

CHARACTERISTICS OF DAIRY AND DISTILLERY INDUSTRIAL WASTEWATER

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ABSTRACT: This study focuses on the characteristics of the Dairy and Distillery Industrial wastewater. The characteristic of wastewaters shows high biochemical oxygen demand (BOD). Dairy and Distillery wastewater had BOD values 11787mg/L and 49975mg/L respectively. Both wastewater had higher Chemical oxygen demand (COD) 16296mg/L (Dairy wastewater) and 120000mg/L(Distillery wastewater). Solids, Nitrate, Sulphate, Chloride, Alkalinity concentration contents also higher. Both wastewater had higher strength such wastewaters if discharged without proper treatment severely pollute receiving water bodies and creates problem in ecosystem.

Key words: Distillery; Dairy; Effluent, Effective treatment; Strength; BOD, COD.

I INTRODUCTION

In whole world cane molasses base distilleries are included under one of the polluting Industries in concern to water pollution. After fermentation remains waste from bottom of distillation columns termed as silage. This highly aqueous residue containing organic soluble is considered a troublesome and potentially polluting waste due to its extremely high BOD (20,000–50,000 mg/L) and COD (40,000–100,000 mg/L) values, apart from low pH. India is the second largest producer of ethanol in Asia. Alcohol distilleries are rated as one of the 17 most polluting industries. Production of ethyl alcohol in distilleries based on cane sugar molasses. The world's total production of alcohol from cane molasses is more than 13 million m³/annum. The 295 distilleries in India produce 2.7 billion liters of alcohol and generating 40 billion liters of wastewater annually. The typical Odour emanating from distilleries is a major nuisance. The Colour of the spent wash interferes with its oxygenation and self-purification. The treatment of distillery wastes is a priority area for Environmental sustenance and its quality. Due to the large volumes of effluents and presence of certain recalcitrant compounds the treatment of this stream is rather challenging by conventional methods.

Dairy Industries is one of the biggest food Industries in India and ranks first for producing milk. According to the Ministry of Agriculture, Government of India, the average rate of milk production in India is 3.56% annually in the period from 2001–2007. The Dairy Industry in India has been reported to generate 6-10 litres of wastewater per litre of the milk processed and generates between 3.74 and 11.22 million m³ of wastewater per year. The requirement for milk and milk products is growing in steady state, making a significant impact on the Indian agriculture domain. The Dairy Industries require large quantity of water for the purpose of washing of cans, machinery and floor, the liquid waste in a Dairy originates from manufacturing process, utilities and service section. So there is every need to reuse the waste water generated with proper and efficient treatment methods.

1.Sources of Dairy Wastewater

Dairy industries are involved in the manufacturing of various types of milk products such as fluid milk, butter, cheese, yogurt, condensed milk, flavored milk, milk powder, ice cream, etc. Typical by-products obtained include buttermilk, whey, and their derivatives. A chain of operations involving receiving and storing of raw materials, processing of raw materials into finished products, packaging and storing of finished products, and a group of other ancillary operations (e.g., heat transfer and cleaning) are examples of some of the great variety of operations performed in the dairy industries. The initial operations such as homogenization, standardization, clarification, separation, and pasteurization are common to most plants and products. Clarification (removal of suspended matter) and separation (removal of cream form Milk standardization to desired butterfat content), generally are accomplished by specially designed large centrifuges. Drying, condensing, etc. are also used in dairy industries for the production of various products.

A general process flow diagram for dairy processing is shown in Figure 1 However this diagram summarizes the major steps in the production of dairy products.

