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Characterization and Treatment of Industrial Effluent by Trickling Filter

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ABSTRACT

Biological wastewater treatment methods are classified as suspended growth and attached growth. Activated sludge process and trickiling filters are examples of these types of methods. Removal of organic matter is main objective behind these treatment methods. In the present research wastewater from dye industries is treated by using trickiling filter. The trickilng bed was prepared by growing the microbial slim layer on the stone gravel filling. The dissolved oxygen, chemical oxygen demand and pH of the treated and untreated effluent was compared. In the present investigation about 75 percent of COD removal was obtained with 6 fold increase in dissolved oxygen.

Key words: Attached growth process, biological oxygen demand, dissolved oxygen, chemical oxygen demand.

INTRODUCTION

Industrial and industrial effuent contains organic matter, inorganic matter and pathogens. The metal ions and their derivatives are also present in wastewater. Various physical, chemical and biological methods can be used for wastewater treatment. The domestic effluent also needs treatment before disposal. The removal of organic matter is one of the main and important aspect of wastewater treatment. The physicochemical methods like adsorption are found to be very effective for removal of organic matter with COD removal ranging from 90 to 95 percent. [1-4] COD removal by various biological methods was also very effective. [5-8] Advanced methods such as membrane seperation were also used by few investigators. [9-11] Advanced methods such as advanced oxydation, ozonation, U.V. treatment are important from regeneration point of view. [12-15] The cost and sringent norms for effluent are driving forces for research on cost effective treatment of wastewater. Trickilng filters (TF) have simple operation and robust construction. The current research explores use of trickling filters for Wastewater treatment.

EXPERIMENTAL SET UP AND METHODOLOGY

Fig 1: Trickling Filter Tank

Trickling filter has been designed and fabricated at laboratory as shown in fig.1, with following details.
Material of construction: Mild steel
Volume of tank: 47liter
Since the tank includes cylindrical as well as conical shapes the dimensions are as follows:
Dimensions for cyclinder: Diameter of cylinder: 30 cm, Height of cylinder: 60cm

Dimensions for cone: Diameter of cone: 30cm, Height of cone: 20cm.

Procedure for making Filter media:

Two buckets were used as container to produce the micro organism in it. For developing the micro organism, in one bucket waste water fruit waste was kept with stone granules and second bucket was used to prepare synthetic wastewater. Only the waste water and sludge was used. The bucket was kept undisturbed for near about 8 days in open atmosphere. Slowly micro organism started developing in it. This was used in trickling filter as a filter media. Granules and sand was also used in it of different diameter as making the layer of it.

Working of trickling filter

- The container was kept at height so that flow rate can be adjusted accordingly.

The filter media was then transferred into trickling filter.

- Alternate layers of sand were created.
- Inlet Flow rate was maintained of 60ml per minute and it is kept fixed throughout the entire procedure.
- After every 30 minute sample (20 ml) was collected in beaker from bottom of trickling filter
- Total 5 sample were collected after every 30 minute.

Preparation of solution:

- **Manganese sulphate solution**: 48gms of $MnSO_4.2H_2O$ was dissolved in water and volume was made up to mark in 100ml volumetric flask.
- **Alkaline Potassium iodide solution**: 125 gm. NaOH & 37.5 gm. at KI was dissolved in D.W. (H_2O) & diluted to mark in 250 ml volumetric flask.
- **Standardization of sodium thiosulphate**: about 0.6 – 0.7 gm of AR grade $Na_2S_2O_3$ $5H_2O$ was dissolved in 100 ml distilled water, next 10ml of 0.025 N ($K_2Cr_2O_7$) & potassium dichromate and 10ml of conc. HCL acid are mixed in conical flask. Also mixture was added with 6ml of 10% KI and was kept in dark for 5 minutes to liberate I_2, the sides of the flask were washed with 10 ml water and shaken well. Then titrated with newly prepared thiosulphate solution till strew yellow colour was obtained then starch solution was added and titrated to a light green & product
- **Starch solution:** A small quantity of distilled water was also added to about 0.5mg of soluble starch (A.R.) taken in beaker. The mixture was stirred with a glass rod and heated to make transparent paste. This was added to 100ml of boiling distilled water with constant string & Cooled.
- BOD bottle was taken & 200 ml of water sample was added into it.
- 2 ml of manganese sulphate & 2 ml of alkali iodide solution was also added to the BOD bottle. The top of the pipette should below the Liquid level, while adding these agents.
- It was stoppered to exclude air bubble and mix by repeatedly inserting the bottle 2-3 times.
- If no O_2 is present the manganese ion reacts with hydroxide ion to form white ppt. of $Mn(OH)_2$, if O_2 is present Mn^{++} is oxidized to Mn^{+} and ppt. is brown coloured.
- After shaking and allowing sufficient time for all O_2 to react and settle, liquid within upper portion was seperated.
- 2ml of concentrated H_2SO_4 was added.
- The bottle was inverted & mixed by inverting until the suspension completely dissolved and yellow colour is uniform throughout the bottle.

$MnO_2+2I^{-}+4H^{+}\rightarrow Mn^{++} +I_2 +2H_2O$

- A volume of 20ml was taken to conical flask and titrated into conical flask with 0.025N sodium thiosulphate solution until yellow colour iodine turns to pale straw colour.
- Since it was impossible to accurately titrate the sample to colourless liquid 1-2 ml of starch was added.
- Continued titration was made to the 1st disappearance of the blue colour.D.O. and COD of effluent samples are shown in table 1 and 2.

