REVIEW PAPER ON TREATMENT OF WASTE WATER IN DAIRY INDUSTRY

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Abstract: With the increase in demand for milk and milk products, many dairies of different sizes have come up in different places. These dairies collect the milk from the producers, and then either simply bottle it for marketing, or produce different milk foods according to their capacities. Large quantity of waste water originates due to different operations. The organic substances in the wastes comes either in the form in which they were present in milk, or in degraded form due to their processing's. As such, the dairy wastes, through biodegradable, are very strong in nature.

Keywords **- Dairy waste water, treatment, effluent treatment plant.**

1. INTRODUCTION-

Wastewater is one of major environmental concerns of milk processing industry. In terms of volume, dairy processing plants discharge mainly wastewater produced during washing and cleaning processes. The wastewater contains 3-4% processed milk, on average.

Dairy wastewater contains easily biodegradable organic substances. Due to rapid fermentation, resulting in a marked pH decrease (to pH=4.5) and promoting rapid oxygen consumption, the wastewater has to be pre-treated before it is sent to drain. Due to the fact that dairy processing wastewater has got much higher values of pollution indicators, compared with domestic or municipal wastewater, it is necessary to pre-treat the wastewater before it is discharged to sewers and a sewage processing plant.

The wastewater is produced at various stages and during various processes of the milk processing cycle. Problems associated with pre- treatment of dairy industry wastewater arise from its specificity (it contains e.g. dissolved and crystallized fat, carbohydrates (lactose), both colloidal and clotted protein as well as cleaning- related substances). In addition to the proteins, carbohydrates and fats, there is a high concentration of organic nitrogen and the following ions: NH_4^+, NO_2^- and NO_3^- . Also, organic and inorganic phosphorus is found and the following elements are detected: Na, K, Ca, Mg, Fe, Co, Ni and Mn.

Dairy wastes are made up, for the most part of various dilutions of whole milk, separated milk, butter milk, and whey from accidental or intentional spills, drippings allowed to escape into waste through inefficient design and operation of process equipment, washes containing alkaline or other chemical used to remove milk and milk products as well as partially caramelized material from cans, bottles, tanks, vats, utensils, pipes, pumps, hot wells, evaporating coils, churns, and floors and process washes of butter, cheese , casein and other products.

Dairy wastes are largely neutral or slightly alkaline, but have a tendency to become acid quite rapidly, because of the fermentation of milk sugar to lactic acid. Lactose in milk wastes may be converted to lactic acid when streams become devoid of oxygen, and the resulting lowered pH may cause precipitation of casein.

Cheese plant waste is decidedly acid, because of presence of whey. Milk wastes contain very little suspended material (except curd found in cheese waste) and their pollution effects are almost entirely due to oxygen demand which they impose on receiving stream. Heavy black sludge and strong butyric acid odors, caused by decomposing casein, characterize milk waste pollution.

2. MATERIALS AND METHODS-

The review study was carried out by visiting various dairy plants at Rajasthan as well as Gujarat. The aim of the study is to provide a basic knowledge about dairy its waste water and its treatment.

We had visited dairy units in Rajasthan and Gujarat regularly to understand dairy products and dairy discharge more deeply.

Table 1 Average composition of milk, milk by products, and cheese waste (ppm)

Characteristics	Whole milk	Skim milk	Butter milk	Whey	Process waste	Separated whey
Total solids	125000	82300	77500	72000	4516	54772
Organic solid	117000	74500	68800	64000	2698	49612
Fat	36000	1000	5000	4000	-	-
Soluble solids	-	-	-	-	3956	54656
Suspended solids	-	-	-	-	560	116

3. TREATMENT OF DAIRY WASTE-

As evident from low COD: BOD ratio, the dairy wastes can be treated efficiently by biological processes. Moreover, these wastes contain sufficient nutrients for bacterial growth. But for economical reasons, attempt should be made to reduce volume and strength of waste.

Milk plant waste are generally high in dissolved organic matter, contains about 1000ppm BOD, and are nearly neutral in pH. Since these wastes are mainly composed of soluble organic matter, they tend, if stored, to ferment and become anaerobic and odorous. Aerobic processes are most suitable, but the final selection of treatment method hinges on the location and size of the plant

The conventional methods generally used which are most effective are:

1. Activated Sludge Process
2. Trickling Filtration
3. Anaerobic Digestion (UASB)

Activated Sludge Process – The activated sludge process has proved a successful method for complete treatment of milk wastes. This system employs aeration to cause the accumulation of an adapted sludge. The bacterial mass in active sludge, when supplied with sufficient air oxidizes the dissolved organic solids in waste. Excess sludge is settled out and subsequently returned to aeration units. There is some indication that the treatment can be carried out without wasting any sludge, although this requires an aeration period sufficient to burn up most of excess sludge. A properly designed plant which provide ample air for handling raw waste plus returned sludge are not easily upset, nor is control procedure difficult.

Trickling Filtration - High rate trickling filters can be employed very effectively for a complete treatment of dairy waste. But these conventional methods involve much maintenance, skilled personnel, and special type of equipments. Two stage filter yield greater than 90 percent BOD reduction, while single stage filters yield about 75-80 percent BOD reduction.

Anaerobic Digestion (UASB) – It is the best method for complete method of dairy waste water. Homogenized effluent from equalization tanks is pumped to UASB reactor bottom and gets distributed uniformly through the inlet distribution system. The waste water passes upwards through the dense anaerobic sludge bed. Organic matter gets rapidly utilized by biomass and converted to methane rich biogas. Upward circulation of water and biogas purging from the bottom of the reactor keep the biomass in suspension and break any scum formation. The three-phase separator in UASB tank allows effective degasification to occur. The dense, granular sludge particles, devoid of attached gas bubbles, sink back to the bottom establishing are turn downwards circulation. The treated effluent flows into collection channels at the top of the settlers for discharge and transferred for further treatment either aeration tank or any other secondary treatment. BOD and COD removal is around 85-90 %.

4. RESULTS AND DISCUSSION-

Most of the milk dairies in Gujarat have their own ETP (Effluent Treatment Plant) and mostly of them have UASB reactor followed by Aeration Tank for both anaerobic as well as aerobic treatment further having RO for ZLD (Zero Liquid Discharge) , but in Rajasthan many small dairies are yet to have their own ETP . Till now they discharge their water into drains although most of the big dairies have their own ETP but they are not operating it properly. Some are under good observation and are producing satisfactory result as per discharge norms of local board.

As per our observation we found that UASB is the best technology for treatment of dairy waste. As by product of UASB is Biogas which can be used as a fuel in dairy itself only.

5. CONCLUSION-

The main objective of the paper was to acquire a better knowledge of dairy industry and treatment of dairy waste water and further use of treated waste water.

We noticed that the main parameters of the waste water were pH, BOD, COD, Oil & Grease, TSS, Hardness, and TDS etc. And in most of the industries in Gujarat and Rajasthan the removal was 80 to 90 % of all parameters except TDS.

The industries having treatment up to tertiary i.e. filtration use their treated waste water for horticulture, Irrigation, floor washing, bathroom flushing and discharge their some water to local common treatment plant.

The industry having RO reuse their water in industry itself and some of the industries have achieved 100 % ZLD treatment.

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