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Water and Wastewater Auditing for KMF, Dharwad

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***Abstract*-This study was conducted at the Karnataka Co-operative milk producers federation limited (KMF), Dharwad. The Dharwad Milk Union is Co-operative society among 13 establishments, under KMF. It is located in the spacious 25 acres of land in Lakamanahalli Industrial area, adjacent to the National Highway – 4 in between the twin cities of Hubli and Dharwad.**

DMU has 115 functional Milk producers co-operative societies in Dharwad, Gadag, Haveri and Uttara Karnataka District. The production capacity of DMU is 2.2 lakh liters per day and also has a capacity to produce 12 tons of milk powder, 8 tons of butter, 6 tons ghee, and 600 kg of curds.

The DMU is collecting 70 thousand liters of milk per day from its societies and sells 60 thousand liters of milk per day and the remaining milk is used for production of milk products such as curds, skimmed milk powder, butter, ghee, khoa, pedha, buttermilk, lassi and Paneer and the source of water supply to this dairy is from Malaprabha river.

As, Auditing conducted in this factory the water and wastewater characteristics and flow rate of wastewater were analysed separately for each section in dairy to find out the wastewater reusing opportunities. The overall water consumption from this dairy was found to be 190,539 liters/day. At present the factory is facing the problem in proper management and usage of water. After conducting water and wastewater audit, the cleaner production was identified and methods were proposed to save water and wastewater reuse options were also recommended.

Keywords—Water and wastewater characteristics, KMF, Dharwad Milk Union, auditing, flow rate.

I. INTRODUCTION

Milk is a nutritive beverage obtained from various animals and consumed by humans. Most of the milk is obtained from the dairy cows, although milk from goats, water buffalo, and reindeer is also used in various parts of the world. In many industrialized countries, raw cow's milk is processed before it is being consumed. During processing the fat content of the milk is adjusted, various vitamins are added and potentially harmful bacteria are killed. In addition to being consumed as beverage, milk is also used to make butter, cream, yogurt, cheese, and a variety of other products.

The use of milk as a beverage probably began with the domestication of animals. Goats and sheep were domesticated in the area now as Iran and Afghanistan in about 9000 BC and by about 7000 BC cattle were being herded in what is now Turkey and parts of Africa. The method for making cheese from milk was known to the ancient Greek and Romans and the use of milk and milk products spread throughout Europe in the following centuries [1,2]. The main objectives of the dairies are collection, transportation, processing, pasteurizing, bottling and sacheting of milk. This milk will then be sold to consumers through the distribution network. In view of importance of milk and its products and necessity of supplying hygienic milk, it becomes necessary to check and audit milk producing units in a dairy industry.

II. MATERIALS AND METHOD

A. Genral study programe

This section presents the methodology used in the study.

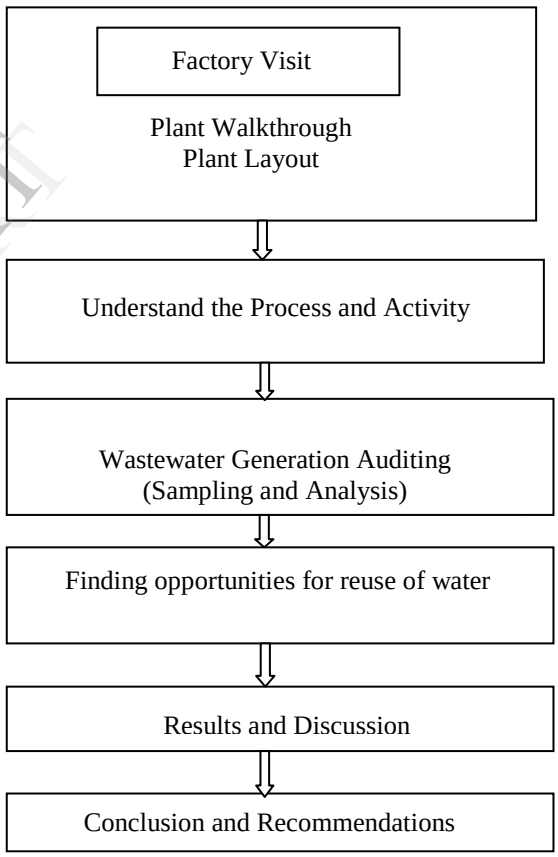


Fig.1: General study of auditing in KMF milk factory, Dharwad

B. In plant monitaring

First step of audit in the factory was identification process. Plant walkthrough was used for observations and understanding the production process, raw milk consumption, water consumption, production rate, and wastewater sources. Plant layout and process diagrams were prepared for auditing program.

