

## Characterization and Treatment of Industrial Effluent by Activated Sludge Process

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### ABSTRACT

Wastewater treatment is common research interest among environmentalists. Treatment of wastewater for organic matter removal can be carried out by various physical, chemical and biological methods. Treatment by using various biological methods is effective way of organic matter removal. In the present research, characterization of effluent is carried out. The effluent is treated for organic matter removal by using activated sludge. In this investigation about 77 % removal was organic matter was obtained.

**Key words:** Chemical oxygen demand, biological oxygen demand, dissolved oxygen.

### INTRODUCTION

Wastewater treatment consists of applying known technology to improve or upgrade the quality of a wastewater. Usually wastewater treatment will involve collecting the wastewater in a central, segregated location (the Wastewater Treatment Plant) and subjecting the wastewater to various treatment processes. The disposal of untreated wastewater from municipal sewage is the major environmental problem. Industrial effluent contains various organic and inorganic pollutants. In past few decades, pollution control has given full attention and knowledge of biological processes was successfully developed with the aim of low utilities and process operation costs. The effluent can be treated for removal of organic matter by using various treatment methods such as physical, chemical and biological. [1-5] Adsorption on various adsorbents is very economical method for wastewater treatment. [6-8] various membrane separation operations

also find wide applications in wastewater treatment. [9,10] Various techniques like advanced oxidation process, electro dialysis finds wide application in wastewater treatment. [11-15] In the present research industrial wastewater from dye industries is treated for organic matter removal. Measured in terms of chemical oxygen demand (COD).

### EXPERIMENTAL SET UP AND METHODOLOGY



Fig 1: Activated Sludge Tank

Since the tank includes cylindrical as well as conical shapes the dimensions are as follows:

**Dimensions for cylinder**

Diameter of cylinder = 25 cm

Length of cylinder = 27 cm

**Dimensions for cone**

Diameter of cone = 25cm

Length of cone = 13cm

The first step in the activated sludge process is to bring the microorganisms in contact with the organics of the wastewater. This is generally accomplished by the rapid mixing of the return sludge with the wastewater at the inlet of the aeration tank. In some cases small mixing chambers are provided, but this is not the common practice.

**Preparation of solution**

- **Manganese sulphate solution:** 48gms of  $MnSO_4 \cdot 2H_2O$  was dissolved in water and volume was made up to mark in 100ml volumetric flask.
- **Alkaline Potassium iodide solution:** 125 gm. NaOH & 37.5 gm. at KI was dissolved in D.W. ( $H_2O$ ) & diluted to mark in 250 ml volumetric flask.
- **Standardization of sodium thiosulphate:** about 0.6-0.7 gm of AR grade  $Na_2S_2O_3 \cdot 5H_2O$  was dissolved in 100 ml distilled water, next 10ml of 0.025 N ( $K_2Cr_2O_7$ ) & potassium dichromate and 10ml of conc. HCL acid were mixed in conical flask. To the mixture was added 6ml of 10% KI and kept in dark for 5 minutes to liberate  $I_2$ . The sides of the flask were washed with 10ml water and shaken well. It was then titrated with newly prepared thiosulphate solution till strew yellow colour was obtained. Then starch solution was added and titrated to a light green & product
- **Starch solution** A small quantity of distilled water was also added to about 0.5mg of soluble starch (A.R.) taken in beaker. The mixture was

stirred with a glass rod and heated to make transparent paste this was added to 100ml of boiling distilled water with constant string & Cooled.

- BOD bottle was taken & 200 ml of water sample was added into it.
- 2 ml of manganese sulphate & 2 ml of alkali iodide solution was also added to the BOD bottle. The top of the pipette should below the Liquid level, while adding these agents.
- Bottle was stoppered with cone to exclude air bubble and mix by repeatedly inserting the bottle 2-3 times.
- If no  $O_2$  is present the manganese ion reacts with hydroxide ion to form white ppt. of  $Mn(OH)_2$  if  $O_2$  is present  $Mn^{++}$  is oxidized to  $Mn^+$  and ppt. is brown coloured.
- After shaking and the allowing sufficient time for all  $O_2$  to react, clear liquid within upper portion was separated.
- 2ml of concentrated  $H_2SO_4$  was added.
- The bottle was mixed by inverting until the suspension completely dissolved and yellow colour was uniform throughout the bottle.  
 $MnO_2 + 2I^- + 4H^+ \rightarrow Mn^{++} + I_2 + 2H_2O$
- A volume of 20 ml was taken to conical flask and titrated into conical flask with 0.025N sodium thiosulphate solution until yellow colour iodine turns to pale straw colour.
- Since it was impossible to accurately titrate the sample to colourless, liquid 1- 2 ml of starch was added.
- Continued titration was made to the 1<sup>st</sup> disappearance of the blue colour.

**Table 1: Dissolved Oxygen Characterization**

| Wastewater (ml) | $K_2CR_2O_7$ (ml) | Burette reading (ml) | DO (mg/lit) |
|-----------------|-------------------|----------------------|-------------|
| 190             | 10                | 4.3                  | 4.3         |
| 180             | 20                | 5.6                  | 5.6         |
| 170             | 30                | 6.2                  | 6.2         |
| 160             | 70                | 8.4                  | 8.4         |
| 150             | 50                | 9.9                  | 9.9         |

**Table 2: COD Characterization**

| Sludge(ml) | Effluent(ml) | CBR (ml) | COD (mg/lit) |
|------------|--------------|----------|--------------|
| 40         | 10           | 13.5     | 240          |
| 30         | 20           | 7.7      | 704          |
| 20         | 30           | 6.9      | 768          |
| 10         | 40           | 6.7      | 784          |
| 50         | 0            | 3.5      | 1040         |

## RESULTS AND DISCUSSION

**Table 3: COD, DO and pH of Treated Effluent**

| Tests     | Initial | Final |
|-----------|---------|-------|
| Ph        | 5       | 6     |
| DO(Mg/L)  | 1.32    | 9.9   |
| COD(Mg/L) | 1040    | 240   |

It can be observed from above results that it was possible to remove 77 percent organic matter and DO level of treated water increased 7.5 times.

## CONCLUSION

Biological treatments are effective for removal of organic matter from the effluent. In the present investigation 800 mg/l of chemical oxygen demand, about 80 percent of initial was treated successfully.

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