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Review Article

Research on Advanced Biological Effluent Treatment: A Review

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ABSTRACT

Effluent treatment can be carried out by various biological, physical and chemical methods. Physical treatment techniques are used for removal of coarser materials from the water followed by biological and chemical treatments. Removal of many organic matters is generally carried out by biological methods. Biological treatment can be either attached growth or suspended growth. The selection of biological treatment depends on quality of effluent and the percentage removal required. Biological treatments are also used for selective removal of many heavy metals, phosphorous and other pollutants. The current review summarizes the research and advancements in biological treatments.

Key words: organic matter, heavy metals, percentage removal, activated sludge process.

INTRODUCTION

The removal of organic matter from wastewater can be carried out by using various primary, secondary and tertiary treatment methods. In primary treatment, physical methods such as screening, sedimentation are used for removal of coarser and settleable pollutants. In secondary treatments attached growth processes such as biotowers and trickling filters or suspended growth processes such as activated sludge process are used. Tertiary treatment generally contains advanced methods such as membrane separation, adsorption, and ultra filtrations. Other important pollutant in many industries is heavy metal. Various investigators have successfully used activated sludge process and trickling filters for removal of organic matter and heavy metals. [1-4]

The application of adsorption for removal of organic matter and heavy metals on low cost adsorbents is also widely studied area of research. [5-7] The percentage removal for organic matter is reported to be more than 90 percent by using various adsorbents. [8-11] The heavy metal removal was also observed to be more than 95 percent in some investigations. [12-14] The biological methods are widely accepted because of applicability, simplicity and performance. The present review summarizes the advancements and research in the wastewater treatment by biological methods.

RESEARCH ON ADVANCED BIOLOGICAL TREATMENT: Manfe et.al investigated biological removal of Cr (VI) from contaminated wastewater using

biosorbent prunus amygdalus (almond) nut shell carbon. [15] They studied uptake capacity of biosorbent as a function of contact time, pH, adsorbate concentration and adsorbent dose. They observed the equilibrium contact time to be 6 hr. The optimum pH value was obtained to be 6. Laboratory experiments of biological oxidation of the process water after the dephenolation stage were carried out by Kamenev et.al. [16] According to the studies, shale phenols were generally quite easily degradable when the need for phosphorus is covered by added reagents. It was also observed that aerobic bio-oxidation with ozonation in re-circulation system, enabled to increase the efficiency of purification at relatively low ozone dosages.

Hassani et.al carried out investigation on treatment of Waste Water Containing Ethylene Glycol (EG) using Ozonation. [17] Ethylene glycol is usually used in synthetic fibers, films, antifreeze, resins, explosives, fibers, paper, leather, protective coatings, printing inks and textile. They achieved EG removal 93.31, 89.96, and 85.01 %, at concentrations of 10, 20 and 50 mg/L after 180 minutes respectively. Advanced oxidation methods were used for removal of dyes by Kosogina et.al. [18] Borkar et.al. investigated moving bed biofilm reactor (MMBR) for wastewater treatment. [19] According to them, the benefits of both the activated sludge process and conventional fixed film systems without their disadvantages can be obtained in MMBR. In this system, biomass grows on plastic supports that move in the biological reactor via agitation generated by aeration systems (aerobic reactors) or by mechanical systems (in anoxic or anaerobic reactors).

Jogdand et.al, studied remediation of textile industry waste water using immobilized aspergillus terreus. [20] They monitored the pollution in terms of Biological oxygen demand (BOD) and Chemical oxygen demand (COD).They used the strain Aspergillus terreus for its efficiency to decolorize and decrease BOD and COD values of the effluent. Zhu et.al, investigated the effect of limited aeration on swine manure phosphorus removal. [21] On laboratory scale they investigated two low level aeration schemes (intermittent vs. continuous). They observed 80% reduction in soluble P when the manure pH was increased to 8. They observed drastic increase in pH for both aeration schemes within the first day of test, resulting in a 76% reduction in soluble P concentration in the liquid.

Torobi et.al carried out investigation on removal of ammonium (NH_4) and organic matter (COD) in landfill leachate. [22] They observed that reduction of ammonium started happening after 24 hours up to 96 hours. After this the reduction did not happen. They also observed that the concentration of ammonium in the processed leachate after 96 hours was 5.5mg/L. The percentage of ammonium reduction reached 98.36 percent in this period. Chen et.al, investigated occurrence and treatment of wastewater-derived organic nitrogen. [23] They observed 52% DON in total dissolved nitrogen (TDN) in tertiary treated effluents. They also observed that lime softening (with pH 11.3-11.5) removed <25% of DON and DOC without selectivity. According to these studies, in-situ biological treatment using soil systems or rivers does seem to remove part of the DON. Vijayabhanu and Radha carried out survey on anaerobic wastewater treatment plant based on effluent COD. [24] Their paper revealed most of the techniques in the field of anaerobic wastewater treatment plant (WWTP) for the Prediction of COD.

