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# Treatment of Dairy Industrial Wastewater by Chemical Coagulation

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***Abstract:*— The dairy industry is among the most polluting food industries in volume to its large water consumption. More than 90% of cleaned water is converted into wastewater with demonstrating very high potential risk of environmental pollution. In the present study an attempt has been made to investigate the feasibility of chemical coagulation for the treatment of dairy wastewater by employing two coagulants like Aluminium Sulphate and Calcium Hydroxide. Analysis of pH, COD and TDS are considered as typical selective parameters for the present study. The COD removal of 76.5% and TDS removal of 73% was achieved with Aluminium Sulphate coagulant whereas COD removal of 82% and TDS removal of 79% with Calcium Hydroxide coagulant.**

***Keywords:*----- Dairy wastewater, Chemical treatment, Coagulation Aluminium Sulphate and Calcium Hydroxide.**

## I. INTRODUCTION

The dairy industry involves processing of raw milk into products such as consumer milk, butter, cheese, condensed milk, dried milk and ice creams in various process. The wastewater generated from these process are white in colour and these effluents may cause serious problems in terms of organic load. Most of the wastewater volume generated in the dairy industry results from the cleaning of transport lines and equipment between production cycles, cleaning of tank trucks, washing of milk silos and equipment malfunctions are operational errors. Dairy wastewater has Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and nutrient levels are high ( Khoudir et al.,1997; Longhurst et al.,2001; Garrido et al.,2001 and Hamdani et al.,2001 ). This wastewater can cause environmental damage if discharged without treating. Therefore dairy wastewater treatment is very important from environment and water requirement point of view for dairy industry.

Dairy wastewater are generally treated usually using biological methods such as activated sludge process, aerated lagoons, trickling filters, sequencing batch reaction, UASB reactors etc. On the other hand the chemical methods have been proven to be successful by coagulation, oxidation and flocculation. There are also physicochemical process like adsorption, ion exchange, electro chemical and membrane treatment etc.(Roterau,1969; Moletta and Torrijos,1999 and Hamdani,2002)

The experimental tests carried out in this study lies within scope of decreasing chemical oxygen demand and total dissolved solids which are present in the dairy effluent by using coagulants like Aluminium Sulphate and Calcium Hydroxide. The performance of the coagulants were compared in terms of removal efficiency of parameters of pollution, the dosage of the reagents added to the effluent, the effect of pH and duration of agitation on the coagulation-decantation process were also studied.

## II. MATERIAL AND METHODS

The raw wastewater sample for the present study was collected from Dairy Industry. In the dairy the wastewater generated from receiving stations, bottling plant, cheese plants, butter plants, casein plants, condensed milk and dried milk plant. A grade chemicals and Distilled water are used.

### *2.1 Methodology*

The study was carried to assess the effectiveness of chemical coagulation in the removal of COD and TDS by employing Aluminium Sulphate and Calcium Hydroxide.
This process was carried out in laboratory by using jar test with the following conditions: Fast speed of 120 rev/min for 2 minutes, followed by 30-40 rev/min for 20 minutes and finally decantation for another 60 minutes. Tests were carried out in three phases.

In the first phase effect of dosage on the COD and TDS were studied. In the second phase the effect of pH on the COD and TDS were studied. In the third phase, optimum dosage in the removal of COD and TDS were studied.

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## III. RESULTS AND DISCUSSIONS

The samples which are collected from the dairy industry are analyzed for pH, TDS, COD, TSS, Chlorides, Alkalinity and Phosphates are shown in the table1.

***Table 1.Charactersistics of Dairy Industry Raw Wastewater***

| S.No | Parameters | Values |
|---|---|---|
| 1 | pH | 8.4 |
| 2 | COD | 2150 mg/L |
| 3 | TDS | 1800 mg/L |
| 4 | TSS | 700 mg/L |
| 5 | Chlorides | 860 mg/L |
| 6 | Alkalinity | 1900 mg/L as $CaCo_3$ |
| 7 | Phosphates | 4.9 mg/L |

### *3.1 Coagulation with Aluminium Sulphate:*

The dairy wastewater subjected to coagulation process with Aluminium Sulphate with different doses and varying pH and also optimum dosage was investigate the removal of COD and TDS.

**3.1.1 Effect of dosage:**

The dosage was varied from 0.2 g/L to 1.6g/L and percentage removal of COD and TDS were calculated which are present in the fig.1.

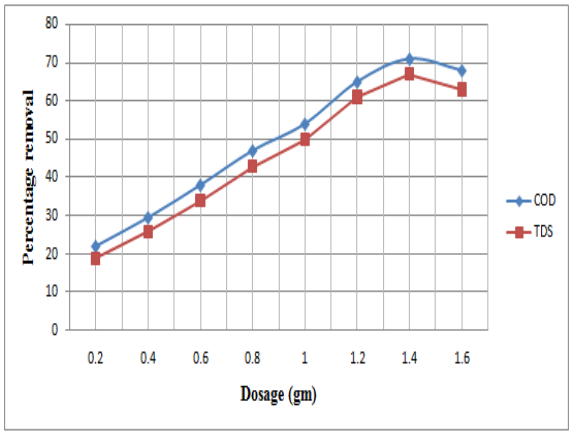


***Fig.1. Effect of Aluminium Sulphate Dosage***

From the fig.1, it was observed that maximum removal of COD (71%) and TDS (67%) was obtained at the dosage of 1.4 g/L.

