Cross Current International Journal of Medical and Biosciences
Abbreviated Key Title: Cross Current Int J Med Biosci
ISSN: 2663-2446 (Print) & Open Access

Volume-1 | Issue-6 | Dec-2019 |

Research Article

A Study on the Effect of Temperature in Effluent Treatment Process

Dr.C.Madhavi

Lecturer, Dept.Of Microbiology, Govt.College (A), Anantapur Andhra Pradesh, India

***Corresponding author:**
Dr.C.Madhavi

Received: 04.12.2019
Accepted: 16.12.2019
Published: 28.12.2019

Abstract: An experimental investigation was carried out to determine the suitable temperature for efficient functioning of Effluent treatment plant. For this purpose different temperatures were maintained to reduce the Chemical Oxygen Demand and Biological Oxygen Demand during anaerobic process. Experiments were carried out by maintaining the pH 6.8- 7.2 at laboratory level for 5 days. Different temperature ranges i.e. 25^0C, 30^0C, 35^0 C and 40^0 C were maintained throughout the experiments. Among these four temperatures 40^0 C had given good results in reducing the COD and BOD levels.

Keywords: Effluent treatment plant, Chemical Oxygen Demand, Biological Oxygen Demand, anaerobic process, optimum temperature.

1. INTRODUCTION

Anaerobic processes have been used in the treatment of wastewater and sludge for more than 100 years for environmental protection (Martina 2008). It was reported domestic sewage is reported as the main source of pollutant on a global scale, its treatment deserves ample research. Therefore, effective sewage treatment systems are required for treatment wastewater.

In anaerobic digestion, the organic matter in the waste and wastewaters is transformed to biogas, a mix of methane (CH4) and carbon dioxide (CO2) and a nutrient rich sludge (Gujer and Zehnder, 1983).This occurs by four processes:): (i) hydrolysis, the solubilisation of particulate organic material or macromolecules generating soluble materials like sugars, amino acids and lipids; (ii) the fermentation of the soluble material to secondary metabolites of smaller molecular weight (volatile acids, alcohols etc.); (iii) the fermentation of these metabolites to acetate and hydrogen, the substrates of the fourth process; and (iv) methane production, accompanied by variable production of carbon dioxide and other gases . The rates of each of these four biological processes is strongly influenced by temperature (Silvânia Lucas dos Santos *et al.*, 2018).The effect of temperature on pollutant removal and performance of the anaerobic filter (AF) reactor has been examined by several researchers (Elmitwalli *et al.*, 2002b; Bodik *et al.*, 2000).The influence of temperature affecting the performance of AF reactor has been discussed in a previous paper (Chuan 2007; LADU *et al.*, 2014).

In a basic anaerobic treatment cycle, wastewater enters a bioreactor receptacle. The bioreactor contains a thick, semi-solid substance known as sludge, which is comprised of anaerobic bacteria and other microorganisms. These anaerobic microorganisms, or “anaerobes,” digest the biodegradable matter present in the wastewater, resulting in an effluent with lower biological oxygen demand (BOD), chemical oxygen demand (COD), and/or total suspended solids (TSS), as well as biogas

Quick Response Code

Journal homepage:

http://crosscurrentpublisher.com/ccijmb/

DOI: 10.36344/ccijmb.2019.v01i06.004

byproducts. It was established that temperature is the main operational variable that affects the efficiency of anaerobic treatment in reducing BOD and COD.

Assessment of temperature is an important factor as it influences the overall metabolic activities of microorbial population in the bioreactor (Bogte *et al*., 1993; Van Haandel and Lettinga, 1994). Thus the aim of this study was to examine the effect of the factor temperature on the overall performance of the AF reactor in treating wastewater at the Government Hospital, located in Andhra Pradesh. The objective of any effluent treatment plant is to eliminate as much COD as possible from the waste water.

2. MATERIALS AND METHODS

An experimental investigation was carried out at an Effluent treatment Plant operating in a Government Hospital, Andhra Pradesh, where the sewage temperature is 25 ± 1°C, throughout the year.

2.1 Experimental Setup:

500ml of ETP sample was taken in a conical flask and 10gr of cow dung slurry (which contains acidogens and methanogens) was added to it. The sample was kept for four days in an anaerobic process by maintaining different pH ranges at 40^0C. During the four days period on 2^{nd} and 3^{rd} day pH and VA were checked. After the completion of four days sample was aerated for 3hrs with help of an electric air blower by adding aerobic bacteria bacillus and pseudomonas then it was kept for 1hr on standing position to settle down the sludge particles, the supernatant of the settled water was analyzed for COD and BOD levels.

