

Treatment of Dairy Wastewater by Physiochemical Method

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Abstract: Environmental engineering and wastewater treatment are growing concerns of today. With the increase in population, industrialization is a must to meet the growing demand, which leads to environmental problems like air pollution, land pollution and water pollution etc, out of which water pollution is the most serious. Our Present work deals with the Dairy Industry wastewater its characteristics, treatment & disposal. The composit wastewater generated from Dairy plant contains high BOD, COD, Total solids, Dissolved solids, Suspended solids and Oil & Grease. Due to highly biodegradable nature of dairy wastewater it requires urgent attention. The treatment of such wastewater is normally based on the treatment i.e. Activated Sludge Process, Oxidation Ditch, Oxidation pond, Aerated Lagoon. But in presence study we perform physicochemical treatment for the Dairy wastewater treatment. We use chemical such as Alum, Lime, Ferric chloride, Ferrous sulphate for physiochemical treatment and examine their optimum dose by conducting standard Jar Test in our PHE laboratory. Now at optimum dose the treated effluent is analyzed, for different parameters such as pH, COD, BOD, TS, TDS, TSS and Oil & Grease. It was observed that by using Alum dose of 75 mg/l, results in reduction of COD, BOD, TS, TSS and Oil & Grease as 30%, 20%, 11.94%, 62%, 45.78% respectively. In second attempt we added a dose of 10 mg/l of Lime with 50 mg/l Alum dose, results in reduction of BOD, COD, TS, SS and Oil & Grease as 37.5%, 23.5%, 13.7%, 72.2%, 57.3% respectively. By using a dose of 300 mg/l of Ferrous sulphate, result in reduction of BOD, COD, total solids, TS, SS and Oil & grease as 55%, 32%, 31.9%, 88%, 53.8% respectively. Using 300 mg/l of Ferric chloride, result in reduction of BOD, COD, TS, TSS and Oil & Grease as 47.55, 13.5%, 44.3%, 76%, 60.8% respectively. From the above observed values it was found that Ferrous sulphate proved to be the most effective chemical for the removal of COD, BOD, TS, SS and Oil & Grease. These results indicate that coagulation and flocculation process of physicochemical treatment is effective in the treatment of wastewater from Dairy plant.

1. Introduction

Dairy industry is one of the biggest industries in India. A dairy involves processing raw milk in to products such as consumer milk, cheese, butter, milk powder and ice cream, using process such as receiving of milk, pasteurization, homogenization and packing of products. The dairy industry wastewater are primarily generated from the cleaning and washing operation in the milk plant. It is estimated that about 2% of total milk processed is wasted into drain [2]. Dairy wastewater are characterized by high BOD, COD, TS, SS and Oil & Grease. Due to high pollution load of dairy wastewater, the milk processing industries discharging untreated/partially treated wastewater cause serious environmental problem [2]. So there is need of treatment to the effluent before discharging this to the stream or ground or municipal sewer line. Biological process produced lot of order and amount of sludge production is very high, show we use physicochemical treatment for treating Dairy wastewater.

The present study of physicochemical treatment conducted on dairy wastewater of Gwalior Sahakari Dugdha Sangh Maryadit (Banmore). This industry is 20 k.m. away from Gwalior at Morena road. This dairy plant produced consumer milk, butter, ghee, lassi, shrikhand, peda, ice cream etc. from various process such as show in Figure 1. Total production capacity of milk plant is 25, 0000 liters per day. Considering 4 liter of water required per liter of milk, quantity of wastewater become 10, 00000 liters per day.

Source of wastewater form: Equipment cleaning, tanker and cans washing, floor washing, water softening, boiler house, refrigeration plant.