Pramanik et.al studied biological aerated filters (BAFs) as an emerging wastewater treatment technology designed for a wide range of municipal and industrial

applications. [25] In their review, they presented the influence C/N ratio, nitrification and denitrification principle, effect of pH, DO and alkalinity on the nitrification and denitrification systems, organic and hydraulic loading of BAF reactor, etc. The study indicated that, under the optimal conditions, significant amount of COD, ammonia-nitrogen and total nitrogen were removed. A review on sewage water treatment was carried out by Topare et.al. [26] According to them, effective wastewater collection and treatment are of great importance from the standpoint of both; environmental and public health. In their paper they discussed sewage/Wastewater treatment techniques, factors affecting selection and design Sewage/Wastewater systems.

Sandhu and Pandey studied energy saving possibilities in wastewater treatment plant. [27] They highlighted that, in a conventional waste water treatment plant, working on conventional activated sludge process, a portion of energy is spent in operation of the primary clarifiers. According to them, if the extended Aeration process is followed, the energy spent in the operation of primary clarifiers will not be required.

Yasar et.al, investigated color and COD removal of raw and an aerobically biotreated combined industrial waste water. [28] They used ozone for the purpose. According to these investigations, ozonation resulted in 81% color and 75% COD removal (100 mg O_3/80 mg COD) while for raw wastewater 25 min ozonation furnished 51% color and 67% COD removal (250 mg O_3/345 mg CO D).At optimized conditions, they were able to remove 100 percent colour and 96 percentage COD from the wastewater. Chaudhary et.al, reviewed application of biofilter in wastewater treatment. [29] According to them biofilter is one of the most promising alternative for removal of organic matter from water. According to them, the crucial point for the successful operation of a biofilter is to control and maintain a healthy biomass on the surface of the filter. Attachment, growth and decay of microorganisms are three important steps in this process. The emphasized the importance of incorporating the biofilter parameters estimated for different operating conditions.

CONCLUSION

Water pollution affects ecology and environment. It can also cause severe health problems. There is need to aware the people about the water pollution. Biological treatments are very effective in removing various pollutants from wastewater. The biological processes can be combined with techniques like membrane filtration for increasing the removal efficiency of the treatment process. Aerobic or anaerobic treatments are very effective alternate for wastewater and sewage treatment. Anaerobic method can also synthesize fuel as a byproduct. Selection of appropriate method depends on the composition and quantity of the waste water.

REFERENCES

1. K. Rani, V. Sridevi, R. Srinu Venkat Rao, K. Vijay Kumar, N. Harsha, Biological Treatment Of Distillery Waste Water - An Overview, International Journal of General Engineering and Technology, 2013, 2(4),. 15-24.
2. 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.
3. Bruce E. Logan, Slawomir W. Hermanowiz, Denny S. Parker, A Fundamental Model for Trickling Filter,