***3.1.2 Effect of pH:***

The pH was varied from 3 to 10 by keeping the constant dosage of 1.4 g/L as shown in fig.2

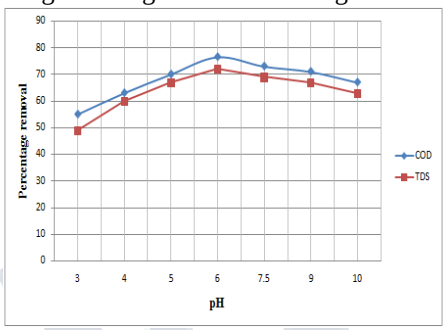


***Fig.2. Influence of pH by Aluminium Sulphate***

From the fig.2, it was observed that maximum removal of COD (76.5%) and TDS (72%) was obtained at pH: 6

***3.1.3 Optimum Dosage:***

The dosage was varied from 0.2 g/L to 1.2g/L by keeping constant pH: 6 and percentage removal of COD and TDS were calculated which are present in the fig.3.

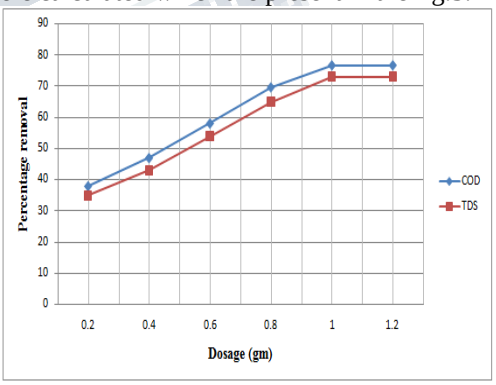


***Fig.3. Effect of Aluminium Sulphate Dosage***

From the fig.3, it was observed that maximum removal of COD (76.5%) and TDS (72%) was obtained at the dosage of 1 g/L.

### *3.2 Coagulation with Calcium Hydroxide*

The dairy wastewater subjected to coagulation process with Calcium Hydroxide at different doses and varying pH and

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also optimum dosage was investigated the removal of COD and TDS.

### *3.2.1 Effect of Dosage:*

The dosage was varied from 0.2 g/L to 1.4g/L and percentage removal of COD and TDS were calculated which are present in the fig.4.

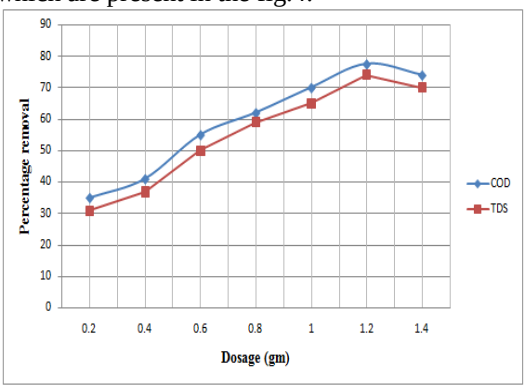


*Fig.4. Effect of Calcium Hydroxide Dosage*

From the fig.4, it was observed that maximum removal of COD (77.5%) and TDS (74%) was obtained at the dosage of 1.2 g/L.

### *3.2.2. Effect of pH:*

The pH was varied from 3 to 10 by keeping the constant dosage of 1.2 g/L as shown in fig.5

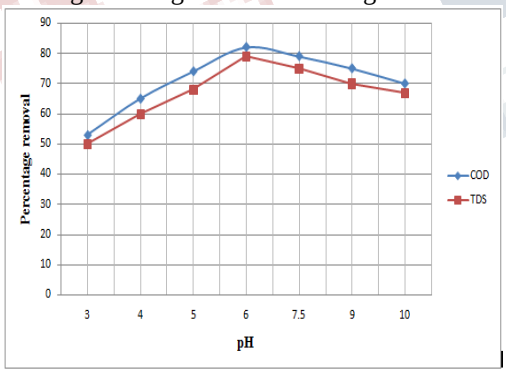


*Fig.5. Influence of pH by Calcium Hydroxide*

From the fig.5, it was observed that maximum removal of COD (82%) and TDS (78%) was obtained at pH: 6.

### *3.2.3 Optimum Dosage:*

The dosage was varied from 0.2 g/L to 1g/L by keeping constant pH: 6 and percentage removal of COD and TDS were calculated which are present in the fig.6.

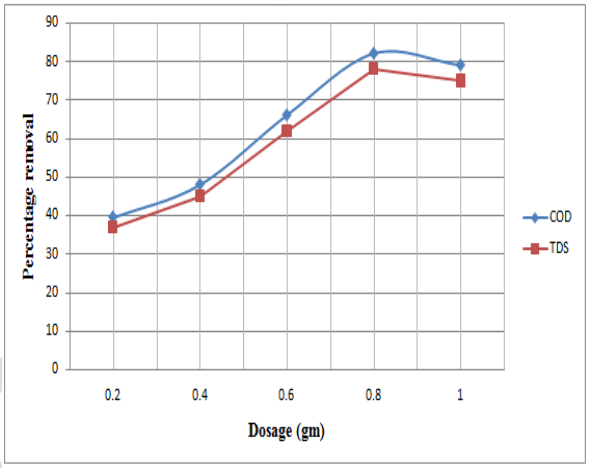


*Fig.6. Effect of Dosage*

From the fig.6, it was observed that maximum removal of COD (82%) and TDS (78%) was obtained at the dosage of 0.8 g/L.

## IV CONCLUSIONS

1. Treatment with aluminium sulphate resulted in COD and TDS removal of 76.5% and 73% at the pH: 6 and the optimum dosage of 1 g/L.
2. Treatment with calcium hydroxide resulted in COD and TDS removal of 82% and 79% at the pH: 6 and the optimum dosage of 0.8 g/L.
3. The maximum removal of COD and TDS was obtained with coagulant Calcium Hydroxide.

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