C. Mass balance

Material balance was carried out for each unit process. Inputs (raw water, water supply) and outputs (wastewater) were recorded by stopwatch method and recorded information of factory to determine efficiency of it. Input and output materials were record in terms of mass per time.

D. Sampling techniques and preservation

Sampling is one of the most important and foremost steps in collection of representative water and wastewater sample from the industry. The reliability of laboratory analysis and tests depends upon the method of sampling. Moreover, the integrity of the sample must be maintained from the time of collection to the time of analysis. All samples of water and wastewater should be properly labeled and should be accompanied by complete and accurate data of the sample. The data should include date and time of collection, type of source of the sample and temperature of water/wastewater at the time of collection. When samples are being collected from the same sampling point for different analysis, it is essential that the sample for temperature examination be taken first. A factor involved in the proper selection of sampling site depends on the objective of the study. The quantity of sample to be collected varies with the extent of laboratory analysis to be performed. A sample volume between two and three liters is normally sufficient for a fair complete analysis. The total number of samples will depend upon the objectives of the monitoring programmer.

E. Sampling

In this study, the samples were collected in clean polyethylene containers fitted with screw caps rinsed with distilled water, transported to the laboratory and preserved accordingly as prescribed in the standard methods. For the evaluation of characteristics of water and wastewater from different unit operation in the dairy industry grab samples were collected at 8 a.m., 12 noon and 4 p.m from different unit operation in the dairy industry. Samples were analyzed for the parameters such as pH, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Temperature, Oil and Grease.

F. Wastewater sampling

In production process of the dairy factory, wastewater samples were collected raw water, can washing, curd section, milk separation section, Paneer section, combined wastewater to effluent treatment plant and treated effluent.

G. Wastewater characteristic

The wastewater samples taken from each unit operation were analyzed at site for parameters such as temperature and the flow measurement. Other parameters such as BOD, COD, DO, pH, oil and grease, TDS, TSS were analysed.

H. Wastewater flow measurement

A flow rate of wastewater from production process of the dairy factory was measured by bucket and stopwatch method, this method was adopted as there were no measuring devices such as notches and weirs in the factory.

I. Wastewater flow measurement points

The locations of wastewater generated throughout the industry was identified, and the wastewater measurement points were at milk receiving section, curd section, milk separation section, Paneer section, lassi and butter milk section, can washing/ can conveyor washing section, packing area, IBT (Ice Bank Tank) section, condenser section, boiler section, effluent treatment plant.

III. RESULT AND DISCUSSION

A. Auditing sections of the dairy

Wastewater auditing for KMF Dharwad was carried out in following sections:

1. Milk Receiving section
2. Curd section
3. Milk separation section
4. Paneer section
5. Lassi and butter milk section
6. Can washing / Can conveyor washing section
7. Packing area
8. IBT (Ice Bank Tank) section
9. Condenser section
10. Boiler section
11. Effluent treatment plant.

B. Auditing results

The wastewater auditing in all different sections of the dairy was performed. The flow rate was measured by stopwatch and bucket method, this method was adopted as there was no flow measuring device used in the industry. Auditing was carried out repeatedly to get the average flow rate.

Table1 furnishes the details of wastewater generated at different sections of KMF, Dharwad. Fig 5.6 illustrates the quantity of wastewater at all sections.