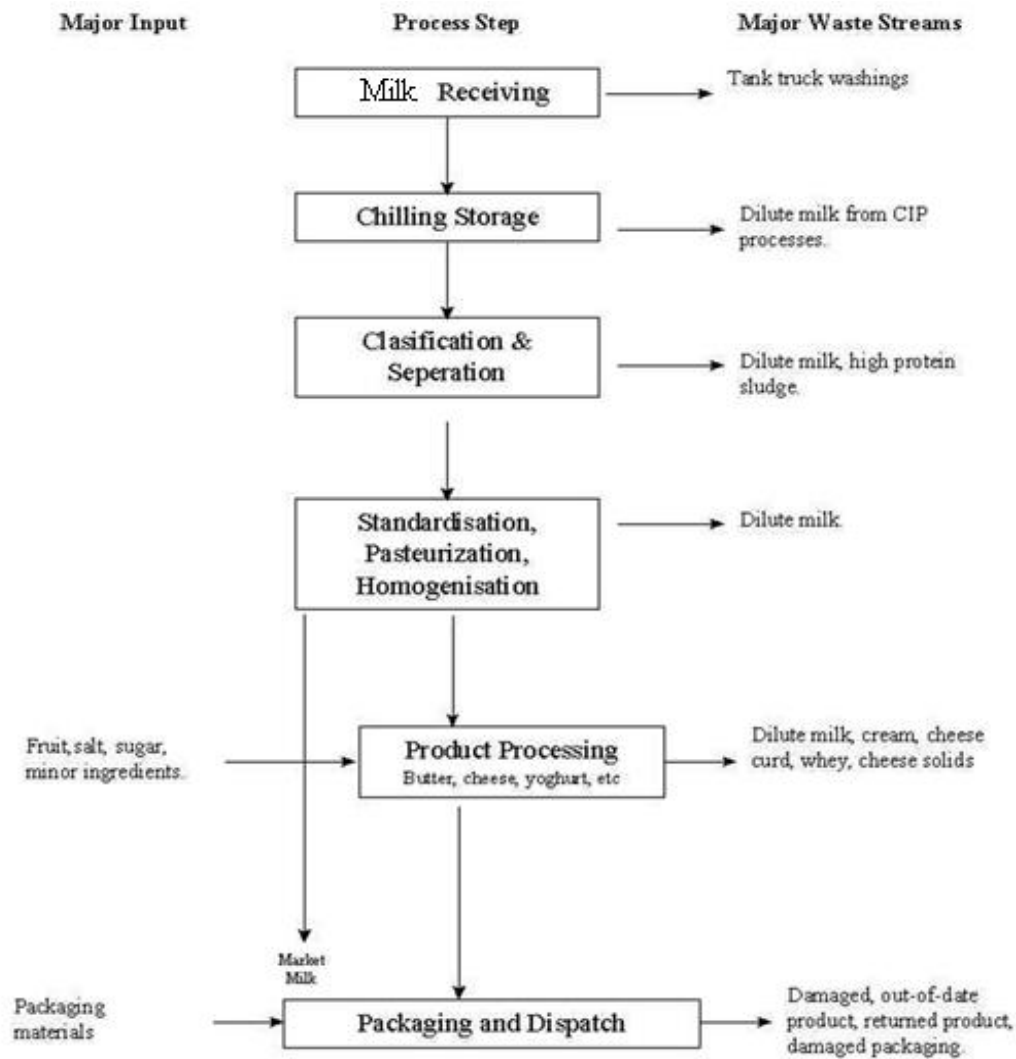


Figure 1: General Process Flow Diagram for Dairy Processing Operations

Waste generating processes of major significance include:

- Washing, cleaning and sanitizing of pipelines (metals), pumps, processing equipment, tanks and trucks and filling machines.
- Start-up, product change over and shut down of pasteurizers.
- Breaking down of equipment and breaking of packages resulting in spilling during filling operations.
- Lubrication of cases, stackers and conveyors.

2.0 DISTILLERY INDUSTRY

Sources of Distillery Wastewater classified into two categories:

Process waste streams: Spent wash from the analyzer column, Fermented sludge, Spent lees from the rectifier.

Non-process waste streams: Cooling water, Waste wash water, Boiler blow down, Bottling plant wash wastewater, other wastes.

A general process flow diagram for distillery processing is shown in Figure 2. However this diagram summarizes the major steps in the production of most distillery products.

