

Dairy Waste Water – A Case Study

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Abstract- Environmental Engineering & Pollution control are the growing concerns of today. Rising population technological, economical and industrial revolution and changing life style has lead to various types of environmental problems, water pollution, land pollution, Air pollution, nuclear pollution, sound pollution including spiritual pollution are the aspects of pollution today. Out of which, water pollution is most concerned with civil engineering. Water treatment, supply and waste water treatment of domestics and industrial sources is very important aspect of civil engineering. Present work deals with the industrial waste water treatment. The major cause of water pollution was dairy effluent; Dairy waste water is diluted in milk. It contains BOD, COD, total solids dissolved solids and sometimes PH and oil-grease as highly biodegradable and COD/BOD is less than 1.5.

Index Terms- Dairy waste water, treatment, characteristics, housekeeping etc.

I. INTRODUCTION

Due to highly biodegradable nature of dairy wastewater its treatment requires urgent attention but as such treatment is not a big issue. Biological treatment technologies can readily treat the dairy wastewater. The final effluent can be readily used for irrigation and sludge itself becomes a good fertilizer.

If waste is disposed in water bodies or ground BOD becomes the major concern. It may lead to anaerobic conditions and related problems. The BOD is in a range of 1000 to 2000 mg/L (1) obviously, Biological threatening is required for it. The Biological treatment may be Activated sludge process, Trickling filter, aerated lagoon or oxidation pond. However anaerobic process is also found to be successful. Dairy waste water is an area, already quite exposed.

The present work investigated in "Goverdh Dairy, Muzaffarnagar". The work includes following things.

- Study of various process of Dairying.
- Characterization of composite waste water.
- Characterization of treated effluent and hence performance appraisal of treatment plant.
- Study of treatment plant.
- Study of industry's housekeeping.

We have collected composite samples from the industry, five times in peak durations, suggested by the industry person we analyzed them for BOD, COD, TS, pH, DS, VS, FS, alkalinity, acidity, DO etc. we found that the treatment given by the industry is excellent and housekeeping is also good. The treated effluent is used for irrigation purpose. As a scope

for future work, we suggest for detailed analysis at other parameters, reuse scope and advanced treatment studies.

Objectives of Present Work

- To identify the sources of waste water generation
- To identify the scope waste water minimization by process alteration.
- To decide the type of treatment required by the wastewater.
- To estimate the pollution effects of waste water.
- To examine the suitability of treatment scheme adopted according to the characteristics of waste water.
- To examine the adequacy of size of treatment units as compared to the quantity of waste water.
- To compare the treatment scheme with the IS recommended schemes.
- To determine the efficiency of treatment facility
- To decide the suitable method of disposal of final effluent

Housekeeping Observations

Housekeeping is growing concern now days. Housekeeping ensures good quality of production, cost minimization, waste minimization, and consequently environmental protection and saving on pollution control. Each and every process of the industry has been examined carefully from this aspect. The surroundings and campus are also observed with this view.

Dairy wastewater is an area that has been explored quite adequately by various researchers. Data base is available in the IS codes also. The present work is done with an objective to examine the industry under study, the standards and to further enrich the research database.

Design Verification of Treatment Units

The dairy under study has an intake of around 15000L of milk per day. Considering 4 L of water required per L of milk, quantity of waste water becomes = $4 \times 15000 = 60000$ L/day.

For this quantity of flow, the various units of treatment plant are designed. Their sizes are calculated and are compared with the existing sizes. Thus the design of existing treatment plant is verified.

Pasteurization

Pasteurization is the process of heating liquid for the purpose of destroying viruses and harmful organism. It is different from sterilization because pasteurization only aims to reduce the number of bacteria so they are unlikely to cause disease. Sterilization is not common in food processing because it can affect the flavor.

Milk cans are unloaded at the receiving station and emptied into a receiving station and emptied tank after testing for physical fitness for their freshness. Cans which are turned sour are segregated.

The milk from each lot is weighed and conveyed to the pasteurization and other units. Pasteurization is accomplished the heating either to 61.5 oC for 30 min or 71 oC for 15 second. Milk is then bottled for distribution. It is the basic process carried out on all sorts of milks collected in the dairy and is done invariably before supplying milk directly or using it for any product making. Adjustment of temp is allowed to settle. The whey is then run off. The curd is then subjected to various processes depending on the type of cheese sting made.

