SUMMARY

S U M M A R Y

Rapid industrialization of the country has brought in light the impact of this development on the environment. The water and air pollution has acquired such a dimension that it is time that all concerned sit together and decide about certain norms and strategies to abate pollution.

In the present work some of these problems are addressed and different strategies are tried. The work is divided in two parts.

PART - I

Removal, recovery and utilization of waste materials (organics and inorganics) of caprolactam effluent.

The caprolactam plant has waste liquor highly reach in organic fatty acids. At present this liquor (WL-I) is incinerated by using fuels and other by-products of the plant. The incineration adds to air pollution and thermal pollution. Moreover, valuable materials are used up for incineration.

In the present method different processes of separation of fatty acids (organic oil) are tried and conditions are optimized. Effluent, after the separtion of organic oil is still having high COD values. Methods of efficient extraction and adsorption are tried and final effluent is obtained which can be used for the recovery of sodium sulphate by solar evaporation. The experiments were monitored by measuring COD values in each experiment, before and after treatment. COD values were cross checked by determining TOC and TC values. Some of the experiments were

monitored by GC and results of COD values were confirmed.

The strategy evolved is quite feasible for the recovery of organic oil and sodium sulphate. It is scaled up upto 10 litres effluent.

The important point is the utilization of organic oil (mixed fatty acids). It contains mono and di carboxylic acids. Work was undertaken to find different utility patterns for the mixed fatty acids as it is key to the feasibility of the recovery process. In the present study different experiments were carried out for the various applications of recovered fatty acids as listed below :

1. Surfactants.
2. Polymers.
3. Single cell protein raw material.
4. Conversion to fatty amine.

The laboratory experiments were quite encouraging and feasibility of large scale applications is discussed. The recovered sodium sulphate is also of good quality and can be used in the detergent industry as filler.

The overall experimental results have provided a zero pollution approach where treatment cost will be recovered from the recovery and saving of expensive materials and will make it a profitable proposition.

PART - II

Fatty amines were tried as new flocculating agents for the treatment of number of effluents for the removal of pollutants.

PART-II A

Removal of colour and organics from the effluents :

Effluents of dyes and dyes-intermediate industries :

Whole of Western India is known for the manufacture of dyes and dyes-intermediates. Small scale as well as large scale industries face the problem of the treatment of effluents. Some of the effluents are very difficult to treat by classical methods. Many of the recommended methods are highly sophisticated and expensive. Even after all these recommendations there is no single treatment for the efficient removal of colour from the effluents of dyes and dyes-intermediate industries.

Liquid ion-exchangers (fatty amines - primary, secondary, tertiary and quaternary amines) are used for the removal of inorganics and some of the organics.

In the present study long chain fatty amines are used as flocculating agents. Their efficiency was tested by varying concentration of pollutants (colour) as well as by varying the amount of fatty amines and keeping the pollutants constant. The results are highly encouraging.

The efficiency of fatty amines in the removal of colour as well as organics is excellent. After the treatment, normally colourless effluent is obtained, COD is decreased by 80 to 90%, the pH is also shifted towards permissible limit. Such three fold action by a single treatment is rare in the removal of coloured pollutants. However, the ratio of pollutant to fatty amine is 1:2 in the efficient treatment.

The positive aspect of the treatment strategy is the recovery and recycling of fatty amines. Flocks obtained are treated with small quantity of solvent and the base. The regenerated fatty amine is recovered from the solvent and re-used. Its efficiency is quite comparable with the

virgin samples. The coloured aqueous phase is used to recover dyes or dyes-intermediates.

Number of experiments were carried out with three fatty amines. They were monitored by measuring COD, TOC and TC values. Colour was monitored by visible spectrophotometer.

The efficiency of new flocculating agent was compared with granular activated carbon (GAC). The results indicate that GAC is efficient for the synthetic samples of dyes but fails for the effluent, whereas flocculating agents are more effective with the effluents.

The process is highly feasible and is being patented.

PART - II B

Removal and recovery of organics from the effluent of detergent industry :

The effluent of the industry manufacturing linear alkyl benzene sulfonic acid was taken for the study. The effluent was treated with flocculating agent (Fatty tertiary amine) used in the previous section.

The flocks of surfactant immediately separates when stoichiometric amount of fatty amine is used. The filtrate can be disposed as the removal of COD is 92-95%. The flocks are recovered and can be used as ampholytic surface active agents as it is the complex of anionic and cationic surfactants.

PART - C

Removal of 'Hg' from effluent of chlor-alkali industries :

Lately 'Hg' pollution has resulted in many epidemics and disasters. Modern technological advancement in chlor-alkali industries have replaced Hg cell by membrane cell for the production of alkali. However, almost all the existing chlor-alkali industries in India are based on old technology. It was proposed to utilise new flocculating agent for the removal of Hg from the effluent of chlor-alkali industries.

Number of experiments were carried out with the effluent of Chlor-alkali industries, by treating it with different quantity of tertiary amine. 'Hg' was determined by using mercury analyser MA 5800 (cold vapour atomic absorption spectrophotometer) having sensitivity 3 ng absolute for 1% absorbance. The flocculating agent has shown very good efficiency in the removal of mercury.

The synthetic samples of $HgCl_2$ were also prepared and number of variations were tried to find the efficiency of tertiary fatty amine (dimethyl stearyl amine - B-DMS) for the removal of Hg from the effluent.

The results of experiments indicate that the efficiency of B-DMS is quite good in different ranges of concentration of 'Hg' in the effluent. Moreover, 'Hg' can be recovered from the flocks.

THE HIGHLIGHTS OF THE STUDY

1. Caprolactam industry has a good alternative to incineration. The present treatment recovers fatty acids and provides different applications of recovered fatty acids. Moreover the process saves potential source of adipic acid (WL-II)

and fuel used for incineration and provides recovered organic oil and sodium sulphate.

The pilot plant operations are worth experimenting.

2. The removal of organics from dyes and dyes-intermediates industry is more than 90% and brings the effluent at acceptable limits as colour is removed. The fatty amines used as flocculating agents can be recycled. The process has great potential.

3. The removal of anionic surfactant is highly effective. The recovered ampholytic surfactant has good potential for application in different fields. The separation of ampholytic flocks is very easy.

4. The mercury can be recovered and recycled. The results are highly encouraging. The fatty amines also can be recovered and recycled.

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