

Performance Evaluation of ETP of Dairy industry with respect to Physico-chemical characteristics

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Abstract - Because of the rising demand for milk, India's dairy industry is predicted to expand significantly. Untreated wastewater from this industry pollutes the land and river systems, hence thorough treatment of dairy effluent before disposal in the environment is essential. Pasteurization, cream, cheese, milk powder, and other procedures in the dairy sector are only a few examples from which wastewater is generated. Wastewater with excessive concentrations of pollutants produced by poor design, operation, or treatment systems can cause serious environmental problems. The present study is an attempt to analyze the performance of the Effluent Treatment Plant (ETP) designed for dairy wastewater. Samples of wastewater were collected during pre-treatment, post-primary treatment, post-secondary treatment & post-tertiary treatment. Parameters analyzed for performance evaluation of effluent treatment plant are Temperature, pH, Total Solids (TS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Oil & Grease (O&G).

Table no.1 Disposable Limit as per consent.

Parameters	Disposable limit as per consent
Temperature	20 ^o C – 30 ^o C
pH	5.5 – 9.0
TDS	2100 mg/l
TSS	100 mg/l
Oil & Grease	10 mg/l

Key Words: Dairy Industry, Effluent Treatment, Removal Efficiency, TS, TDS, TSS

1. INTRODUCTION

Effluent treatment in industries to meet the stipulated discharge limit as per consent has always been a major issue for Industries. Wastewater from Dairy Industry is highly polluted in terms of organic and inorganic constituents and if not treated prior disposal it can cause significant and irreparable damage to the environment and human health. The treated wastewater must meet stipulated discharge limit as specified in consent given to industry. The dairy selected for this study is located in gokul shirgaon, Kolhapur. It has daily milk processing capacity of 2000 m³/day with ETP to treat 1800 m³/day wastewater. The ETP has been modified several times to augment its capacity and efficiency to meet the stipulated standards as per Table 1.

The current flow sheet of ETP is given as fig 1.

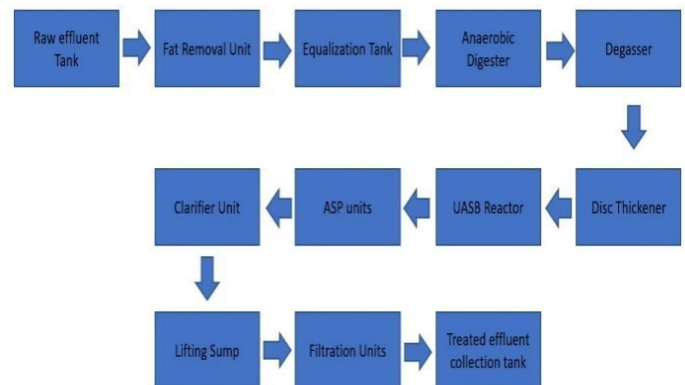


Fig. 1: Flow diagram of ETP of Dairy industry

2. METHODOLOGY

The wastewater samples were collected during pre-treatment (RAW wastewater), post-primary treatment, post-secondary treatment & post-tertiary treatment. All samples were tested in the laboratory of dairy itself & analyzed for temperature, pH, TS, TDS, TSS & Oil and grease.

The temperature of each sample was measured with the help of a temperature probe. pH of each sample was measured with the help of a pH electrode while TS, TDS & TSS were measured by using hot plate apparatus. Oil and grease content was measured with the help of separatory funnel.

3. RESULTS AND DISCUSSION

A. Temperature (temp.):

The temperature of raw effluent was found varying from 24.1 to 29.9°C. The value of Temp. Post-primary treatment was varying from 25.1 to 30.4°C. The value of temp. post-secondary treatment was varying from 24.1 to 29.4°C. The value of temp. post-tertiary treatment was varying from 24.3 to 27.8°C respectively. The avg. value of finally treated effluent was 25.41°C. Which is within permissible limit of 30°C

B. pH:

pH of effluent before treatment was found varying from 10.52 to 11.52. The value of pH post-primary treatment was varying from 6.34 to 9.3. The value of pH post-secondary treatment was varying from 6.88 to 7.45. The value of pH post-tertiary treatment was varying from 7.61 to 8. The avg. value of finally treated effluent was 7.75. Which is within the permissible limit 9

C. TS:

TS of effluent was found varying from 2000 to 2680 mg/l before treatment. The value of TS post primary-treatment was varying from 1695 to 1808 mg/l. The value of TS post-secondary treatment was varying from 1600 to 1832 mg/l. The value of TS post tertiary-treatment was varying from 860 to 1060 mg/l. The avg. value of finally treated effluent was 969 mg/l. Percentage reduction of 57 to 60% was observed.