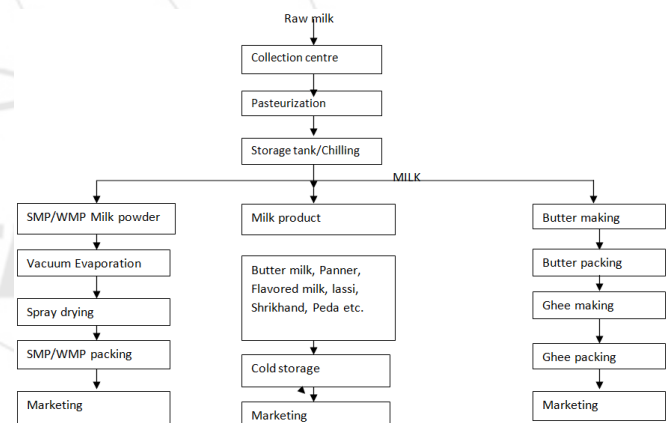


Figure 1: Flow diagram of manufacturing in a Dairy industry

2. Objective of Study

The various objectives of present study are as follows:

1. To study the different process carried out in Dairy plant for the production of various Dairy products.
2. To analyze the characteristics of wastewater generation and its volume from.
3. To study the ETP of Dairy.
4. Treatment of wastewater generated from Dairy plant by various Physio-chemical treatment processes followed in our lab.

3. Materials and Methodology

3.1. Wastewater collection

Wastewater samples were collected from Gwalior Sahakari Dugdha Sangh Maryadit (Banmore) industry

having frequency twice in a month. We have collected 8 samples in conjucetive 4 month from November to February and analyses them in our PHE laboratory, according to lab manual procedure and then treated the wastewater by using various physicochemical processes.

- (a).Instruments used:-pH meter, BOD incubator, BOD bottle's, COD digester and Jar Test Apparatus.
 (b).Chemicals used:-Alum, lime, Ferrous sulphate, Ferric chloride.

3.3. Experimental procedure

We have collected composite wastewater from Dairy plant and applied various physicochemical processes for its treatment.

The characteristics of wastewater generated are as follows:

Table 1

Sr. No.	Parameters	Characteristics of composite wastewater generated (Range)
1.	pH	7.9 - 8.5
2.	COD	720 - 784 (mg/l)
3.	BOD	298 - 340 (mg/l)
4.	Total solids	786 - 1164 (mg/l)
5.	Total dissolved solids	412 - 846 (mg/l)
6.	Total suspended solids	180 - 530 (mg/l)
7.	Oil & grease	120 - 166 (mg/l)

