ASSESMENT OF PHYSICAL AND BIOLOGICAL STATUS OF WASTE WATER DISCHARGED FROM MILK PROCESSING UNIT AT DURG

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Abstract : "Raipur Sahakari Dugdh Utpadak Sangh Limited" is a co-operative society established in village-Urla of Durg district of Chhattisgarh State in India. This unit is one of the major suppliers of milk and milk products in whole Chhattisgarh State. Milk processing unit requires huge amount of water. Waste water is disposed in a pit. In present study an effort has been made to analyze the physical and biological parameters viz., temperature, pH, turbidity, salinity, electrical conductivity, total dissolved solids, carbohydrate, protein, fat and Most Probable Number of bacteria. The results of study had higher values for parameters like conductivity, turbidity, salinity, electrical conductivity, total dissolved solids, protein, fat, carbohydrate and Most Probable Number of bacteria. All the studied physical and biological parameters proved that the water discharged from milk processing unit is of polluted nature.

IndexTerms - Milk processing unit, Waste water.

I. INTRODUCTION

Water is an indispensable and one of the precious natural resource of this planet (Mc Arthur *et. al.* 2001). The quality of water resources usually depends on its physical, chemical and biological characteristics (Buddhi *et. al.* 2004). Characteristics of waste water like temperature, colour, pH, dissolved solids, suspended solids, etc. largely depends on quantity of milk processing unit. Waste water produced and discharged daily with considerable concentration of organic matter like carbohydrate, protein, fats, suspended solids originating from the milk and milk products (Omil *et. al.* 2003, Dermirel *et. al.* 2005). Physico-chemical analysis of dairy industrial effluent was studied by(Agosh and Anuradha 2017). The aim of present study was to access the waste water of milk processing unit with respect to physical and biological status.

II. MATERIAL AND METHOD

The sampling of waste water was done in the year 2008 in second week of every month between 10.00 AM - 12.00 Noon (2 hrs). Sample was collected from the surface of the pit with the help of 1 litre sampler. Measurement of temperature was done immediately at sampling site, while analyses of physical and biological parameters were carried out in preserved sample within four hours of collection. The preservation of waste water sample was done as prescribed in APHA-AWWA-WPCF (1980). Physical parameters like temperature, pH, salinity, electrical conductivity, total dissolved solids were done by instrumental methods (Temperature was recorded by digital temperature recorder, pH was recorded by systronic digital pH meter, standardization of instrument was done with buffer solution of 7.4 and 9.2 pH, salinity was recorded by elico digital salinity meter, electrical conductivity and total dissolved solids were recorder by elico EC/TDS analyzer) . Turbidity was done by Nephelometric turbidity units (NTU) by Systronics turbidity meter as per the method prescribed in APHA-AWWA-WPCF (1980). Protein and Carbohydrate were determined by using Folin–Lowry method and Anthrone method respectively in waste water following Plummer (1971). Fat of waste water was measured in % by Electronic Milk Tester. Most Probable Number (MPN) was determined by following Aneja (2001) and APHA-AWWA-WPCF (1980).

Statistical analysis: Data were expressed as mean ($\bar{x}$) and standard deviation of mean (± SD).

III. RESULT AND DISCUSSION

Study of waste water quality of milk processing unit: Quality of waste water from milk processing unit was assessed by analyzing physical and biological status of waste water in monthly interval; data are presented in table and figure 1 to 5. Observed values of physical and biological parameters of waste water of milk processing unit was collected in year 2008.

3.1 Temperature

Temperature of waste water was ranged from 26.2 - 35.4ºC (Table-1and fig-1).The observed range of temperature was quite similar to the observed value by Sooknah et.al.(2004) for dairy waste water. The minimum temperature of wastewater was

observed in the month of December, maximum in the month of May. Temperature had showed an increasing trend from January to May and decreasing trend from June to September for wastewater. Temperature had exhibited higher value during summer months from March to June and lower value in winter months of January and December (Fig-1). Random change in temperature was observed in the month of October and November. Mean value of Temperature was calculated 30.1ºC.