D. TDS:

TDS of effluent was varying from 1620 to 2300 mg/l before treatment. The value of TDS post-primary treatment was varying from 1422 to 1647 mg/l. The value of TDS post-secondary treatment was varying from 860 to 980 mg/l. The value of TDS post-tertiary treatment was varying from 1330 to 1562 mg/l. The avg. value of finally treated effluent was 908 mg/l. which is within the permissible limit of 2100 mg/l. Percentage reduction of 48 to 57% was observed.

E. TSS:

TSS of effluent was varying from 320 to 440 mg/l before treatment. The value of TSS post-primary treatment was varying from 161 to 287 mg/l. The value of TSS post-secondary treatment was varying from 233 to 300 mg/l. The value of TSS post-tertiary treatment was varying from 60 to 100 mg/l. The avg. value of finally treated effluent was 83 mg/l. Which was within the permissible limit of 100 mg/l. Percentage reduction of 77 to 82 % was observed.

F. O&G:

The dairy wastewater contains significant amount of Oil and Grease due to high fat content of milk. The O&G content of wastewater pre-treatment varied from 750 to 990 mg/l. The value of oil & grease post-primary treatment was varying from 565 to 615 mg/l. The value of oil & grease post-secondary treatment was varying from 105 to 117 mg/l. However, the value post-tertiary treatment was observed below the detection limit. Hence percentage reduction of 100 % was observed.

The following Figures show comparison between Treated Effluent and MPCB standards