Pretreatments

- Equalization
- Neutralization
- Separation/Clarification

Secondary Treatments

- Biological Methods
- Activated sludge process
- Aerobic process
- Oxidation ditch / trick ling filters
- Rotating biological discs
- Anaerobic digestion

II. TREATMENT OF DAIRY WASTE WATER

The average volume of waste water in dairies is currently 1 to 3 L/kg milk. This results in considerable waste water disposal costs. A schematic representation of treatment of dairy wastewater is given in below fig.

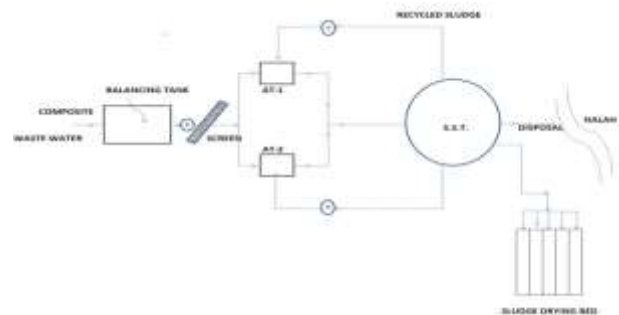


Fig.1 Flow chart for treating the Goverdh Dairy

The various processes held in the dairy are discussed below:

- Butter Making
- Ghee Making
- Cheese Making
- Chenna Making
- Ice Cream
- Paneer Making
- Khoa Making
- Lassi Making
- Dahi Making
- Cream

Effluent Treatment Plant

The wastewater is collected from different sources and is collecting joining in a balancing tank. From here it is periodically pumped to the other unit of E.T.P It is a single pump of 3.0 kw Capacity Balancing tank is a rectangular tank of size (5x5x)m. The balancing tank is an important part of the dairy waste water treatment plant. Because dairy effluents fluctuate quality wise and quantity wise too much. As dairy wastewater is highly biodegradable, the balancing tank must is an aerated balancing tank so that anaerobic conditions are avoided. But here the balancing tank is not provided with aerators. The next unit after balancing tank is screens though dairy waste water ordinary does not contain anything screen able. Screen are generally provided in treatment plants so that if anything like polythene, paper piece etc. comes by accident' sore litter cones, it may remove them and may gone further units. Next the screen there must be skimming tanks to remove. Oil and grease from waste water. But no skinning tanker is provided in this treatment plants. These will definitely increase the load on subsequent units. It is a significant discrepancy of treatment plant. Next to it the unit is aeration tank.

Methodology Adopted

The methodology adopted for the E. T. P. monitoring was like this -) We discussed with the industry personals and indentified the peak timings of discharge as loam to 12 pm., 3 to 4 pm. 6 to 7 pm and 12am (in night) So we collected samples on first 3 peaks and nixed then to get composites

samples. The samples were collected from balancing tank with the help of a cane and rope and were spared in a large cane. They were taken to the laboratory and were analyzed for various pollution parameters. Simultaneously we measured D.O. content of aeration tank by taking samples and fixing the oxygen at the site itself by chemicals. We collected samples once each time from aeration tanks for the analysis of M.L.S.S. once in a day the heated effluent was collected for analysis of pollution parameters and D.O. also. For that D.O. sample was separately collected in a bottle and was fixed at the site itself pH was measured in the laboratory.

Table1: Characteristics of composites waste water

Sr.no.	Characteristics	Unit	Value
1.	BOD ₅ @ 20 °C	mg/l	530
2.	COD	mg/l	790
3.	pH	--	6.5
4.	Total solid	mg/l	2532
5.	Total dissolved solid	mg/l	1803
6.	Total suspended solid	mg/l	729
7.	Total fixed solid	mg/l	63g
8.	Total volatile solid	mg/l	1702
9.	Dissolved fixed solid	mg/l	1562
10.	Alkalinity	mg/l	213