3.2 Hydrogen ion concentration (pH)

The pH value of waste water varied from 6.2 - 7.6 (Table-1). Lower value of pH was noted in the month of December, while the maximum value of pH was observed in the month of February. pH had a fluctuating trend throughout the year within very small range. pH recorded was in between 7 to 8 in four of the months like January, February, July and August in rest of the months observed pH value was in between 6 to 7(Fig-1). The obtained range of pH was quite similar to the observed value of Khojare *et. al.* (2005), Gaikar *et. al.* (2010) while higher range of pH was noted by Carawan *et.al.* (1979) and Shaikh *et. al.*(2009).

Table - 1: Monthly variation in temperature(ºC) & pH

Months	Temperature	pH
JAN	26.7	7.2
FEB	27.8	7.6
MAR	31.2	6.7
APR	33.8	6.5
MAY	35.4	6.4
JUN	34.9	6.6
JUL	30.2	7.2
AUG	28.7	7.4
SEP	28.6	6.5
OCT	29.4	6.4
NOV	28.9	6.7
DEC	26.2	6.2
MEAN x̄	**30.1**	**6.7**
± SD	**3.0**	**0.4**

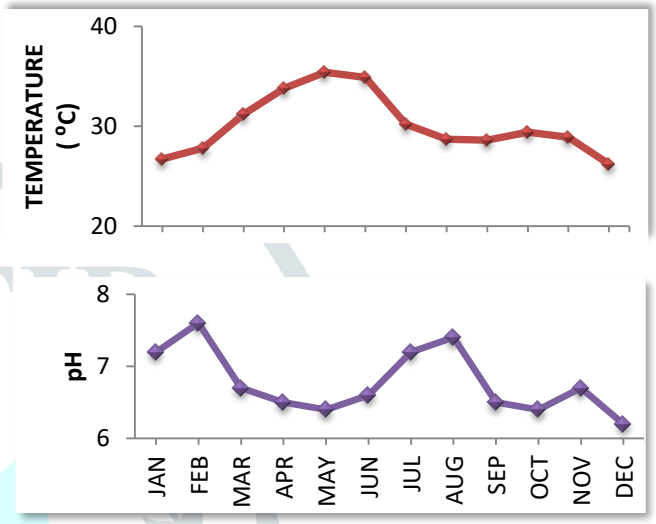


Fig-1 Monthly variation in temperature(ºC) & pH

3.3 Turbidity

Turbidity was varying form 35.9 - 97.1 NTU in wastewater (Table - 2). The difference between the minimum and maximum was more than the double. The maximum turbidity value was noted 97.1 NTU in the month of November and minimum 35.9 NTU in April. An increasing trend was observed from August to November in the turbidity value, while decreasing trend in the months of March and April, other months had a fluctuating value (Fig-2). Comparatively higher values were recorded during the winter months, while the values of other months had less difference. Mean value of turbidity was recorded 62.8.

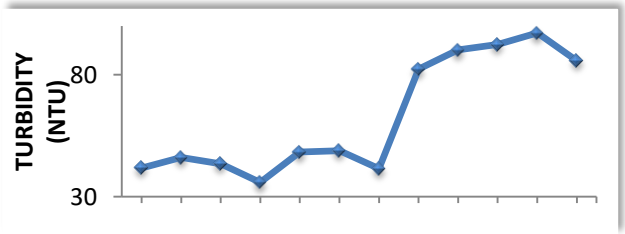
3.4 Salinity

Salinity was recorded in ppm unit. Salinity value had ranged from 0.254 - 0.639 ppm in wastewater (Table-2). The maximum value of salinity was observed in the month of July, while minimum value recorded in the month of October for wastewater. Comparatively higher values of salinity were observed in rainy months July to September and lower values during winter months October to December. Other months had an intermediate value. No specific trend was noticed in salinity with exception of month January (Fig-2). Average salinity value was recorded 0.390 ppm for waste water.

