Performance Evaluation of Effluent Treatment Plant of Dairy Plant

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Abstract : One of the primary causes of water pollution is the dairy industry. In India, dairy production produces about 5-6 Litre wastewater per litre of milk processed depending on the process exercised and the type of plant. As the dairy production industries grow, they also generate a notable amount of environmental problems. If not appropriately treated the discharge will cause the problem to the surface water as well as the soil. An attempt has made in the existing project to evaluate the effluent treatment plant for dairy waste. For the test, the samples collected from the five points: which are Raw Effluent (P-1), Equalization Tank (P-2), Aeration Tank (P-3), Secondary Clarifier (P-4) and V-Notch (P-5).
The present research work is to find out the behaviour of various parameters of wastewater. Characterization of wastewater evaluated in terms of Appearance, Odour, Colour, pH, Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Total suspended solids (TSS), Total dissolved solids (TDS), Chlorides and Oil & Grease (O&G). Appearance, Odour and Colour after the treatment found to be Clear, Odourless and Colourless. The pH, BOD5 at 20-degree Celcius, COD, TSS, TDS removal efficiency of the effluent treatment plant is 6.7, 97.8%, 90.4%, 95% and 10.75% respectively.

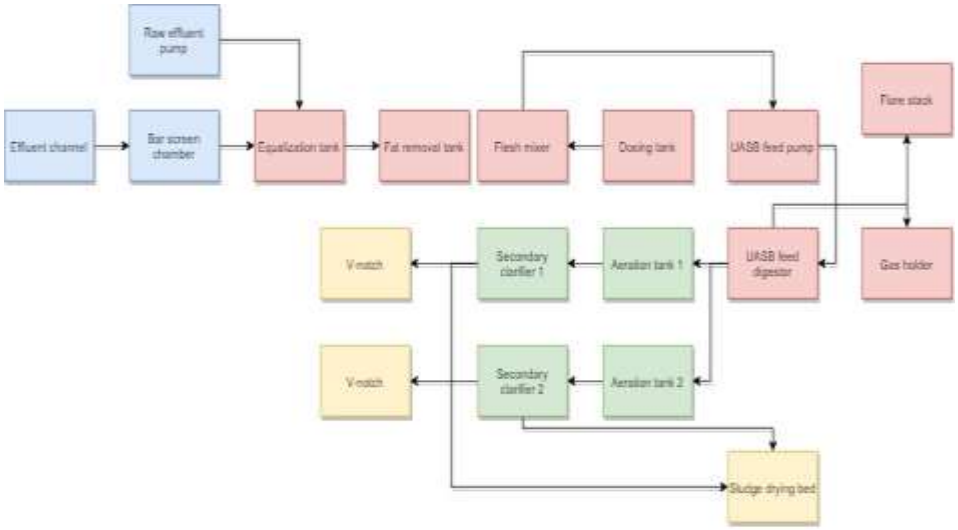
Keywords **- Evaluation of Effluent Plant, Dairy plant, Effluent Treatment.**

I. INTRODUCTION

"The cost of accomplishment should never be pollution." The active growth of industries these days are beneficial for our economy. In the time of COVID- 19 infection, it is more critical because unemployment is rising. However, we cannot overlook the harmful outcomes caused by industries. This fast growth comes with its hurdles, and one of them is the discharge of contaminated waste into the environment. Waste which comes out of industries has the potential to contaminant the ponds, lakes and rivers, which is why it is crucial to treat the Influent coming into the plant carefully. For that purpose, we need to understand in brief about the effluent, its characteristics and adverse effects which not only influence the aquatic animals but humans as well. Suppose the influent discharged into the ponds, lakes or rivers without conventional treatment. In that case, the organic matter present in the wastewater will become a cause of accelerated oxygen depletion from the river bodies which suffocates the fishes and other aquatic animals as well. After the contamination of water bodies, if humans use that contaminated water, then it will be the reason for causing several diseases like typhoid, cholera and dysentery. The present evaluation conducted to get to know about the effluent treatment plant and how it treats the influent, which then reused to achieve numerous objectives.
The study intends to determine the parameters on which we can judge the treated effluent and can be thoroughly sure that this effluent is fit for reuse. The parameters on which we are going to assess the effluent are pH, BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand), TDS (Total Dissolved Solids), TSS (Total Suspended Solids), Chlorides and O & G (Oil and Grease). Selected parameters should be fall under the guidelines and Maximum permissible limits provided by MPPCB (Madhya Pradesh Pollution Control Board) to pass the evaluation.

