International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

A Review on Removal of Organic Matter from Waste Water Using Activated Sludge Process

Pratibha R. Gawande[1], Kalyan I. Patil[2]

[1]Datta Meghe College of Engineering, Airoli, Navi Mumbai, Maharashtra, India

[2]Tatyasaheb Kore Institute of Engineering and Technology, Warananagar, Kolhapur, Maharashtra, India

Abstract: ***Activated sludge process is the biological aerobic wastewater treatment that uses micro-organisms and air to biologically oxidize the organic pollutants. This uses naturally occurring bacteria and protozoa thus it is eco-friendly as well as economical process. Activated sludge process was found to be effective method with scope for further research in terms of cost effectiveness, good quality effluent, efficient removal of BOD and COD.***

Keywords: Activated sludge process, BOD5, COD, Microorganisms.

1. Introduction

Water is a vital natural resource which is essential for a multiplicity of purposes. As a source of life for man, plants and other forms of life it cannot be replaced. Safe drinking water is essential to humans and other life forms. Access to safe drinking water has improved over the last decades in almost every part of the world, but approximately one billion people still lack access to safe water and over 2.5 billion lack accesses to adequate sanitation. However, some observers have estimated that by 2025 more than half of the world population will be facing water-based vulnerability. Water plays an important role in the world economy, as it functions as a solvent for a wide variety of chemical substances and facilitates industrial cooling and transportation. In the chemical process industry water is used as a reaction medium, a solvent, a scrubbing medium, and a heat transfer agent.

This natural resource is becoming scarcer in certain places, and its availability is a major social and economic concern. Currently, about a billion people around the world routinely drink unhealthy water. Most countries accepted the goal of halving by 2015 the number of people worldwide who do not have access to safe water and sanitation. Even if this difficult goal is met, it will still leave more than an estimated half a billion people without access to safe drinking water and over a billion without access to adequate sanitation. Poor water quality and bad sanitation are deadly; some five million deaths a year are caused by polluted drinking water. The World Health Organization estimates that safe water could prevent 1.4 million child deaths from diarrhea each year. Water, however, is not a finite resource, but rather re-circulated as potable water in precipitation in quantities many degrees of magnitude higher than human consumption.

Therefore, it is the relatively small quantity of water in reserve in the earth (about 1% of our drinking water supply, which is replenished in aquifers around every 1 to 10 years), that is a non- renewable resource, and it is, rather, the distribution of potable and irrigation water which is scarce, rather than the actual amount of it that exists on the earth. Water-poor countries use importation of goods as the primary method of importing water (to leave enough for local human consumption), since the manufacturing process uses around 10 to 100 times products' masses in water. In the developing world, 90% of all wastewater still goes untreated into local rivers and streams. Some 50 countries, with roughly a third of the world‘s population, also suffer from medium or high water stress, and 17 of these extract more water annually than is recharged through their natural water cycles. The strain not only affects surface freshwater bodies like rivers and lakes, but it also degrades groundwater resources.

One of the major problems faced by human race today is to provide clean water to the vast majority of population all around the world. With fresh water sources as rivers, canals and estuaries, etc limited and those available being polluted by indiscriminate discharge of industrial pollutants and other processes, making fresh water much cherished commodity now a days. The widening gap between demand and supply of water comes in the way of sustainable development. Thus in the wake of 21st century, emphasis is being laid on reduction, recycle and reuse of natural resources such as fresh water. Thus for recycling and reusing the waste water that leads to reduction of fresh water consumption and for treating difficult waste waters, there is an urgent need to develop innovative, more effective and inexpensive technique of waste water treatment. Waste water treatment is closely related to the standards for expectation set for the effluent quality. The processes are designed to achieve improvement in the quality of waste water. The various treatment processes may reduce following: suspended solids, biodegradable organics, pathogenic bacteria, nutrients.

2. Literature Review

Adaptation of bagasse fly ash, a sugar industry solid waste into zeolite material for the uptake of phenol was studied by Shah.[1] Ahamaruzzaman has studied Role of fly ash in removal of organic pollutants from wastewater.[2] Removal of dissolved organic matter by granular-activated carbon adsorption as a pre-treatment to reverse osmosis of membrane bioreactor. Bioreactor effluents were studied by Reznik.[3] Marin and Beiras have carried out work on

adsorption of different types of dissolved organic matter to marine phytoplankton.[4]

Matilainen et al. presented coagulation and flocculation as effective methods for removal of natural harmful organic matter from water. [5]Ren et al. experimentally reported the application of carbon nanotubes (CNTs) as a new type of adsorbents for the removal of various inorganic and organic pollutants, and radionuclides from large volumes of wastewater.