Table - 2 : Monthly variation in turbidity(NTU) & salinity (ppm)

Months	Turbidiy	Salinity
JAN	41.8	0.510
FEB	46.1	0.357
MAR	43.5	0.310
APR	35.9	0.319
MAY	48.3	0.317
JUN	48.8	0.309
JUL	41.5	0.639
AUG	82.3	0.525
SEP	90.2	0.572
OCT	92.4	0.254
NOV	97.1	0.262
DEC	85.8	0.311
MEAN x̄	**62.80**	**0.390**

± SD	**24.09**	**0.132**



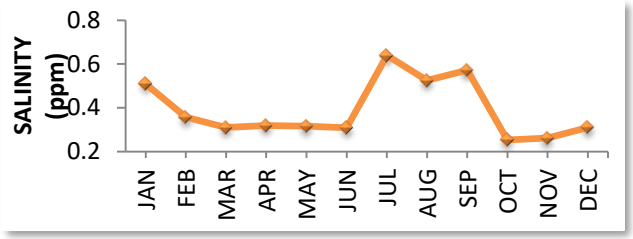


Fig-2 Monthly variation in turbidity(NTU) & Salinity (ppm)

3.5 Electrical conductivity

Electrical Conductivity was recorded in µmhos/cm. Electrical Conductivity values were varying from 352.7 - 954.0 µmhos/cm in waste water (Table-3). The maximum value of electrical conductivity was observed in the month of July, while the minimum value of electrical conductivity was obtained in the month of October. Comparatively higher values were recorded in rainy months July to September and lower values in winter months October to December with exception in January. EC Value was found increasing in the months of April, July, November and December, while other months exhibited a fluctuating trend (Fig-3). The mean value of electrical conductivity was maximum 623.5 µmhos/cm.

3.6 Total dissolved solids (TDS)

Total dissolved solid in wastewater was determined in ppm unit. (Table-3). The values of total dissolved solids were varying from 180.2 - 445.4 ppm in wastewater. Shaikh et.al.(2009) obtained the value similar to the present investigation.The higher value of total dissolved solids was observed in the month of September, while lower value in the month of October. Both minimum and maximum values were contrastingly recorded in to consecutive months. Comparatively higher values were recorded during the rainy months August and September, while lower values were obtained in the winter month October to December other months had exhibited random fluctuation in the value. TDS value was found increasing from July to September, November and December, while decreasing trend was observed in the month of February, March and May, June. Other months recorded fluctuation in data. (Fig-3). The mean value of Total dissolved solids was calculated 300.8.

Table – 3 : Monthly variation in electrical conductivity (µmhos/cm) & Total dissolved solids (ppm)

Months	EC	TDS
JAN	772.7	385.5
FEB	575.0	287.0
MAR	516.1	258.7
APR	601.7	301.4
MAY	606.3	298.8
JUN	519.3	259.8
JUL	954.0	346.0
AUG	838.5	419.5
SEP	891.1	445.4
OCT	352.7	180.2
NOV	378.5	189.4
DEC	477.2	238.7
MEAN x̄	**623.5**	**300.8**
± SD	**197.6**	**84.5**