RESULTS AND DISCUSSION

Table 1: Dissolved Oxygen Characterization

Wastewater (ml)	$K_2CR_2O_7$ (ml)	Burette reading (ml)	DO (mg/lit)
190	10	4.1	4.1
180	20	4.9	4.9
170	30	5.8	5.8
160	70	6.2	6.2
150	50	8.4	8.4

Table 2: COD Characterization

Sludge(ml)	Effluent (ml)	CBR (ml)	COD (mg/lit)
50	0	9.2	584
40	10	14.7	144
30	20	13.5	240
20	30	12.3	336
10	40	11.9	368

Table 3: COD, DO and pH of Treated Effluent

Tests	Initial	Final
Ph	5	7
DO(Mg/L)	1.32	8.4
COD(Mg/L)	584	144

From table 3, percent COD removal=[(Initial COD - Final COD)/Initial COD]x100=[(584-144)/584]x100=75.34

It can be observed from the above results that it was possible to remove 75.34 percent organic matter(measured as COD) from effluent sample. Also, the DO level of treated water increased from 1.32 mg/l to 8.4 mg/l.

CONCLUSION

Biological treatments with trickiling filters are effective for removal of organic matter from the efflent. In the present investigation for 584 mg/l of chemical oxygen demand, about 75 percent of initial, was treated succesfully. Trickiling filters are robust and efficient. The main advantage of trickling filters is that they can handle shock loads. Also TFs produce less sludge and are easy to operate.

REFERENCES

1. Sunil Jayant Kulkarni, A Review on Packed Bed Removal of Organic Matter from Wastewater, Int. Journal on Scientific Research in Science, Engineering and Technology, 2015,1,(2), 27-30.
2. Sunil J. Kulkarni, Removal Of Organic Matter From Domestic Waste Water By Adsorption, International Journal Of Science, Engineering And Technology Research, 2013, 2(10),1836-1839.
3. Sunil J. Kulkarni, Ajaygiri K. Goswami, Adsorption Studies for Organic Matter Removal from Wastewater by Using Bagasse Flyash in Batch and Column Operations, International Journal of Science and Research, 2013, 2(1), 180-183.
4. Sunil J. Kulkarni, Modeling for Adsorption Columns for Wastewater Treatment: a Review, International Journal of Innovative Research in Engineering & Multidisciplinary Physical Sciences, 2014, 2(2), 7-11.
5. Pallavi Amale, Sunil Kulkarni, Kavita Kulkarni, A Review on Research for Industrial Wastewater Treatment with Special Emphasis on Distillery Effluent, International Journal of Ethics in Engineering & Management Education, 2014, 1(9), 1-4.
6. Sunil Jayant Kulkarni, A Review on Packed Bed Removal of Organic Matter from Wastewater, Int. Journal on Scientific Research in Science, Engineering and Technology, 2015,1,(2), 27-30.
7. Er. Kiran D. Bhuyar, Treatment Of Domestic Wastewater In An Up Flow Anaerobic Packed Bed Reactor (UAPBR), International Journal of Advanced Engineering Research and Studies, 2013, 2(2), 122-124.
8. Sunil J. Kulkarni, Removal of phenol from Effluent in Fixed Bed: A Review, International Journal of Engineering Research and General Science, 2014, 2(5), 35-39.
9. Sunil J. Kulkarni, Ajaygiri K. Goswami, Applications and Advancements in Treatment of Waste Water by Membrane Technology- A Review, International Journal Of Engineering Sciences & Research Technology, 2014, 3(9), 446-450.
10. Rashmi Vinod Dahake, A.K.Goswami, Dr. V. Kalyanraman, S.J.Kulkarni, Performance Evaluation Of Hybrid Membrane Bioreactor For Low Strength Wastewater Treatment, International Journal of Science, Engineering and Technology Research (IJSETR),2013,2(2),2167-2169.

11. Pawar Avinash Shivajirao, Treatment Of Distillery Wastewater Using Membrane Technologies, International Journal of Advanced Engineering Research And Studies, 2012, 1(3), 275-283.
12. Sunil J. Kulkarni, Pallavi M. Kherde, A Review On Advanced Oxidation Method For Waste Water Treatment, International Journal Of Engineering Sciences & Management Research, 2015, 2(8),33-38.
13. Geeta Chittala, G Sekaran, Paul S Mogadati and M Anjireddy, "Chemoautotrophic Activated Carbon Oxidation: An Advanced Oxidation Process For The Reduction Of Sulphate In Pharmaceutical Effluent", Int. J. LifeSc. Bt & Pharm. Res. , 2012, 1(1), 327-324, 2012.
14. Sunil J. Kulkarni, A Review On Studies And Research On Applications Of Ozonation And U.V. Treatment With Emphasis On Water Disinfection, International Journal Of Research And Review, 2(12),764-768,2015.
15. V. De Bock, H. De Backer, R. Van Malderen, A. Mangold, and A. Delcloo, Relations between erythemal UV dose, Global Solar Radiation, Total Ozone Column And Aerosol Optical Depth At Uccle, Belgium, Atmos. Chem. Phys., 2014, 14, 12251–12270.

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