Table2: Characteristics of treated effluent

Sr.no.	Characteristics	Unit	Value
1.	BOD ₅ @ 20 °C	mg/l	10
2.	COD	mg/l	260
3.	pH	--	7.2
4.	Total solid	mg/l	1103
5.	Total dissolved solid	mg/l	1036
6.	Total suspended solid	mg/l	30
7.	Total fixed solid	mg/l	1030
8.	Total volatile solid	mg/l	96
9.	Alkalinity	mg/l	270

Monitoring of Aeration Tank:

Interpretation:-From the above results. It can be interpretable that:

- BOD is less than what is given in 1.5 code 8673
- BOD/COD ratio is $530/790 = 0.67$. So wastes highly biodegradable
- pH is slightly acidic
- Alkalinity is good.
- D.O. available in tank as good
- M.L.S.S.
- Treatment leads to every clear effluence. It can be disposal safety.

Table3: Characteristics of composite waste water

S.No.	Characteristics	Unit	Value
1.	BOD ₅ @ 20 °C	mg/l	585
2.	COD	mg/l	810
3.	pH	--	6.7
4.	Total solid	mg/l	2608
5.	Total dissolved solid	mg/l	1912
6.	Total suspended solid	mg/l	696
7.	Total fixed solid	mg/l	818
8.	Total volatile solid	mg/l	1790
9.	Alkalinity	mg/l	228

Table4: Characteristics of treated effluent

S.No.	Characteristics	Unit	Value
1.	BOD ₅ @ 20 °C	mg/l	18
2.	COD	mg/l	243
3.	pH	--	7.0
4.	Total solid	mg/l	1218
5.	Total dissolved Solid	mg/l	1170
6.	Total Suspended Solid	mg/l	48
7.	Total fixed solid	mg/l	1120
8.	Total volatile solid	mg/l	98
9.	Alkalinity	mg/l	250

Characteristics of Aeration Tank

M.L.S.S. 3608 mg/l

D.O. 2.0 mg/l

Interpretation:- From the above results. It can be interpretable that:

- BOD is less than what is given in LS. Code 8673
- BOD/COD ratio is $585/810 = 0.72$. So waste highly biodegradable
- pH is slightly acidic
- Alkalinity is good.
- D.O. available in aeration tank as good.
- M.L.S.S.

Treatment leads to every clear effluent. It can be disposal safety. After designing of all treatment units. following comparison can be made.

Table5: Comparison Table of Design verification of treatment Unit

S.No.	Type of Unit	Design size of Unit (m)	Existing size of unit (m)
1.	Screens	5 x 1 x 1.4	6 x 1 x 1.4 m
2.	Skimming tank	5x5x3	7 x 7 x 4 m
3.	Aeration tank	21x15x8	12 x 12 x 8 m
4.	Secondary sedimentation tank	63 m diameter x 2 m width	60 m diameter x 2 m width
5.	Sludge drying bed	8 x 10 x 1.2	5 x 2 x 1.5 m

III. CONCLUSION

- Dairy industry is a very important and lastly growing food processing industry of world.
- Dairy waste water is simply diluted milk.
- Dairy waste water is highly biodegradable and aerobic biological treatment is most feasible.
- Govardh Dairy- is good in housekeeping, but they require more quantity of water than average.
- The composite waste water is poor in BOD (Very near to 50014/1) which can be directly disposed on land, without treatment. The value of BOD is much less than that is reported by IS code.
- Industry is having a well equipped laboratory for monitoring the E.T.P.

House Keeping:- House keeping refers to the cleanliness and maintenance aspects of the industry. The Gauvardh dairy having very good housekeeping. The dairy has obtained ISO 9001- 2008 certification that includes housekeeping aspect also.

The dairy has maintained a very good dairy. Greenery all around using its own waste water. This greenery not only gives a good look to the industry but also prevents the dust which is a requirement of dairy industry. In Govardh dairy nowhere foul smell comes. All floors are washed after every shift. Pipe lines and containers are cleaned regularly. Now here in industry can fly or insects be observed. They controlled by sprinkling insecticides in surroundings. The solid waste is collected and removed in an organized way. The fly- insects are controlled by UV lamps also. All workers used specially designed caps to control fall of hair. They wear uniforms of their cadre and keep it clean. Everywhere hard washing facility along with Cl₂ water is available. Workers clean their hands before entering into specified units. In overall, the housekeeping of Govardh dairy is appreciable.

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