Hami et al. investigated effective use of powdered activated carbon (PAC) on the performance of a pilot-scale laboratory dissolved air flotation (DAF) unit. Experimental findings shows that for dosages of activated carbon in the range of 50–150 mg/l, the removal efficiencies for BOD increased from 27–70% to 76–94% while those for COD increased from 16–64% to 72–92.5% for inlet values of 45–95 mg/l and 110–200 mg/l for BOD and COD respectively. [6]

Alvarez et al. reported the application of a simultaneous combination of ozone and granular activated carbon as a tertiary treatment of a wastewater generated from the activity of various food-processing industries. [7]

Chaudhari et al. carried out experimental investigations on the removal of molasses-derived colour and chemical oxygen demand from the bio digester effluent of a molasses-based alcohol distillery effluent treatment plant using inorganic coagulants. Flocculation with carbon was found to be a better alternative to the conventional aerobic treatment process of the bio digester effluent.[8]

Mohana et al. presented an overview of the pollution problems caused by distillery spent wash, the technologies employed globally for its treatment and its alternative use in various biotechnological sectors.[9] Satyawali and Balakrishnan presented a review of the existing status and advances in biological and physico-chemical methods.[10]

COD is the amount of oxygen consumed for oxidizing the organic matter. In the present study the oxidizing agent used is potassium dichromate.[11] Hyung and Kim have used natural organic matter for adsorption to multi-walled carbon nanotubes and also observed the effect of natural organic matter characteristics and water quality parameters.[12]

Treatment of industrial waste was carried out by M. Schwartz.[13] Eddy et.al.wastewater engineering treatment and wastewater engineering.[14]Sewage treatment and disposal was investigated by Modi[15]

Oxygen consumption values can be used to quantify the amount of organic matter present in the wastewater. The typical COD and BOD of the distillery effluent are 70000-100000 and 45000-60000 respectively. By using primary and secondary treatment it can be brought down to 5000 – 8000. For further removal of organic matter many advanced methods have been tried. The UASB reactor for post treatment of distillery waste water was reported by Musee.[16]

A Distillery spent wash was treated in the hybrid anaerobic reactor by Gupta and Singh.[17 Wentzel et,al.(1985)developed effluents generated from the distillery were treated in two stage anaerobic-aerobic biological system. This set up has been developed for purpose of treating winery effluent

Borja and Seghezzo et.al 1998,in addition to COD and BOD pollution wine distillery wastewater contain phenolic compounds mainly gallic acid, pcoumaric acid and gentisic acid which is impart high antibacterial activity.[18]

Coetzee et.al the aerobic treatment systems are used mainly to remove the BOD of the waste .The partial reduction of BOD is achieved in many distilleries using biological treatment.[19] Natraj et, al 2006, Chemical oxygen demand was considerably reduced in distillery wastewater in India in order to reduce the cost of waste water disposal. This process emphasized the recovery and recycling of valuable chemicals contained in waste water.[20]

3. Conclusion

This paper review the various papers published in journals on the activated sludge methods of waste water treatment which are the most economical and widely used for removing organic components from waste water. The pollution load was estimated by Chemical Oxygen Demand (COD). On the basis of the present study, suitable treatment technology can be developed for the treatment of industrial wastewater. Based upon this review, further work is proposed to study the nitrogen removal in addition to BOD5 and COD in ASP. In addition, effect of different MLVSS concentration and detention time on the efficiency of settling tank may be investigated.

References

[1] B.Shah, R.Tailor, and A.Shah, “Adoptation of baggase fly ash sugar industry solid into zeolite material for the uptake of phenol” Env.progess and sustainable Energy 30(3), 2011, 358-367.
[2] M.Ahamaruzzaman, “Role of fly ash in Removal of organic pollutants from wastewater”, Energy Fuels, 23 (3), 2009, 1494–1511.
[3] S.G. Reznik, I. Katz, C.G.Dosoretz, “Removal of dissolved organic matter by granular-activated carbon adsorption as a pre-treatment to reverse osmosis of membrane bioreactor effluents”, Water Research, 42(4), 2008, 1595-1605.
[4] P S. Marin and R. Beiras “Adsorption of different types of dissolved organic matter to marine phytoplankton and implications for phytoplankton growth and Pb bioavailability”, J. Plankton Res., 33(9), 2011, 1396-1409.
[5] A.Matilainen, M. Vepsalainen, and M. Sillanpaa “Natural organic matter removal by coagulation during drinking water treatment: A Review”, Adv. in Colloid and Interface Sci., 159(2), 2010, 189-197.
[6] M.L. Hami, M.A. Al-Hashimi, and M.M. Al-Doori, “Effect of activated carbon on BOD and COD removal