Table 1 Wastewater generation at different sections

Sl. No.	Section	Wastewater (liters/day)
1	Milk receiving section	11,359
2	Curd section	5,275
3	Milk separation section	1,9195
4	Packing section	1,741
5	Paneer section	6,927
6	Can washing section	2,603
7	Boiler section	1,44,000
8	Condenser section	4000-5000

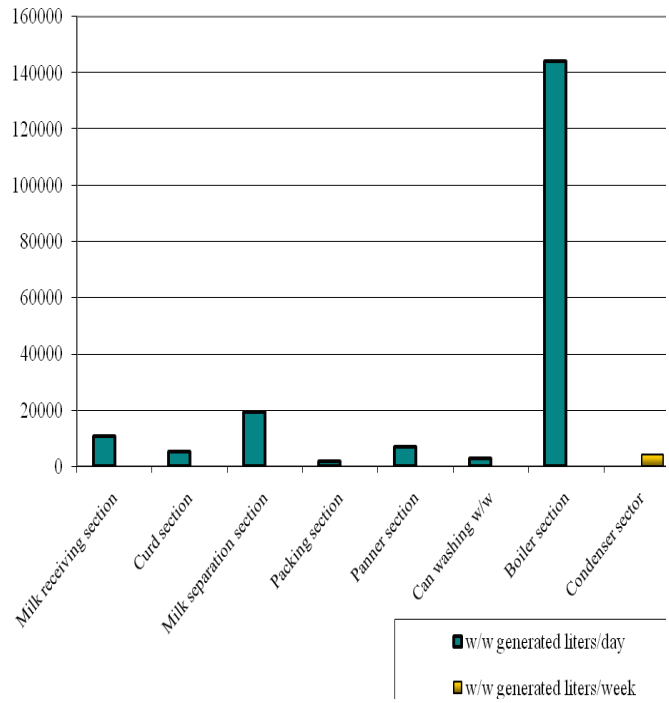
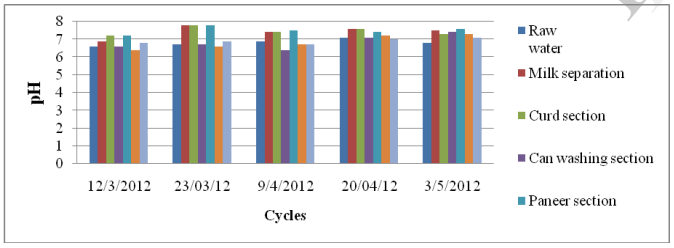
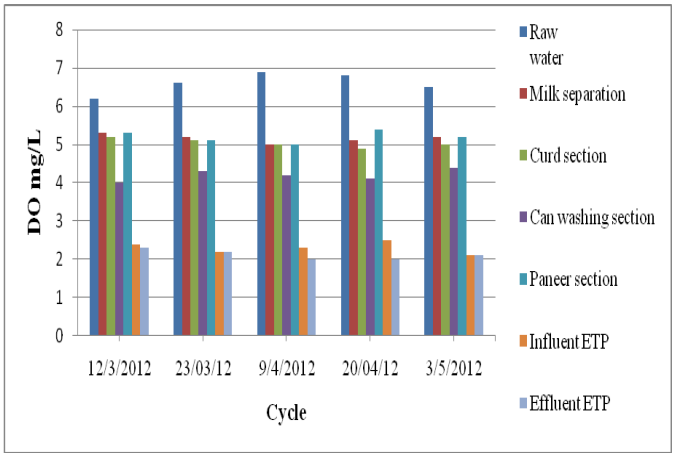


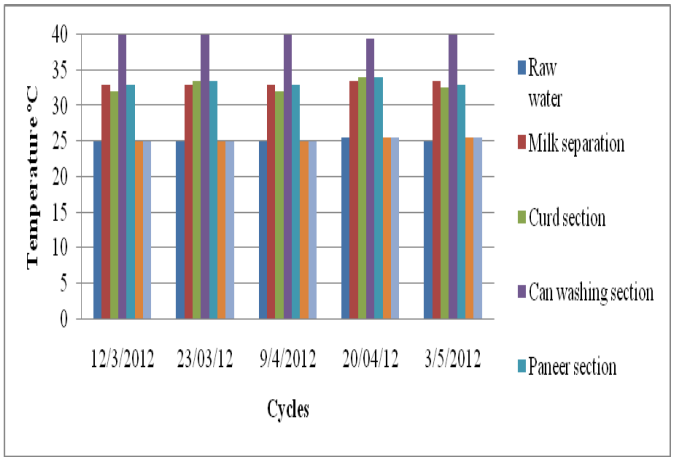
Fig.2: Wastewater Flow Rate From Different Sections of Dairy