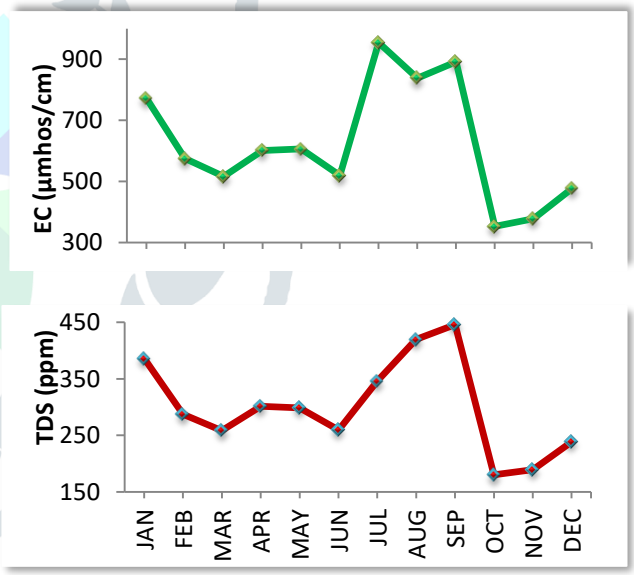


Fig-3 Monthly variation in electrical conductivity (µmhos/cm) & Total dissolved solids (ppm)

3.7 Protein

Protein value determined in mg/L was ranging from 13.78 - 72.12 in waste water of milk processing unit (Table-4). Maximum value was determined in the month of December, while minimum value in the month of October. Comparatively lower value was recoded in rainy months with exception in the month of August and higher value in winter months and summer months. The value recorded was > 50mg/L for seven months while <20mg/L for only two months in October and July. Decreasing trend in Protein value was observed in the months of February, March, June, July, September and October, while increasing trend was noted in the months of April, May, November and December, other months had registered a random fluctuation in the value. Average value of Protein was observed 46.26 mg/L (Fig-4).

3.8 Carbohydrate

Carbohydrate value determined was varying from 0.1007 - 0.2958 mg/L in waste water of milk processing unit (Table-4). Peak value was determined in the month of December, while minimum value in the month of June. Comparatively lower values were recorded in the summer and higher value in winter months and rainy months. The value recorded was <0.3000mg/L for entire study period, while <0.2000mg/L for only two months in April and June. An increase in value of Carbohydrate was

observed in the months of February, May, July, September and October, while decrease in value was noted in the months of March, April, June, August and November, other months had registered a random fluctuation in the value. Average value of Carbohydrate was observed 0.2357mg/L (Fig-4).

3.9 Fats

Fats value determined in % was changing from 0.01 - 0.06 in waste water of milk processing unit (Table-4). Maximum value was determined in the month of November, while minimum value in the month of March, June to August and December. Comparatively lower values were recoded in the rainy months with exception in the month of March and December and higher value in winter months. The value for fat was recorded 0.01% for five months while 0.02% in four months, exceptionally value increased to 0.06% in the month of November with intermediate 0.03% in two months. There was very less difference in the fats % for maximum months. Average value of Fats was observed 0.02% in wastewater (Fig-4).

Table – 4: Monthly variation in protein (mg/l), carbohydrate (mg/l) & fat (%) of waste water of milk processing.

Months	Protein	Carbohydrate	Fats
JAN	70.96	0.2711	0.02
FEB	57.95	0.2785	0.02
MAR	53.15	0.2331	0.01
APR	67.19	0.1883	0.02
MAY	70.12	0.2114	0.03
JUN	36.86	0.1007	0.01
JUL	14.47	0.2743	0.01
AUG	50.96	0.2296	0.01
SEP	23.00	0.2548	0.02
OCT	13.78	0.2701	0.03
NOV	24.56	0.2212	0.06
DEC	72.12	0.2958	0.01
MEAN x̄	**46.26**	**0.2357**	**0.02**
± SD	**22.68**	**0.0531**	**0.01**

