International Journal of Chemistry and Applications.
ISSN 0974-3111 Volume 4, Number 3 (2012), pp. 199-203

http://www.irphouse.com

A Study of Dairy Effluent of Various Products on the Basis of Chemical Oxygen Demand Value and a Comparative Study Between Common ETP with Respect to Other Plants and Possible Load Reduction Method

Mehulkumar Savaliya, Nikhil Vadi and Yagnesh Gambhava

ISTAR PG Student Industrial Chemistry Department,
Sardar Patel University, V. V. Nagar, Gujarat, India
E-mail: msmehulsavaliya@gmail.com, yagnesh.patel44@yahoo.com, nikhilvadi13@gmail.com

Abstract

How to determine the COD value of the effluents and provide plant wise comparison with respect to common effluents treatment plant and which plants are play crucial role for generating effluent having high load and how to reduce COD load in common effluent treatment plant. because In any dairy plant the Quantity and characteristics of effluent is depending upon the extant of production activities, pasteurization to several milk products.

Keywords: COD, Effluent, Load characteristics

Introduction

Wastewater Generation

Animal Feeding Operations (AFOs) have been widely recognized as a significant cause of surface impairment, air pollution, and groundwater contamination. Among many AFOs, dairy farms are the largest wastewater generators, contributing 48% of animal wastewater according EPA and USDA surveys

Wastewater Characteristics

According to EPA Feedlots Point Source Category Study (EPA, 1999) , dairy farm wastewater has average chemical oxygen demand (COD) concentrations of 4997 mg/L and biochemical oxygen demand (BOD 5) of 1003 mg/L. The COD

concentration varies in the range of 2000– 7000mg/L depending on wastewater management, climate, operation conditions, and types of flushing. The high COD concentration is due to waste milk (produced by washing milking equipment), detergent, manure, and waste feeds combined in the washing or flushing of holding pens and exit alleys. According to Henze et al . (2002), 0.7–1.7 m 3 /ton of milk wastewater generated a BOD 7 concentration of 500–1500 mg/L. According to studies of the waste characteristics of dairy farms, large-scale dairies produce a great deal of wastewater.[5]

Methodology

In any water system, microorganism will consume any organic & inorganic matter added to it and will produce biomass using oxygen present in the water. The oxygen required for the degradation of the organic matter biologically is called the Biochemical Oxygen Demand (BOD). The industrial and municipal waste water effluents may contain very high amounts of organic matter and if discharged into natural water bodies, it can cause complete depletion of dissolved oxygen leading to the mortality of aquatic organisms. The amount of oxygen needed to consume the organic and inorganic materials is called the Chemical Oxygen Demand (COD). There exists a definite correlation between the COD and BOD under certain conditions and by determining the COD, the information about the BOD of the water/waste water can be derived. Potassium dichromate is considered the best oxidant due to its strong oxidizing ability, its applicability to a wide variety of samples and ease of manipulation makes it very efficient

Reagents used:

- Potassium dichromate (Standard solution): K2Cr2O7 – 0.004167 M (0.0250 N)
- Mohr's Salt: Ferrous ammonium sulphate (Standard solution): FeSO4.(NH4)2SO4(0.025 M)
- Mercuric Sulphate: Powdered HgSO4
- Silver Sulphate: Powdered Ag2SO4
- Phenanthroline ferrous sulphate indicator solution
- Concentrated Sulphuric acid: H2SO4 18 M

Procedure

20 ml of sample was taken into a refluxing flask and several boiling stones were added. 1 g HgSO4 was added to the solution. 20 ml of concentrated H2SO4 was also added to the solution. To ensure that HgSO4 dissolved completely, the solution was swirled slowly while adding Sulphuric acid. 1 g of Ag2SO4 was added to this solution. Finally Potassium dichromate was added. Thorough mixing of the solution was ensured by swirling the flask in a water bath to recover any volatile substances that may have escaped from the liquid state. The flask was then attached to the condenser and further cooling was done. 20 ml of Sulphuric acid was added to the solution in the flask continuing cooling and swirling to mix the solution. The solution was refluxed for 2 hour. A blank run (using 10 ml distilled water instead of sample)

was simultaneously conducted with the same procedure after cooling; the solution was transferred to an Erlenmeyer flask. The reflux flask was rinsed thrice, pouring the rinsing water to the Erlenmeyer flask. The solution was diluted to about 300 ml and about 8 drops of Phenanthroline ferrous sulphate was added to the solution as an indicator. The solution was titrated against the Mohr's salt and the titer volume required for the color change from blue-green to reddish blue was noted.[6][3]

Calculations

COD = 8000 * (Vbl – Vs)* M/ original volume of sample taken mg/l

Where,

Vbl = Titer volume for the blank
Vs = Titer volume for the sample
M = Molarity of Mohr's solution

Result

The following table shows a COD value of common ETP, Ghee plant and flavor milk plant.