2.2 ANALYTICAL TECHNIQUES

2.2.1 Chemical Oxygen Demand Test (Cod):

METHODOLOGY:

The sample was shaken well, and dilutions for inlet 1: 250 (i.e.,) 1ml sample in 250 ml volumetric flask were prepared. It was made up to the mark (i.e.,) treated 1: 100 dilution means 1ml. sample in 100ml volumetric flask and made up to the mark. 10 ml of potassium dichromate was placed in flask. To this 20ml diluted sample and 30mml (approx) cone H_2SO_4 were added. One pinch mercuric sulphate and one pinch silver sulphate were added and kept for refluxing for 2hours. After 2hours the samples removed and cooed l to room temperature, and 80ml distilled water 3-4 drops of ferric ion indicator and titrated it with standard Ferrous Ammonium Sulphate (FAS) to end point of green to wine red color. Experiments were conducted with a blank using distilled water in place of sample (the quantity of other regents added were the same as added for sample).

ml of FAS required for titration = “A” (For Sample)

ml of FAS required for titration = “B “(For blank)

Calculation:

$$\text{COD (mg/L)} = \frac{(A - B) \times \text{Normality of FAS} \times 8000 \times \text{dilution}}{\text{ml of sample taken}}$$

2.2.3 Dissolved Oxygen Test (Do)

Procedure:

To the sample collected in a 250-300ml. bottle, 1ml of $MnSO_4$ solution added followed by 1ml of alkali iodide azide reagent. To leave clear supernatant above the manganese hydroxide flock, 1ml conc H_2SO_4 added. After mixing thoroughly several times until dissolution was completed, titrated a volume corresponding to 200ml. original sample after correction for a sample loss by displacements with reagents, thus for a total of 2ml (1ml each) of $MnSO_4$ and alkali iodide azide regent in a 300ml bottle titrate was 201 ml.

This mixture was titrated with 0.0021M $Na_2S_2O_3$ solution of pale straw color. To this a few drops of starch solution and continue titration to first disappearance of blue color added. If end point was overrun, back titration with 0.0021 M Bi-Iodate solution added drop wise, by adding a measured volume of treated sample was to follow . Disregard subsequent recollections due to the catalytic effect of nitrite (or) to traces of ferric salts that had not been complexed with fluoride.

Calculation:

For Titrate of 200ml sample,

1ml 0.0021 M $Na_2S_2O_3$ = 1mg Do/l.

3. RESULTS

The following had been the results of Chemical Oxygen Demand and Biological Oxygen Demand from samples of Effluent Treatment Plant maintained at different temperatures.

Trial 1: Temperature maintained at 25^0 C

Sl. No.	**Test**	**Results** (mg/L)	**Standard levels** (mg/L) **(Maximum)**
1	COD	34	30
2	BOD	12	10

Trial no 2: Temperature maintained at 30^0 C

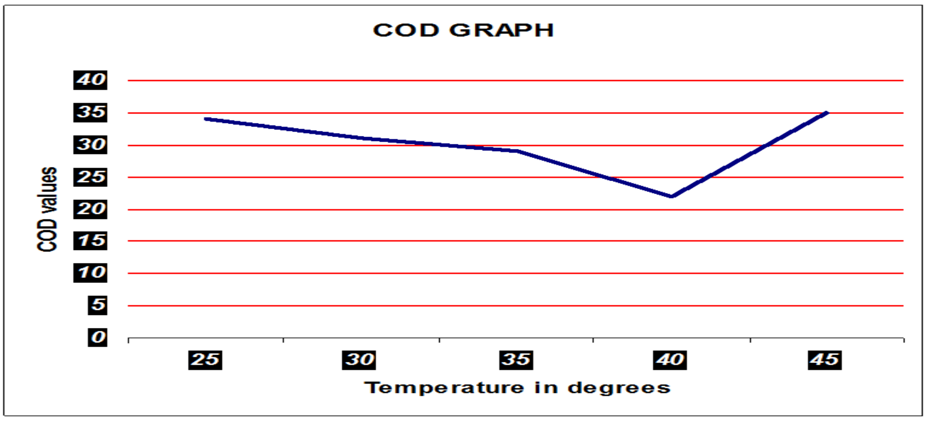
Sl. No.	Test	Results (mg/L)	Standard levels (mg/L) (Maximum)
1	COD	31	30
2	BOD	9	10