II. METHODOLOGY

The study conducted at Sanchi Dugdh Sangh, Bhopal, Madhya Pradesh. The coordinates of the site are 23°13'32.5"N and 77°26'28.3"E. Duration of the research is about three months, during which the effluent samples obtained from five various points (1) Raw Effluent Tank (2) Equalization Tank (3) Aeration Tank (4) Secondary Clarifier (5) V-Notch tank in the Effluent Treatment Plant. The capacity of the plant is 300-meter cubic per day and the method used in the treatment of effluent depicted with the help of the following diagram.



As seen in the diagram, the process employed in the treatment plant is Equalization (for balancing of flow), Neutralization (for effluent conditioning, to make it less acidic or alkaline), Physical treatment, Chemical treatment and Biological treatment. Samples are collected using one-litre plastic containers from the points mentioned above. All the samples are brought to the lab and analyzed.

III. RESULT AND DISCUSSION

The findings after analyzing the samples are as follows:

pH: is 7.8 to 8.2 before treatment; however, after treatment, pH reduced to 7.2 to 7.3. The percentage reduction is 6.7%. The reason is the wastewater comes for the treatment is the water used to wash the tanks used for making milk products & from regular operations of the washrooms at the plant.

Biological Oxygen Demand (BOD): The amount of oxygen consumed by the bacteria to break down the organic matter present in the effluent is the biological oxygen demand. A volume of water put in recipient where the changes in oxygen content measured before and after incubation at 20-degree celsius for a specific time. BOD values increase over time as organic matter is progressively biodegraded. However, after five days, the majority of oxygen is degraded.

BOD of the samples is 700 to 687 mg/l before the treatment; after the treatment, BOD reduced to 11.6 to 14.8 mg/l. The percentage reduction is 97.8 %.

Chemical Oxygen Demand (COD): The amount of oxygen consumed to chemically oxidized the organic matter. The significant advantage of the COD test over the BOD is COD test only take two hours to perform. COD of the samples is 1300 to 1290 mg/l before the treatment; after the treatment, COD reduced to 120 to 118 mg/l. The percentage reduction is 90.4%.

Total Dissolved Solids (TDS): Total dissolved meaning is all the dissolved solids in the water sample; it is very troublesome in the water sample because the dissolved minerals or the organic constituents produces terrible odour.

TDS of the samples is 1055 to 1060 mg/l before the treatment; after the treatment, TDS reduced to 908 to 840 mg/l. The percentage reduction is 10.75%.

Total Suspended Solids (TSS): Total Suspended Solids is the dry weight of the suspended particles that not dissolved in the water sample. The presence of these suspended particles will degrade water quality. In general, Suspended solids led to the development of sludge deposits and anaerobic conditions when untreated effluent discharged in the aquatic environment.

TSS of the samples is 780 to 830 mg/l before the treatment; after the treatment, TSS reduced to 28 to 38 mg/l. The percentage reduction is 95%.

Chlorides: Chloride test is necessary because chloride can corrode metals and affect the taste of food products, high level of chloride in water will put aquatic life in danger as well. Not only the aquatic animals if we drink the water containing a high level of chloride with an elevated level of sodium, but it will also affect our organs.

The chloride level of samples is 133 to 128 mg/l before the treatment; after the treatment, the level reduced to 53 to 66 mg/l. The percentage reduction is 53%.