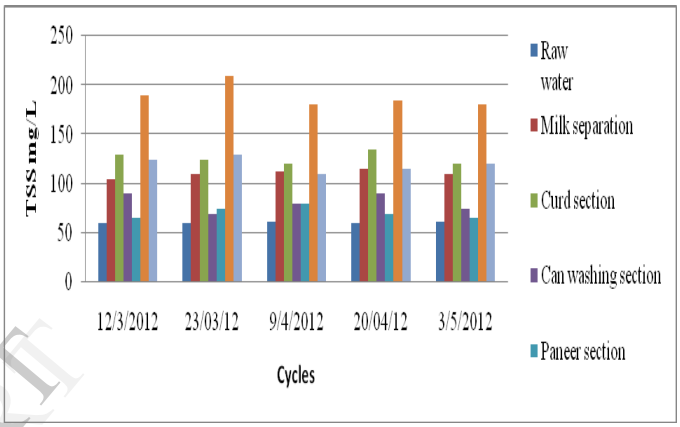
C. *Quality analysis of water and wastewater at KMF, Dharwad*

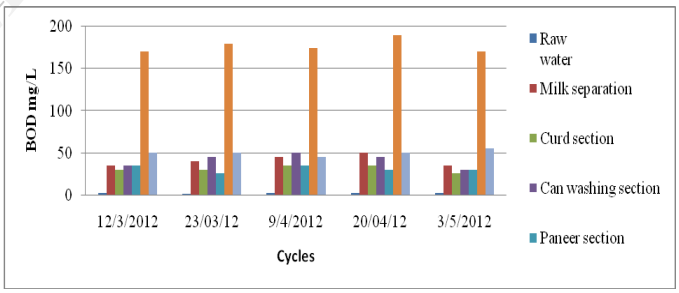
The wastewater samples from different sections were analyzed for parameters such as temperature, pH, BOD, COD, total dissolved solids, total suspended solids, oil and grease to know the wastewater quality and for reuse.

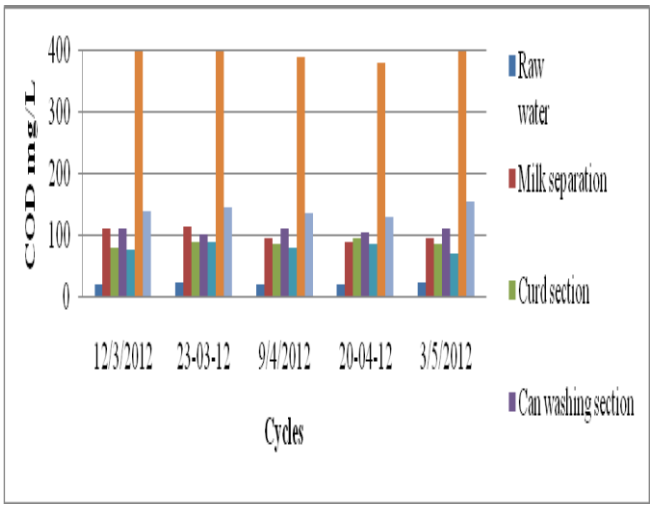












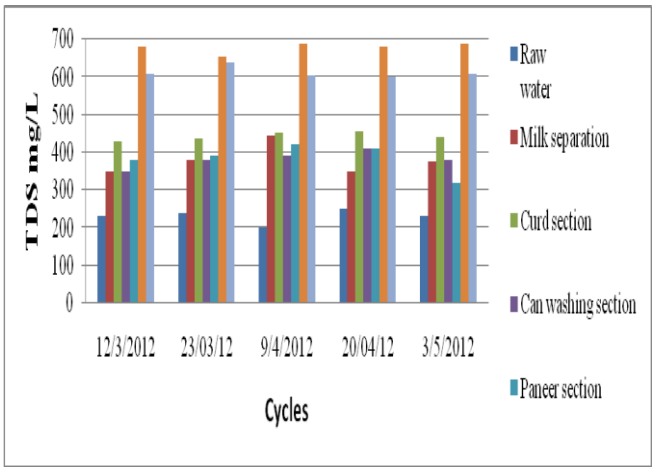


Fig. 3: Variations in wastewater characteristics from different sections of dairy