Trial no 3: Temperature maintained at 35^0 C

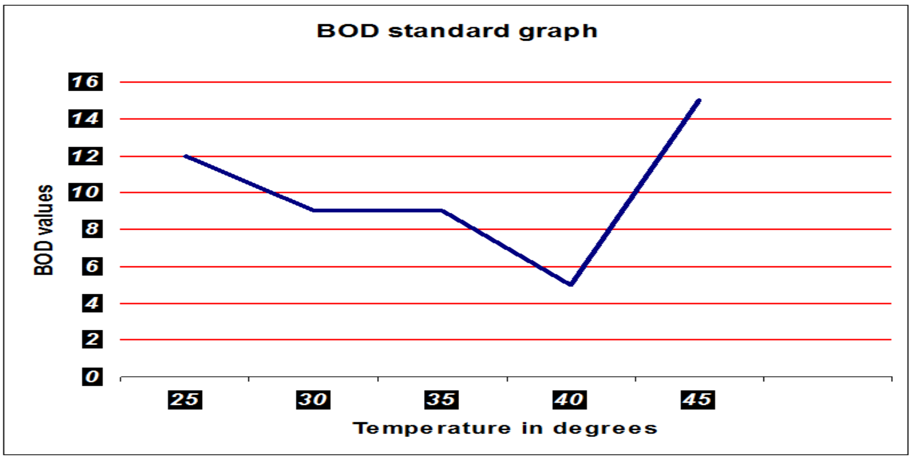
Sl. No.	Test	Results (mg/L)	Standard levels (ml/ltr) (Maximum)
1	COD	29	30
2	BOD	9	10

Trial no 4: Temperature maintained at 40^0 C

Sl. No.	Test	Results (mg/L)	Standard levels (mg/L) (Maximum)
1	COD	22	30
2	BOD	5	10



Effect of different temperatures on COD



Effect of different temperatures on BOD

4. DISCUSSION

The Results Of COD And BOD At Different Temperatures Were Determined As Below:

Trial no 1:

In this Temperature was maintained at 25^0 C. The COD and BOD values obtained were not within the standards.

Trial no 2:

In this Temperature was maintained at 30^0 C. The COD and BOD values obtained were not within the standards.

Trial no 3:

In this Temperature was maintained at 35^0 C. The COD and BOD values obtained were near to the standards.

Trial no 4:
In this Temperature was maintained at 40^0 C. The COD and BOD values obtained were within the standards.

When the results were compared the optimum temperature at which highest removal efficiencies was determined as 40^0 C for maintaining the Effluent Treatment Plant.

5. CONCLUSION

From the present study it can be concluded that the COD and BOD levels in Effluent treatment plant were greatly reduced when the temperature was maintained at 40^0C i.e. from 400-500 mg/L of BOD and 1000-1300 mg/L of COD were reduced to 5 mg/L of BOD and 22 mg/L of COD respectively.

It could be observed that at temperature higher than 30°C i .e; 40°C the removal efficiency of BOD and COD decreases because the activity of microorganism becomes lower after this temperature which means ability to remove pollutants decreases.

REFERENCES

1. Bodik, I., Herdova, B., & Kratochvil, K. (2000). The application of anaerobic filter for municipal wastewater treatment. *CHEMICAL PAPERS-SLOVAK ACADEMY OF SCIENCES*, *54*(3), 159-164.
2. Chuan, W. S. (2007). Performance of Upflow Anaerobic Sludge Blanket Reactor Treating Municipal Wastewater at Different Retention Times. *ME Dissertation, Kent Ridge: National University of Singaphore*.
3. Elmitwalli, T. A., Oahn, K. L., Zeeman, G., & Lettinga, G. (2002). Treatment of domestic sewage in a two-step anaerobic filter/anaerobic hybrid system at low temperature. *Water Research*, *36*(9), 2225-2232.
4. Gujer, W., & Zehnder, A. J. (1983). Conversion processes in anaerobic digestion. *Water science and technology*, *15*(8-9), 127-167.
5. Ladu, J. L. C., & Lü, X. W. (2014). Effects of hydraulic retention time, temperature, and effluent recycling on efficiency of anaerobic filter in treating rural domestic wastewater. *Water Science and Engineering*, *7*(2), 168-182.
6. Uldal, M. (2008). Effect of hydraulic loading variation on a pilot scale UASB reactor treating domestic wastewater at Vapi CETP, India. *Water and Environmental Engineering, Indian Institute of Technology, Kanpur*.
7. Lettinga, G., Roersma, R., & Grin, P. (1983). Anaerobic treatment of raw domestic sewage at ambient temperatures using a granular bed UASB reactor. *Biotechnology and bioengineering*, *25*(7), 1701-1723.
8. Luostarinen, S., Sanders, W., Kujawa-Roeleveld, K., & Zeeman, G. (2007). Effect of temperature on anaerobic treatment of black water in UASB-septic tank systems. *Bioresource technology*, *98*(5), 980-986.
9. dos Santos, S. L., Chaves, S. R. M., & van Haandel, A. (2018). Influence of temperature on the performance of anaerobic treatment systems of municipal wastewater. *Water SA*, *44*(2), 211-222.