Journal Water Pollution Control Federation, 1987,1029-1032.
4. 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.
5. 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 (IJSR), 2013, 2(11), 180-183.
6. 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.
7. Kulkarni Sunil J., Patil Suhas V. Tapre Ravi W., Goswami Ajaygiri K., Adsorption of Chromium from Wastewater on Different Adsorbents, Int. J. Res. Chem. Environ. , 2013, 3(1), 231-236.
8. Dinesh Mohan, Kunwar P. Singh, Vinod K. Singh, Wastewater treatment using low cost activated carbons derived from agricultural byproducts-A case study, Journal of Hazardous Materials,2008, 152(3), 2045-1053.
9. Sunil J. Kulkarni, Suhas V Patil, and Y. P. Bhalerao, Fly ash Adsorption Studies for Organic Matter Removal Accompanying Increase in Dissolved Oxygen, International Journal of Chemical Engineering and Applications, 2011, 2(6), 434-438.
10. Sunil J. Kulkarni, Sonali R. Dhokpande, Dr. Jayant P. Kaware, Studies On Flyash As An Adsorbent For Removal Of Various Pollutants From Wastewater, International Journal of Engineering Research & Technology (IJERT), 2013,2(5), 1190-1195.
11. A.A. Ahmad, B.H. Hameed ,Reduction of COD and COD of dyeing effluent from a cotton textile mill by adsorption onto bamboo-based activated carbon Journal of Hazardous Materials,2009, 172(3-2), 1538-1543.
12. Zahra Saadi, Reyhane Saadi and Reza Fazae, Fixed-bed adsorption dynamics of Pb (II) adsorption from aqueous solution using nanostructured γ-alumina", Journal Of Nanostructure in Chemistry 2013, Vol. 3 No.1, pp.1-8, 2013.
13. Kailas L. Wasewar, "Adsorption of Metals onto Tea Factory Waste: A Review", International Journal of Research and in Applied Science, 2010, 3, 303-322.
14. A. K. Goswami, S. J. Kulkarni, S. K. Dharmadhikari, Adsorption of Copper (II) ions from Synthetic Waste Water By Teak Leaves, International Journal of Scientific Research in Science, Engineering and Technology (ijsrset.com), 2013, 2(6),1356-1359.
15. Mosleh M. Manfe, S. J. Attar, M. Parande And Niraj S. Topare, Treatment Of Cr (Vi) Contaminated Waste Water Using Biosorbent Prunus Amygdalus (Almond) Nut Shell Carbon, Int. J. Chem. Sci., 2012, 10(2), 609-618.
16. I. Kamenev, R. Munter, L. Pikkov, "Wastewater Treatment In Oil Shale Chemical Industry", Oil Shale, 2003, 20(4), 443-457.
17. A. H. Hassani, S.M. Borghei, H. Samadyar, S. A. Mirbagheri, A. H. Javid, Treatment Of Waste Water Containing Ethylene Glycol Using Ozonation: Kinetic And Performance Study", Bull. Env. Pharmacol. Life Sci., 2013, 2 (9) , 78-82.
18. Iryna Kosogina, Igor Astrelin, Grigorii Krimets And Nataliia Vereshchuk, The Process Of Wastewater Treatment With Advanced Oxidation Methods To Remove Dye, Chemical Technology, 2014, 8(3), 365-370.
19. Borkar R.P, Gulhane M.L, And Kotangale A.J, Moving Bed Biofilm Reactor - A New Perspective In Wastewater Treatment, Iosr Journal Of

Environmental Science, Toxicology And Food Technology,2013, 6(6),15-21.
20. Vinod G. Jogdand, Prajakta. A. Chavan, Pramod D. Ghogare And Ajaykumar G. Jadhav, Remediation Of Textile Industry Waste Water Using Immobilized Aspergillus Terreus, European Journal Of Experimental Biology, 2012, 2(5),1550-1555.
21. Jun Zhu, Ancheng Luo, And Pius M. Ndegwa, the Effect of Limited Aeration on Swine Manure Phosphorus Removal, J. Environ. Sci. Health, 2001, B36 (2), 209-218.
22. Pieter M. I. Torobi, Christina N. Manuputty, Jubhar C. Mangimbulude, Removal Of Ammonium (NH4) And Organic Matter (COD) In Landfill Leachate Under Anaerobic And Aerobic Algae Culture In Continuous Systems, Global Advanced Research Journal Of Microbiology, 2015, 4(4) , 054-059.
23. Baiyang Chen, Youngil Kim, Paul Westerhoff, Occurrence and Treatment of Wastewater-Derived Organic Nitrogen, Water Research, 2011, 45, 4641 - 4650.
24. R.Vijayabhanu, V.Radha, A Survey On Anaerobic Wastewater Treatment Plant Based On Effluent COD, The International Journal Of Computer Science & Applications, 2013, 2(2), 59-69.
25. Biplob Kumar Pramanik, Suja Fatihah, Zain Shahrom, Elshafie Ahmed, Biological Aerated Filters (BAFs) For Carbon And Nitrogen Removal: A Review, Journal Of Engineering Science And Technology, 2012, 7(4), 428 - 446.
26. Niraj S. Topare, S. J. Attar And Mosleh M. Manfe, Sewage/Wastewater Treatment Technologies: A Review, Sci. Revs. Chem. Commun, 2011, 1(1), 18-24.
27. Deepika Sandhu, Ruchi Pandey, Energy Saving Opportunity In A Waste Water Treatment Plant, International Journal Of Innovative Technology And Exploring Engineering, 2014, 3(9),66-68.
28. A. Yasar, N. Ahmad, M. N. Chaudhry, M. S. U. Rehman, A. A. A. Khan, Ozone For Color And Cod Removal Of Raw And Anaerobically Biotreated Combined Industrial Wastewater, Polish J. Of Environ. Stud., 2007, 16(2), 289-294.
29. Durgananda Singh Chaudhary, Saravanamuthu Vigneswaran, Huu-Hao Ngo,Wang Geun Shim And Hee Moon, Biofilter In Water And Wastewater Treatment, Korean J. Chem. Eng., 2003, 20(6), 1054-1065.

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