CHAPTER VII

Conclusion:

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Tannery wastewater treatment is a complex and difficult task. To preserve the environment the treatment of tannery wastewater before it is discharged to natural stream is must. Thus BOD reduction of wastewater treatment is of paramount importance. In the present case the study of BOD reduction has been carried out using bacterial action.

From the study carried out in this work 65 species of bacteria have been isolated. The action of these bacteria on tannery effluent have also been studied. The result is shown in Appendix- II in the table VI-3 and graphically presented in the Appendix-III from B 1 - B 65 respectively. The table VI-3 which contains the findings is self explanatory i.e of the 65 samples shown in the table, the first sample appears to be the most efficient compared to others in controlling the first parameter i.e BOD as is revealed from the results. The bacterial strain, which can reduce BOD level to a lower value, is considered to be most active as reduced BOD indicates lower level of organic load which really means removal of the organic compounds from the wastewater; in other words it means better quality of effluent as far as pollution load is considered. Of the other two parameters i.e NO_3^- & PO_4^{3-}, the difference between the initial and the final values is so meager that the change in values appears very insignificant unlike the first parameter, namely BOD. In composite tannery waste treatment the organic matters are decomposed in presence of various microbes. Generally the mechanism going on in decomposition is as follows-

1. Catabolism - $C_xH_yO_2N + O_2 \xrightarrow{\text{bacteria action}} CO_2 + HO_2 + NH_3 + \text{Energy}$

2. Anabolism- $C_xH_yO_2N + \text{energy} \xrightarrow{\text{bacteria action}} C_5H_7NO_2$ (Bacterial Cell)

3. Autolysis- $C_5H_7NO_2 + 5O_2 \xrightarrow{\text{bacteria action}} 5CO_2 + NH_3 + 2H_2O + \text{Energy}$

Some of the nitrifying bacteria produce NO_3^- from NH_3 in the system. PO_4^{3-} consumption is also there in the metabolic activities of microbes where PO_4^{3-} acts as an essential nutrient. In the present study of efficiency determination, it is clear from the set of given data in table VI-3 that BOD is the significant parameter, rather than PO_4^{3-} & NO_3^- estimation in appreciating the efficiency judgement of microbes in waste treatment.It is a fact that the bacteria grow exponentially as is evident from Monod equation, consequently the BOD reduction by bacterial action is also exponential. A mathematical model of falling rate of BOD has also been developed in the form $BOD = (BOD)_0 e^{-\alpha t}$ and for derivation of this equation a computer programme has been developed in C language where $(BOD)_0$ stands for initial BOD, α is a constant and t is for time. The BOD reduction values by bacteria in atmospheric condition have been tabulated in table VI-6 in Appendix-II and graphically presented in B67-B77 in Appendix-III. BOD values for corresponding to each experimentally observed values have been computed using the computer programme.. Computed falling rate of BOD has been graphically plotted along with the experimental BOD reduction values in B78-B88 in Appendix –III and these curves show close similarity between the experimental & computed results of BOD. It may be observed that both experimental and computed results of BOD follow similar relationship as indicated by Monod equation.

Species name of four most efficient bacterial strains were identified and they are *Enterobacter aerogens, Pseudomonas aeruginosa, Bacillus subtilis*, and *Bacillus megaterium* respectively. In atmospheric condition from table VI-6 in Appendix-II, it is evident that though the bacterium no .1 shows the highest removal of BOD, there is no significant difference in the removal of BOD for the next three bacteria in atmospheric working condition. From table VI-6.12, it is clear that BOD

removal will be more if the number of more efficient bacteria is increased in the treatment process. From table VI-6.13 it has been indicated that 98% BOD reduction has come after 72 hrs of aeration when 4 efficient bacterial strains have been applied for treatment of effluent. From the above it may be said that if the effluent in the activated sludge is treated with specific efficient microbes in combination then better BOD reduction could be achieved, simultaneously indirectly increasing the organic load by addition of floc can be avoided .

Future scope of work:

The leather industry is under pressure from various groups to adopt environment friendly methods of processing. The industry, on its part, is trying sincerely to fulfil the expectations of the society. It has already done much, but in respect of effluent treatment method, the position is not very encouraging. Since tannery effluent is complex in nature, the treatment and disposal of tannery wastewater to meet the pollution control standards is a difficult task and require specialized technological input from experienced and knowledgeable experts. The tannery effluent treatment plants are either under designed or under utilized, so organized planning, proper techno-economic feasibility study for ETP are essential to meet the pollution control standards. The present study provides useful information regarding bacteriological treatment technologies with preservation of environment for secondary wastewater treatment. It will also be interesting to study a larger spectrum of microbes present in activated sludge process and formulate the bio-cultures for utilization in ETP of leather industry to make leather industry more eco-friendly. No doubt the magnitude of the problem is colossal.