the effluent at an air flow rate of 1.5 l/min and for detention period of 4 days, the COD value which was initially 4131.7 mg/l was reduced to 2076 mg/l that is 49.75% of reduction was occurred .Total suspended solids is reduced from 1500 mg/l to 1025 mg/l that is 31.6% of reduction was occurred. Percentage reduction in BOD, phenol and ammonia was found to be 49.77, 21.64, and 37 respectively.

On aerating the effluent at an air flow rate of 2.5 l/min and for detention period of 4 days, the COD value which was initially 4131.7 mg/l was reduced to 449 mg/l that is 89% of reduction was occurred .Total suspended solids is reduced from 1500 mg/l to 810mg/l that is 46% of reduction was occurred. Percentage reduction in BOD, phenol and ammonia was found to be 89.13, 49.3 and 86 respectively. pH value increased from 7.49 to 8.46 due to the removal of CO_2.

Rate of air flow increased to 4l/min. COD, BOD,TSS, phenol and ammonia were reduced to 828 mg/l, 537.6mg/l, 1050 mg/l, 9.44 mg/l and 120 mg/l respectively. The percentage reduction was found to be 79.9% in COD, 79.97% in BOD,30%in TSS, 45.2% in phenol and75.5% in ammonia. From the above observations optimum air flow rate found to be 2.5l/minute.

5. CONCLUSIONS

The analysis of sample from plywood industry was done by testing the samples in the laboratory. The results revealed that effluent characteristics like BOD, COD, TSS, phenol and ammonia were beyond its permissible limits. So treatment of effluent is necessary before its disposal.

Conventional activated sludge process was done in a rectangular tank at various air flow rates (1.5l/minute, 2.5l/minute, 4l/minute) at a constant time period of 4 days using air stones as diffuser. 2.5 l/minute found to be the optimum air flow rate. COD, BOD, TSS, ammonia and phenol found to be removed by 89%, 89.13%, 46%, 86%,49.3% respectively.

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