Oil and Grease (O&G): Oil and grease have the potential for machinery breakdowns. If effluent is discharged untreated and it contains the oil and grease element, then it forms a layer on the water surface that will decrease the amount of dissolved oxygen in the sea, and without the dissolved oxygen the bacteria's cannot disintegrate the organic as well as the inorganic components.

O & G level of the samples is 24.8 to 25 mg/l before the treatment; after the treatment, the level reduced to 6.6 to 6.8 mg/l. The percentage reduction is 70%.

Table 1: Parameters of the Effluent

pH Data			BOD Data		
Month	**Influent**	**Effluent**	**Month**	**Influent**	**Effluent**
January	7.8	7.2	January	700	11.6
February	7.6	7.2	February	727	18.2
June	8.2	7.3	June	687	14.8
COD Data			**TDS Data**		
Month	**Influent**	**Effluent**	**Month**	**Influent**	**Effluent**
January	1300	120	January	1055	908
February	1356	140	February	846	868
June	1290	118	June	1060	840
TSS Data			**Chloride Data**		
Month	**Influent**	**Effluent**	**Month**	**Influent**	**Effluent**
January	780	28	January	133	53.6
February	845	46	February	111	52.6
June	830	38	June	128	66

O & G Data		
Month	**Influent**	**Effluent**
January	24.8	6.6
February	23.5	7.2
June	25	6.8