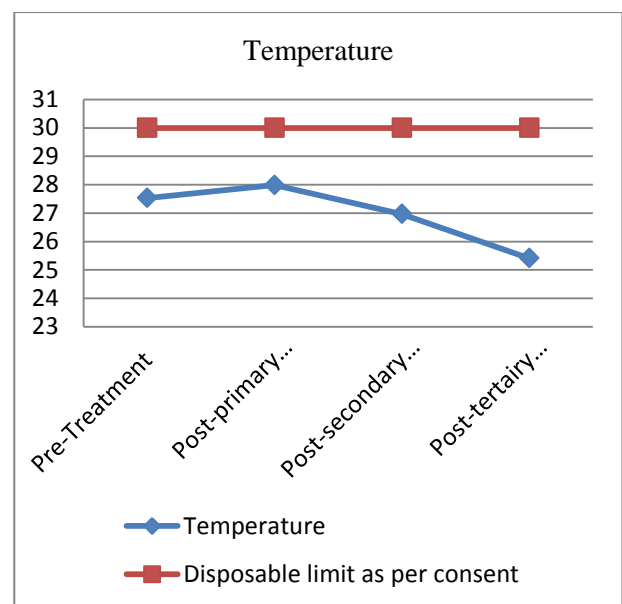


Fig. 2: Temperature value of Effluent

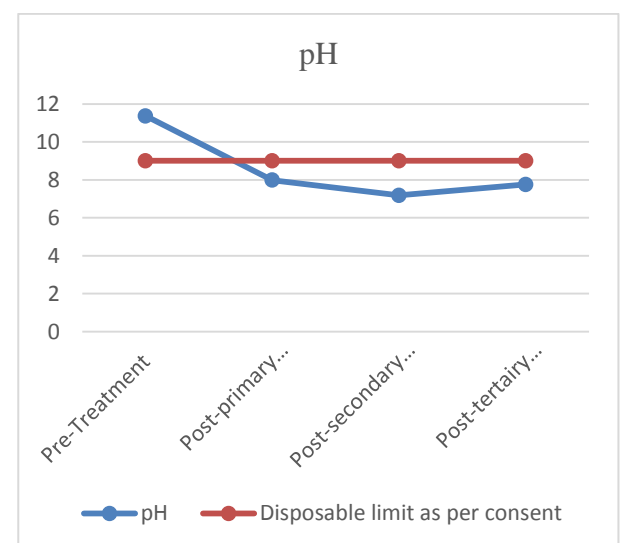


Fig. 3: pH value of Effluent

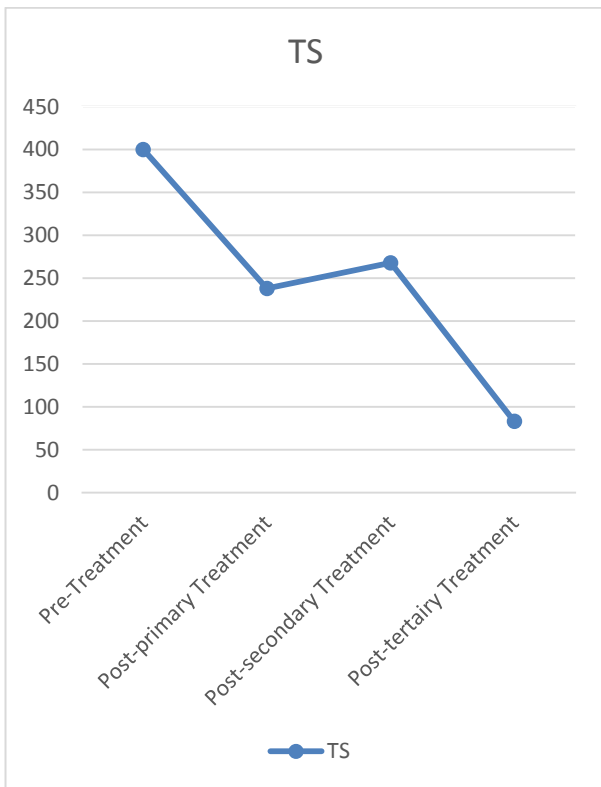


Fig. 4: TS Value of Effluent

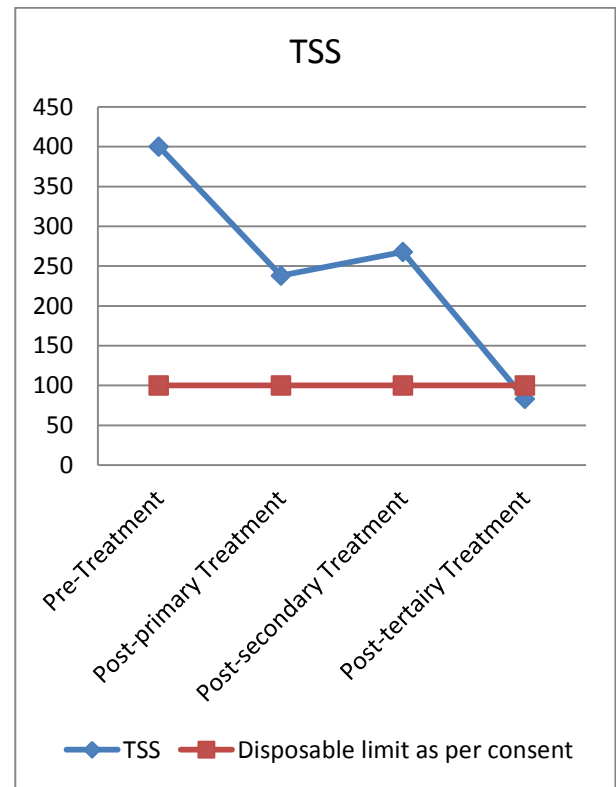


Fig. 6: TSS Value of Effluent

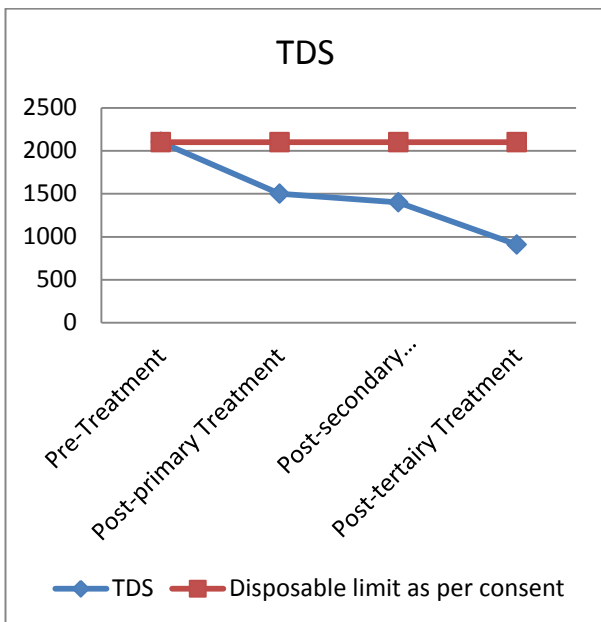


Fig. 5: TDS Value of Effluent

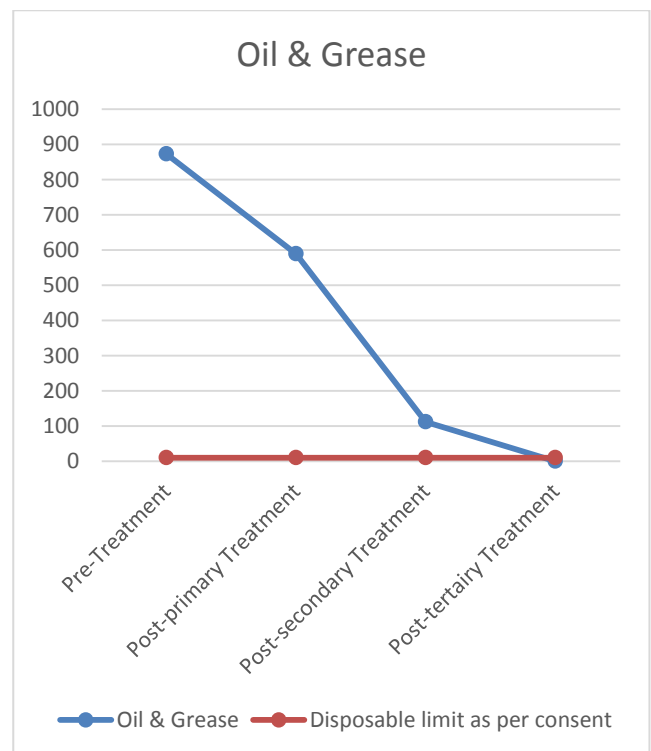


Fig. 7: Oil & Grease value of Effluent

Table no.2: Physicochemical characteristics of Dairy wastewater

Parameter	Before Treatment	Post-Primary treatment	Post-Secondary Treatment	Post-Tertiary Treatment
Temp.	24.1 ^o C – 29.9 ^o C	25.1 ^o C – 30.4 ^o C	24.1 ^o C - 29.4 ^o C	24.3 ^o C – 27.8 ^o C
pH	10.25 – 11.25	6.34-9.3	6.88 – 7.45	7.61 - 8
TS	2000 mg/l – 2680 mg/l	1695 mg/l – 1808 mg/l	1600 mg/l – 1832 mg/l	860 mg/l – 1060 mg/l
TDS	1620 mg/l – 2300 mg/l	1422 mg/l – 1647 mg/l	1330 mg/l – 1562 mg/l	860 mg/l – 980 mg/l
TSS	320 mg/l – 440 mg/l	161 mg/l – 287 mg/l	233 mg/l – 300 mg/l	60 mg/l – 100 mg/l
Oil & Grease	750 mg/l – 990 mg/l	565 mg/l – 615 mg/l	105 mg/l – 117 mg/l	B.D. L

Table no.3 Percentage Reduction

Parameter	Avg. value of RAW effluent	Avg. value of Treated effluent	% Reduction
Temp.	27.53	25.41	
pH	11.363	7.755	31.75%
TDS	2102	908	56.80%
TSS	400	83	79.25%
O&G	873	0	100%

4. CONCLUSION

The present study is concerned with the performance evaluation of ETP of the dairy industry with respect to physico-chemical characteristics. Based on results of analysis it was concluded that the overall performance of the effluent treatment plant of dairy was satisfactory with treated water meeting the stipulated discharge limit with respect to all parameters analyzed during the current study. The average removal efficiency of TDS, TSS and oil & grease was 57%, 82% and 100% respectively.

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