Table 2 Water and wastewater quality analysis results

Sl No	*Parameters*	*Units*	**Average value of parameters at various sections**						
			Raw water	*Milk Separation Section*	*Curd Section*	*Can washing waste water*	*Paneer Section*	*ETP Influent*	*ETP Effluent*
1	Temperature	°C	25.0	33.0	33.0	40.0	33.0	25	25
2	pH	-	6.8	7.5	7.4	6.8	7.5	6.8	6.9
3	Dissolved oxygen	mg/L	6.6	5.1	5.0	4.2	5.2	2.3	2.1
4	Total dissolved solids	mg/L	230	380	440	350	380	680	610
5	Total suspended solids	mg/L	60	110	125	80	70	190	120
6	BOD_3 27° C	mg/L	1.6	40	30	40	30	175	50
7	COD	mg/L	20	100	85	105	80	400	140
8	Oil and grease	mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL-Below detectable limit

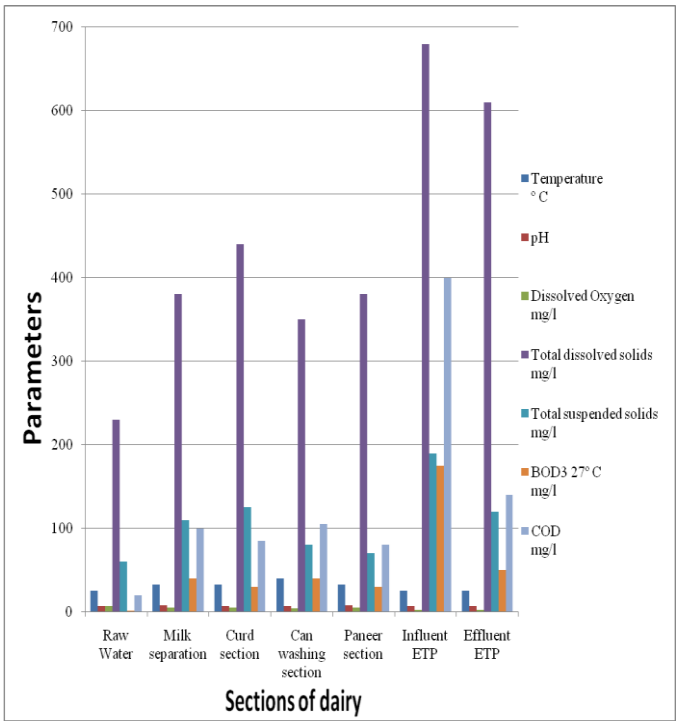


Fig.4: Characteristics of water and wastewater at different sections of the dairy

IV. CONCLUSIONS

The conclusions drawn after the auditing of water and wastewater at KMF Dairy, Dharwad are summarized as

- The overall water consumption from this dairy was 190,539 liters/day.
- Water consumption of condenser section was 1,25,000 liters and 4000-5000 liters/week water was wasted as steam.
- The contribution of main sources of water usage was from Milk Receiving Section which contributed wastewater generation of 10,798 liters/day, Curd Section generated 5275 liters/day of wastewater, Milk Separation Section generated 19,195 liters/day, and Packing Section generated 1,741 liters/day and Can washing generated 2,603 liters/day on an average basis per day.
- The raw water and wastewater samples from different sections of dairy indicate that all the analyzed parameters were well within the permissible limits for the discharge of effluent.
- The analyzed parameter of treated wastewater from effluent treatment plant was within permissible limit as per Table 4.2. Oil and grease was below detectable limit, it was observed that the temperature was 40ºC in can washing wastewater which was more comparatively with other section wastewater samples. The temperature was maintained more in order to obtain quick and easy drying of cans and to obtain effective cleaning.

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