Figure 1: pH value of the Effluent

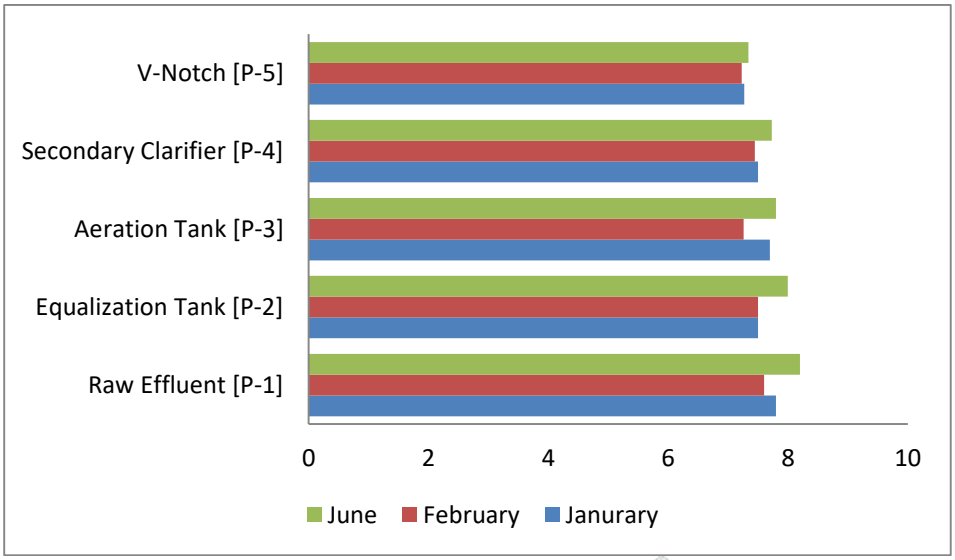


Figure 2: BOD Value of the Effluent

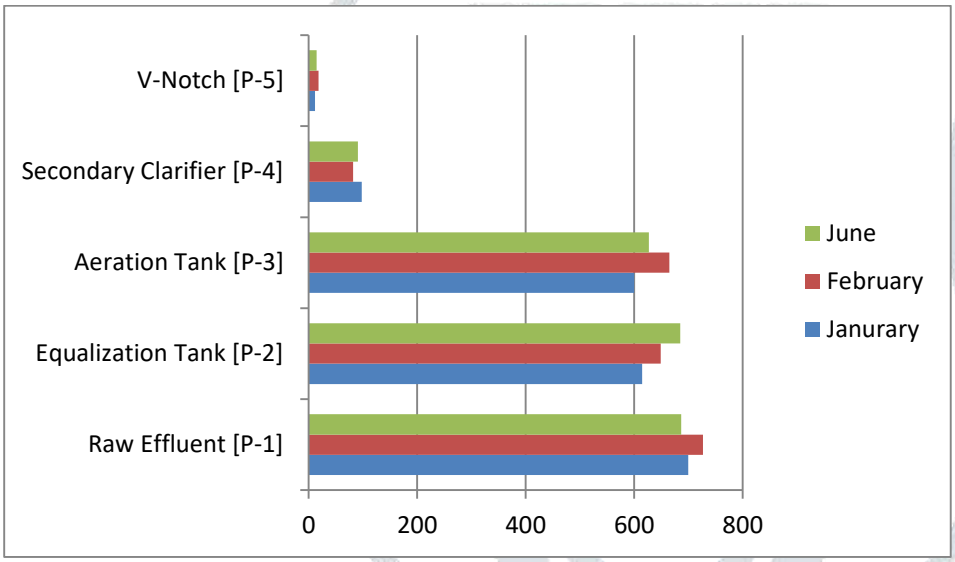


Figure 3: COD Value of the Effluent

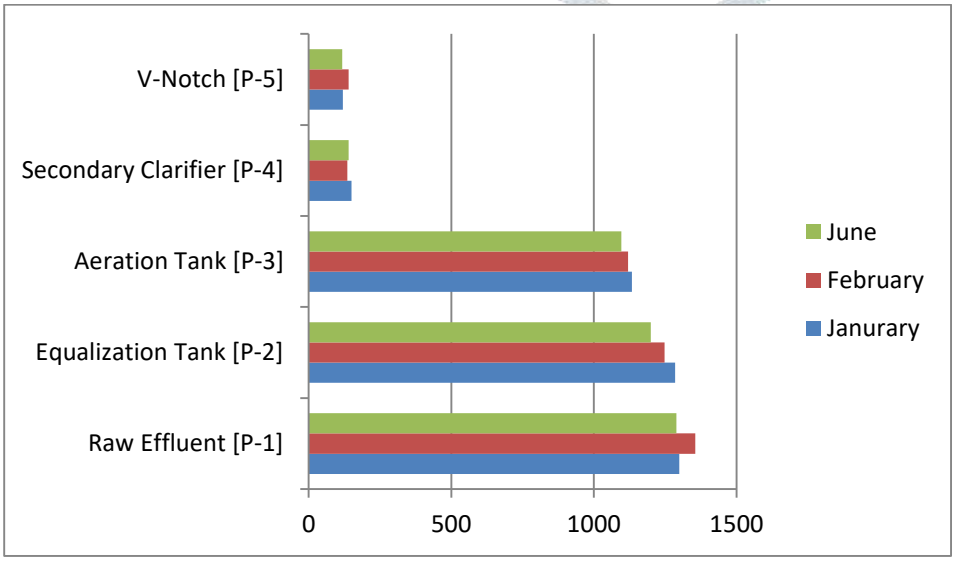


Figure 4: TDS Value of the Effluent

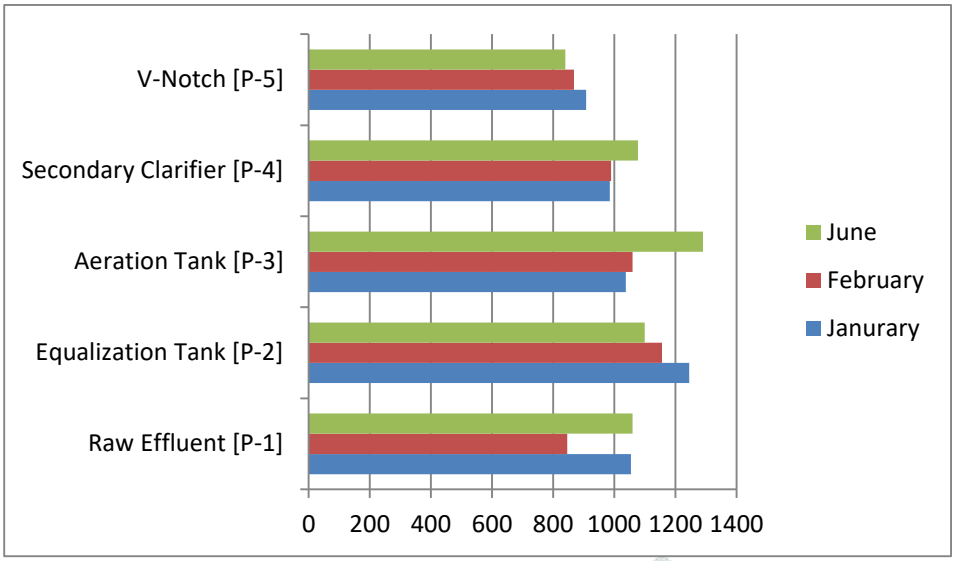


Figure 5: TSS Value of the Effluent

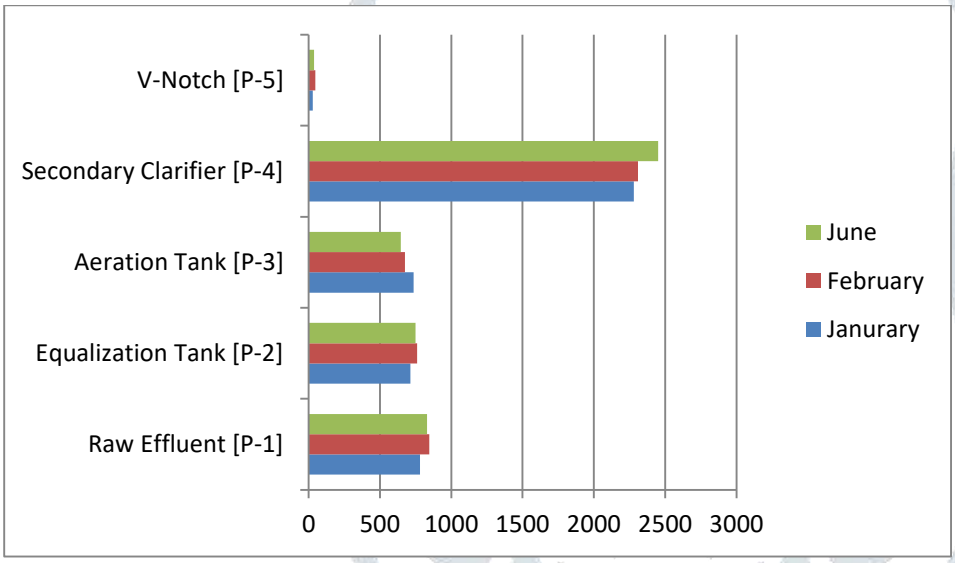


Figure 6: Chloride Value of the Effluent

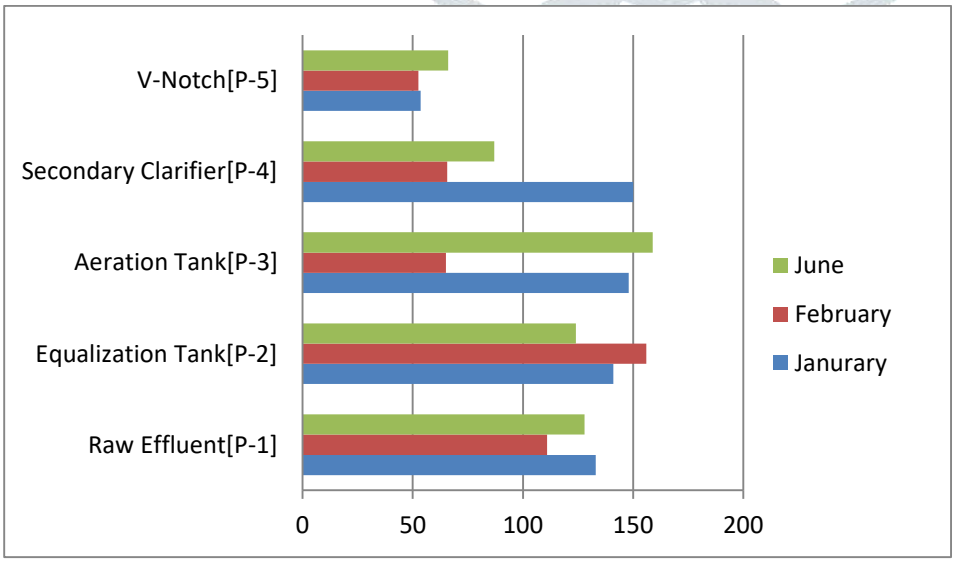


Figure 6: O & G Value of the Effluent

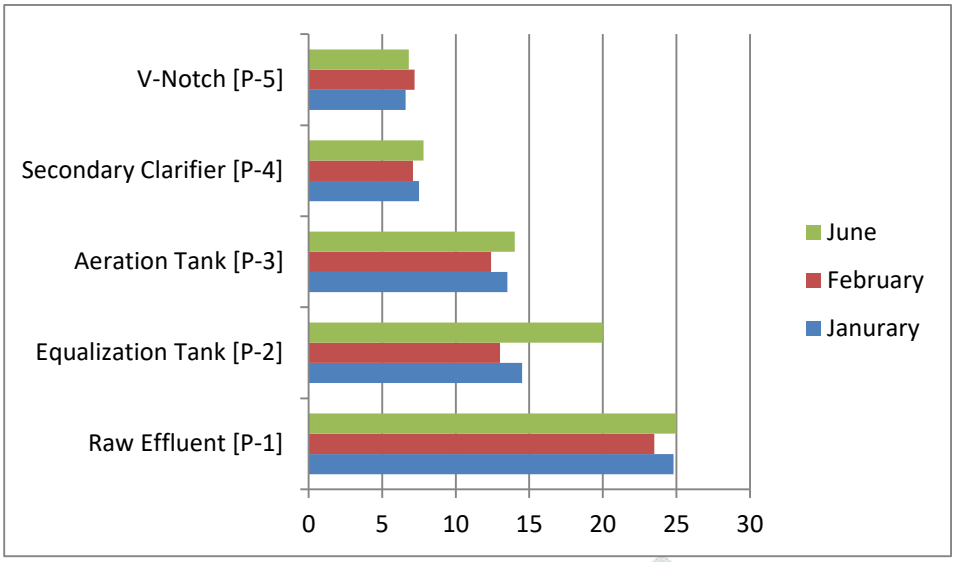


Table 2: Guidelines Provided by MPPCB

Parameters	Permissible Limit
pH	6.5-9.0
BOD	Max 30 mg/l
COD	Max 250 mg/l
TDS	Max 2100 mg/l
TSS	Max 100 mg/l
Chlorides	Max 1000 mg/l
O & G	Max 10 mg/l

IV. CONCLUSION

- The COD, BOD and TSS removal efficiency of the Effluent treatment plant found to be 90.42%, 97.89% and 95.46%.
- The TDS, Chlorides and O&G found to be in permissible limits as well according to the guidelines provided by the Madhya Pradesh Pollution Control Board.
- As for pH, the pH of the treated effluent found to be 7.27, 7.23 and 7.34 with the help of pH meter throughout the study for three months. As per the guidelines mentioned above in the study, the permissible limit is 6.5-8.5.
- Lastly, about the experimental analysis, the Appearance, Odour and Colour of the treated effluent are found to be Clear, Odourless and Colourless.
- Treated effluent from the Effluent treatment plant is found to be safe and can use after for various purposes like gardening.

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V. REFERENCES

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