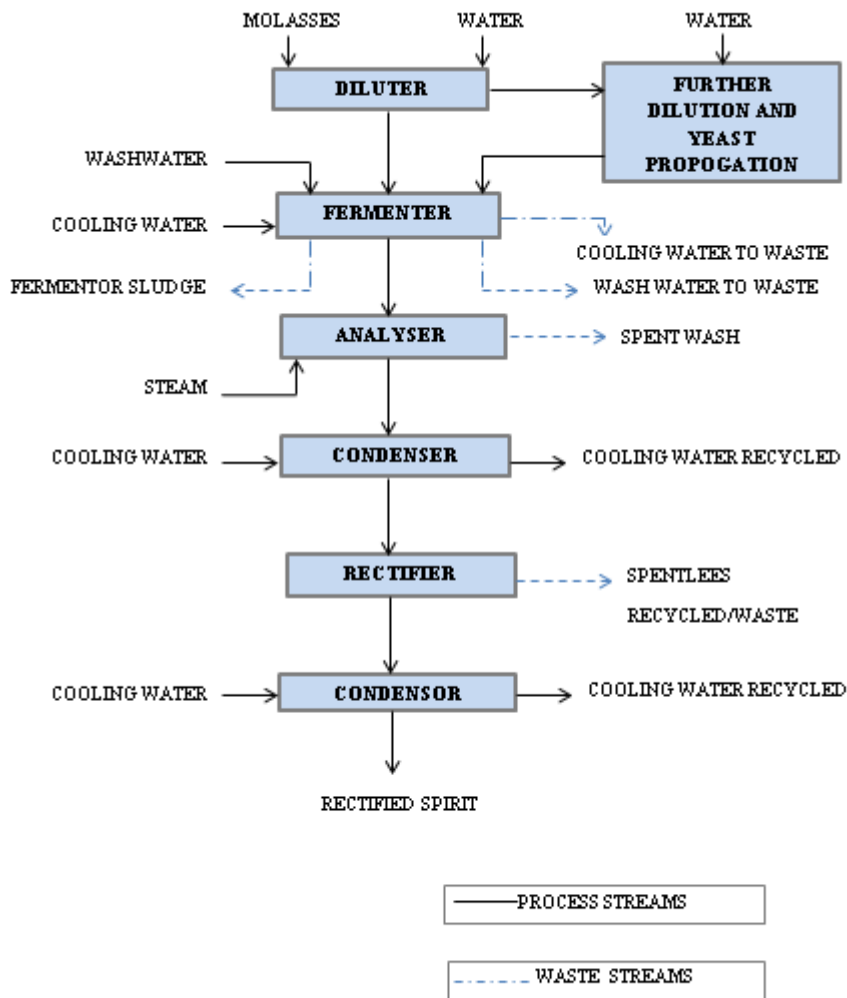


Figure 2: General Process Flow Diagram for Distillery Processing Operations

II. MATERIALS AND METHODOLOGY

The study was conducted under ambient environmental conditions. Grab sampling method was used while sampling. Characteristics were tested as per methods prescribed by central pollution control board (CPCB) for the examination of water and wastewater (21st edition 2012). The characteristics of the Dairy and Distillery industrial wastewater such as Color, Odor, BOD₅, COD, pH, Nitrate, Total Solids, Dissolved Solids, Suspended Solids, Alkalinity, Chloride, Sulphate, had been analyzed. The Characteristics of both the wastewaters are conducted at ambient temperature varying from 27^oC -29^oC the results obtained during the study are presented in table 1.

III. RESULTS AND DISCUSSION

Dairy, distillery wastewater had white and dark brown color respectively so while discharging treatment required removing color. Both wastewater characterized higher BOD₅ 11787mg/L (Dairy wastewater), 49975 mg/L (Distillery wastewater). COD of dairy, distillery wastewater is 16296 mg/L and 120000 mg/L. pH value of dairy wastewater is 8.1 indicates Alkaline in nature and pH value of distillery wastewater is 4.5 indicates acidic in nature . Nitrate of dairy and distillery 84 mg/L and 2400 mg/L respectively. Total Solids concentration of both waste is high 2080 mg/L (dairy) and 64909 mg/L (distillery). Alkalinity of dairy, distillery is 1440 mg/L and 10400 mg/L respectively. Chloride 295mg/L of dairy and 2760 of distillery and Sulphate 90 mg/L of dairy and 1630 mg/L of distillery. BOD₅/COD ratio of dairy wastewater is 0.72 and distillery waste had BOD₅/COD ratio 0.41 it indicates this wastewater cannot be treated biologically.

Table 1: Characteristics of Dairy and Distillery industrial wastewater.

Sl. No.	Parameter	Characteristics	
		Dairy	Distillery
1.	Color	White	Dark Brown
2.	Odor	putrid milk Odor	Burnt sugar odor
3.	BOD ₅ mg/L	11787	49975
4.	COD mg/L	16296	120,000
5.	pH value	8.1	4.5
6.	Nitrate Nitrogen(NO ₃ -Nmg/L	84	2,400
7.	Total Solids mg/L	2080	64909
8.	Dissolved Solids mg/L	1440	48890
9.	Suspended Solids mg/L	642	16019
10.	Alkalinity as CaCO ₃ mg/L	1440	10400
11.	Chloride as Cl mg/L	295	2760
12.	Sulphate as SO ₄ mg/L	90	1630
13.	BOD ₅ /COD	0.72	0.41

The Environment Protection Rules 1986 effluent standards for discharge of wastewater to inland surface water and marine coastal areas as shown in table 2.

Table 2: The Environment Protection Rules 1986 General standards for discharge of environmental pollutants: effluents

SL.NO.	parameter	STANDARDS	
		Inland surface water	Marine coastal areas
1	pH	5.5-9	5.5-9
2	Suspended solids mg/L	100	100
3	Biochemical oxygen demand (mg/L 3days 27 ⁰ c)	30	100
4	Chemical oxygen demand mg/L	250	250
5	Nitrate nitrogen mg/L	10	20

IV.CONCLUSION

From the characteristics studies it is concluded that wastewater discharged from Dairy Industry Had white color and distillery industry had dark brown so it cannot be discharged without any treatment. Both wastewaters had higher values of COD, BOD and Total Suspended Solids indicates strong wastewater. Higher quantity of Nitrate found in wastewater. Dairy industrial wastewater is alkaline in nature and distillery wastewater is highly acidic in nature. Both the wastewaters had high concentration of Alkalinity, Chloride and Sulphate contents. Distillery wastewater cannot be treated biologically compared to dairy wastewater as BOD/COD ratio is less than 0.6. These kind of wastewater cannot be discharged to natural water bodies without suitable treatment.

V.ACKNOWLEDGMENT

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