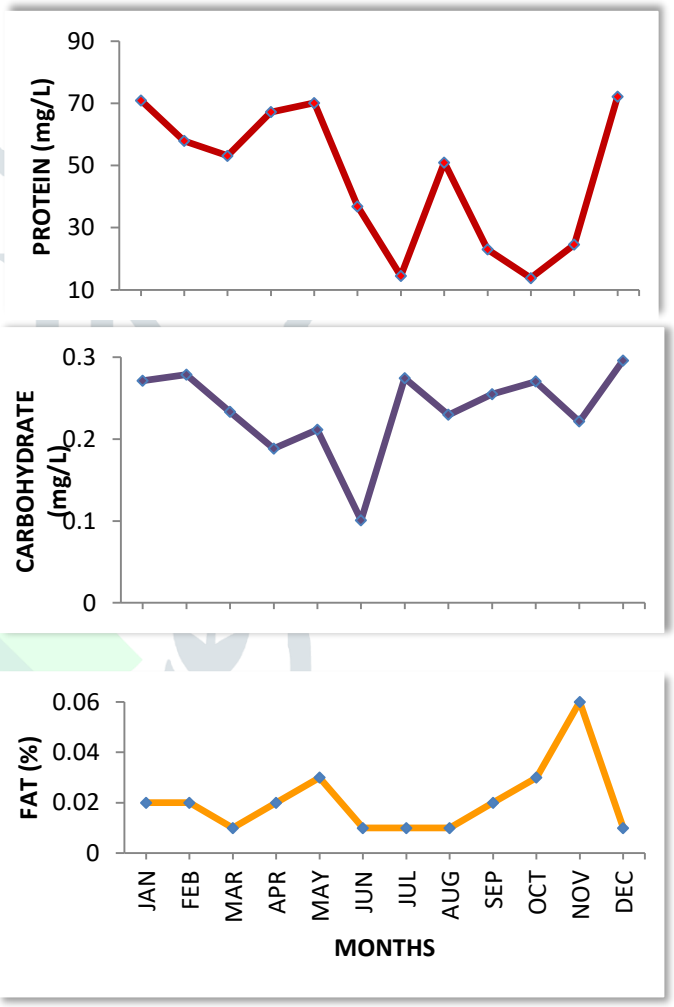


Fig – 4: Monthly variation in protein (mg/l), carbohydrate (mg/l) & fat (%) of waste water of milk processing.

3.10 Most probable number (MPN)

MPN was determined in per 100ml. of waste water of milk processing unit, during the year 2008. The value obtained was >2400 recorded for most 9 months from March to November, while in 3 winter months of December, January and February value recorded (1600) was comparatively low. The mean value calculated was >2200 (Table-5, Fig-5).

Table – 5: Monthly variation in most probable number per 100 ml of waste water of milk processing unit

Months	MPN/100
JAN	1600
FEB	1600
MAR	≥ 2400
APR	≥ 2400
MAY	≥ 2400
JUN	≥ 2400
JUL	≥ 2400
AUG	≥ 2400
SEP	≥ 2400
OCT	≥ 2400
NOV	≥ 2400
DEC	1600
MEAN x̄	**2200**

± SD	361.81

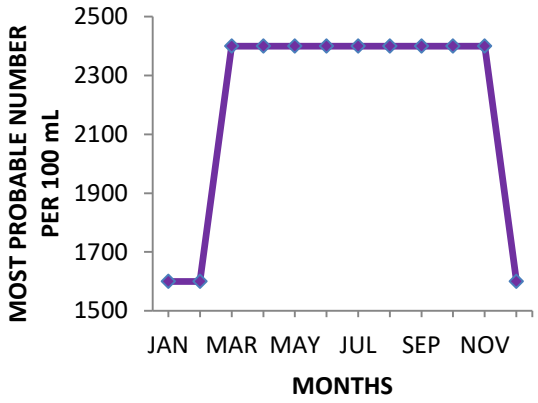


Fig – 5: Monthly variation in most probable number per 100 ml of waste water of milk processing unit

IV. CONCLUSION

Waste water discharged from milk processing unit is white, acidic with higher Turbidity, Salinity, Electrical conductivity and total dissolved solids. Waste water was rich in Protein and Fat content, which can be used as a feed for animals. MPN value was higher again indicates the polluted nature of waste water.

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