CHAPTER 6

SUMMARY AND CONCLUSION

The present study on the treatment of wastewater from caprolactam manufacturing unit using acclimated activated sludge was summarized as below.

- Characterization of caprolactam plant wastewater was carried out using various analytical methods. Wastewater from caprolactam plant was collected from the equalization tank of wastewater treatment plant over a period of 6 months and was analysed for different parameters. It was observed from these study that the average BOD and COD was in the range of 2500 and 1800 mg/l respectively. The ammonia nitrogen and phosphorus was in the ratio 100: 5: 0.5. Which shows that the phosphorus is deficient in the influent and was required to be supplemented to make the ratio 100:5:1, which is considered as the standard for any activated sludge process.

- The organic part of wastewater was found to be mainly cyclohexanone, cyclohexanol, caprolactam and some organic acids.
The treatability study of caprolactam plant wastewater shows that it can be treated by activated sludge process and a BOD reduction of 95% was achieved under the experimental conditions.

Effect of different variables viz; pH, F/M ratio, Airflow rate, degree of agitation, hydraulic retention time etc on the treatment process was studied. The optimum pH for the treatment was found to be in the range of 6.5±0.5.

It was observed that as the airflow rate was increased, the rate of reaction and % COD reduction was increased correspondingly. The degree of agitation found to increase the rate of reaction and COD reduction rate.

The optimum F/M ratio at a hydraulic retention time of 120 hrs was found to be in the range of 0.4-0.5 kg COD/Kg MLSS. Day. Beyond which the efficiency and settling characteristics of the sludge was poor.

The two intermediate products of caprolactam manufacturing process viz, hydroxyl amine sulphate and hydroxyl amine disulphonic ammonia was studied for their toxicity towards activated sludge. The oxygen uptake rate and COD reduction
efficiency was taken as an indication for toxicity. Both these compounds found to inhibit bacterial respiration and there by the treatment process even in very low concentrations.

Biodegradation study of cyclohexanone, cyclohexanol and caprolactam were done using synthetic wastewater and acclimated activated sludge. From the gas chromatographic studies it was observed that all these compounds are biodegradable under the experimental conditions. The results obtained from the biodegradation studies were correlated with the metabolic pathway of these compounds.

It was also observed that the utilisation of anone andanol from a mixture of these two by the microorganisms are not simultaneous but sequential. The cyclohexanone was found to be preferentially metabolized by the microbes than cyclohexanol. The experiment was done at various environmental conditions of pH, nutrient concentrations, and substrate concentrations to study and explain this behavior. The effect of sequential utilisation on the treatment process was studied using a synthetic wastewater in continuous reactor.
The effect of nitrification in aerobic activated sludge process was studied. In order to reduce nitrification and thereby reducing the nitrate in the effluent within allowable limits certain variables were studied. The effect of F/M ratio on nitrification was studied and found that nitrification reaches minimum or ceases at F/M ratios >0.40 kg COD/Kg MLSS. Day.

The effect of drop in pH during nitrification was studied separately. A growth study was done at a pH of 3.0 and found that fungus was dominating at these conditions and bacterial proportion was very negligible.