in a dissolved air flotation unit treating refinery wastewater", Desalination, 216(1-3), 2007, 116- 122.
[7] P.M.Álvarez, J.P.Pocostales, and F.J. Beltran "Granular activated carbon promoted ozonation of a food-processing secondary effluent", J. Hazard. Materials, 185(2-3), 2011, 776-783.
[8] P. K.Chaudhari, I. M.Mishra, and S. Chand "Decolourization and removal of chemical oxygen demand (COD) with energy recovery: Treatment of bio digester effluent of a molasses-based alcohol distillery using inorganic coagulants", Colloids and Surfaces Physicochemical. Eng. Aspects, 296(1-3), 2007, 238-247.
[9] S. Mohana, B.K.Acharya, and D.Madamwar "Distillery spent wash: Treatment technologies and potential applications – A Review", J. Hazard. Materials, 163(1), 2009, 12-25.
[10] Y. Satyawali, and M. Balakrishnan, "Wastewater treatment in molasses-based alcohol distilleries for COD and colour removal-A review", J. Environ. Mgmt., 86(3), 2008, 481-497.
[11] H.E. Reader and W.L. Miller, "Effect of estimations of ultraviolet absorption spectra of chromophoric dissolved organic matter on the uncertainty of photochemical production calculations", J. Geophysical Research, 116(9), 2011, 1029-1039.
[12] H. Hyung and J.H. Kim, "Natural organic matter (NOM) adsorption to multi-walled carbon nanotubes: effect of NOM characteristics and water quality parameters", Environmental Science and Technology, 42(12), 2008, 4416-4421.
[13] E. B. Besselievne, and M. Schwartz, "The Treatment of Industrial Waste" 2nd ed., McGraw Hill Koga Kusha Ltd, 1976.
[14] Metcalf and Eddy "Wastewater Engineering, Treatment and Reuse" 4th ed., Tata McGraw Hill, 2003.
[15] P.N.Modi "Sewage Treatment and Disposal and Wastewater Engineering" Standard Book house Delhi, 1st ed., 280-300, 2001.
[16] N. Musee, M.A. Trerise, and L. Lorenzen, "Post-treatment of Distillery Wastewater after UASB using Aerobic Techniques", S. Afr. J. Enol. Vitic, 28(1), 2007, 50-53.
[17] S. K. Gupta, and G. Singh "Anaerobic Hybrid Reactor – A promising Technology for the Treatment of Distillery Spent Wash", J. Indian School of Mines, 11(1), 2007, 25-38
[18] Borja, R, Martin A Maestra ,R Lugue M and Duran J1993 enhancement of Anaerobic digestion of wine distillery wastewater by removal of phenolic inhibitors Bioresour Technol 45,99-104.
[19] Coetzee G., Malandra L.,Wolfaardt G.M.andViljoen Bloom M.2004 "Dynamics of microbial bio film in rotating biological contractor for the treatment of winery effluent". Water SA30 (3)407-712.
[20] Natraj ,S.K.Hosamani ,K.M.and Aminabhavi T.M.2006 "Distillary waste water treatment by the membrane based nanofiltration based on nanofiltration and reverse osmosis", water Res 40, 2349-2356.

Author Profile

Mrs. Pratibha R. Gawande is pursuing her master degree (Chemical) from T.K.I.E.T., Warananagar, Shivaji University, Kolhapur. She is working as Assistant Professor in Datta Meghe College of Engineering, Airoli,Navi Mumbai. Her area of interest includes membrane separation and technology and Adsorption.

Mr. Kalyan Patil, Chemical Engineer, was completed his M.E. (Chemical) from S.I.T., Tumkur, Bangalore University. And Pursuing Ph.D from T.K.I.E.T., Warananagar Shivaji University, Kolhapur. He is working as assistant professor in Tatyasaheb Kore Institute of Engineering and Technology, Warananagar. He has total Eighteen years teaching experience at UG level and PG level. He has published total nine papers in National and International Conference and journals.