Table 3.1: Common ETP

Sr. no.	Sample (Ml)	Date of Taken	COD (PPM)
1	Water	14/10/11	1302.00
2		15/10/11	1352.00
3		16/10/11	1252.00
4		17/10/11	1241.98
5		18/10/11	1262.00
6		19/10/11	1181.88
7		20/10/11	1452.32

Table 3.2: Ghee Plant

.

Sr.No.	Sample (Ml)	Date of Taken	COD (PPM)
1	Water	14/10/11	1909
2		15/10/11	1803
3		16/10/11	1796
4		17/10/11	1752
5		18/10/11	1878
6		19/10/11	1858
7		20/10/11	1938

Graph 3.1: Ghee plant

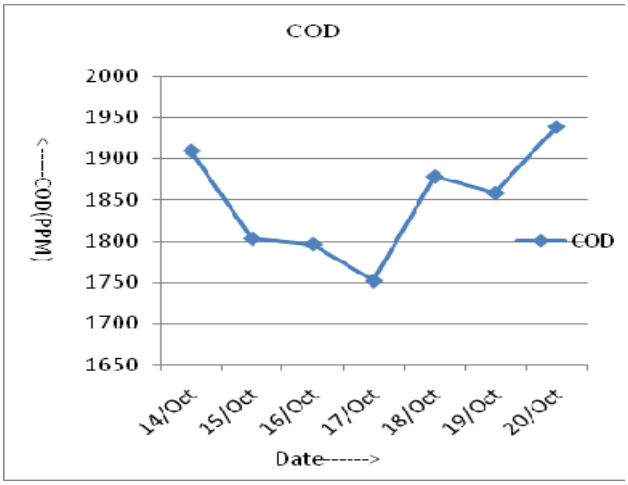
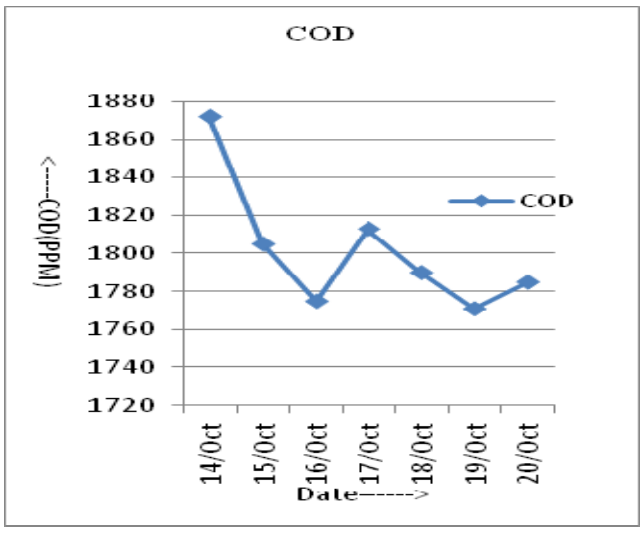


Table 3.3: Flavor milk plant

Sr. no.	Sample (Ml)	Date of taken	COD (PPM)
1	Water	14/10/11	1872
2		15/10/11	1805
3		16/10/11	1775
4		17/10/11	1813
5		18/10/11	1790
6		19/10/11	1771
7		20/10/11	1785

Graph 3.2: Flavor milk plant



Load Reduction

- it has been reported that ghee plant having high fat content so, during the cleaning in place (CIP) hot water is used and then it treated with cold water to solidify the ghee by layer sepration method ghee is seprated and water is discharge in to ETP.
- In the flavour milk plant during the cleaning in place (CIP) the washed water is subjected to evaporation to make it concentrated .then it is removed from plant. so we can reduce the load from ETP.

Conclusion

The COD load in the effluent treatment plant is around 1300 ppm. It is high because of flavor milk plant and ghee plant. Because the COD load in both of the plant are high compare to other plant. Flavor plant utilizes high sugar content and flavoring agents and ghee plant having high fat content.so,both plants are playing crucial role in generating effluent having high load.

References

[1] Bicudo, J. R., Westerman P. W., and Oleszkiewicz J. A. (2000) *Anaerobic and aerobic Treatment of animal manure A review*. In: Proceedings of Animal Residuals Management Conference - Issues and Solutions. Nov. 12-14, Kansas City, MO. Water Environment Federation, Alexandria, VA.
[2] Mogens Henze, Poul Harremoes, Jes la Cour Jansen, Eric Arvin, (2002). *Wastewater Treatment: Biological and Chemical Process*, Springer, New York.
[3] Amul dairy Anand Gujarat.
[4] USDA, 2000 *Agricultural Waste Management Field Handbook*,
[5] School of agriculture and human resources university of hawai page 1-5.
[6] Handbook of waste water treatment by s.k maity