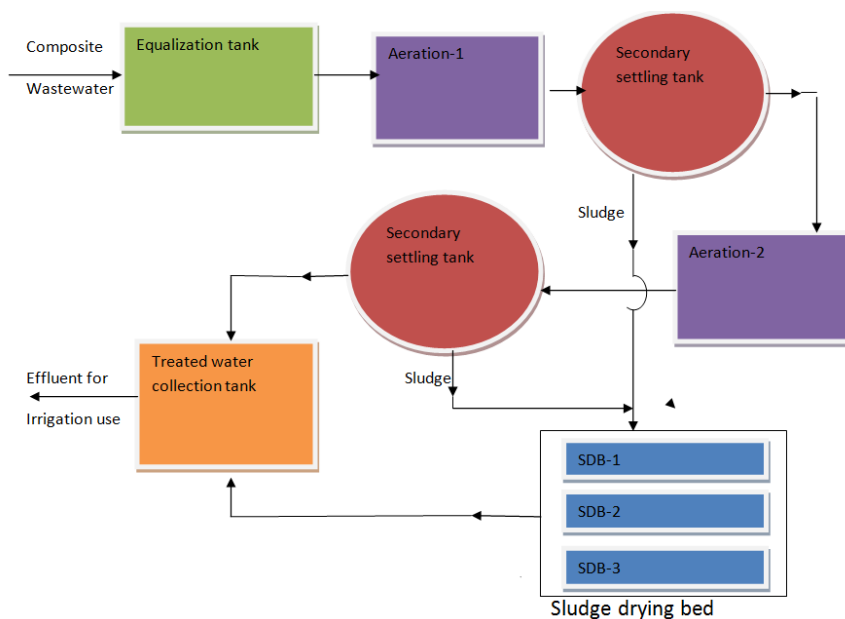


Figure 1: Flow diagram of effluent treatment plant

4. Result and Discussion

The dairy industry show large variation in pH, BOD, COD, total solids and suspended solids and oil & grease, due to high organic loading. Wastewater collected from dairy industry is treated with Alum, Lime, Ferric chloride, Ferrous sulphate individually & in combination. In which Ferrous sulphate being the most effective chemical used to treat Dairy wastewater.

1. Alum dose varied between 25 to 150 mg/l and experiments carried out by using Jar Test apparatus. At a optimum dose of 75 mg/l, COD, BOD, Total solids, Suspended solids and Oil & Grease can be reduced by 30%, 20%, 11.94%, 62%, 45.78% respectively as shown in (Table 3). Alum can be used for initial removal of suspended solids as it is not economical at higher doses. Alum addition with lime results in efficient COD and BOD removal.
2. Optimum Lime dose of 10 mg/l with different doses of Alum is 25, 50, 75, 100, 125 and 150 mg/l, is added sequentially in six beakers and analysis were carried out.

At a optimum dose of Lime 10 mg/l and 50 mg/l Alum, BOD, COD, total solids, suspended solids and oil & grease can be reduced by 37.5%, 23.5%, 13.7%, 72.2%, 57.3% respectively.

3. Dose of Ferrous sulphate varied between 50 mg/l to 300 mg/l and analysis were carried out. At a maximum dose of 300 mg/l of Ferrous sulphate, BOD, COD, total solids, suspended solids and oil & grease can be reduced by 55%, 32%, 31.9%, 88%, 53.8% respectively.
4. In case of Ferric chloride, removal efficiency were much lower than Ferrous sulphate. Dose of Ferric chloride varied between 50 mg/l to 300 mg/l. At maximum dose of 300 mg/l of ferric chloride, BOD, COD, total solids, suspended solids and oil & grease can be reduced by 47.5%, 13.5%, 44.3%, 76%, 60.8% respectively.

This studies carried out indicate that the Dairy processing industry wastewater is amenable to this treatment. Physicochemical treatment is very efficient to reduce higher organic load.

Table 3: %Removal of various parameters by using different Physiochemical treatment

Sr. No.	Chemical used (Dose)	pH		COD			BOD			TS			TSS			Oil & Grease		
		Before treatment	After treatment	Before treatment	After treatment	% removal	Before treatment	After treatment	% removal	Before treatment	After treatment	% removal	Before treatment	After treatment	% removal	Before treatment	After treatment	% removal
1.	Alum (75 mg/l)	8.1	7.8	768	530	30%	340	270	20.5%	1164	1025	11.94%	530	200	62%	166	90	45.7%
2.	Alum+Lime (50 mg/l + 10 mg/l)	8.1	8.2	768	480	37.5%	340	260	23.5%	1164	1004	13.7%	530	145	72%	166	70	57%
3.	Ferrous sulphate (300 mg/l)	7.1	6.7	784	352	55%	295	150	49.6%	1155	786	31.9%	539	62	88.4%	184	72	60%
4.	Ferric chloride (300 mg/l)	7.1	6.6	784	411	47%	295	250	16%	1155	643	44%	539	125	76%	184	85	53%

(*All values are expressed in mg/l except pH)

5. Conclusions

From the above studies it was observed that the dairy industry wastewater is easily amenable to physicochemical treatment. This treatment will help in reducing the organic load. Result obtained shows that some coagulant used individually act efficiently and prove to be cost effective. Ferrous sulphate proved to be most effective coagulant and result in good BOD, COD and SS removals. At optimum dose of 300 mg/l of Ferrous sulphate removal in BOD, COD, total solids, suspended solids removal by 55%, 32%, 31.9%, 88%, 53.8% respectively.

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