Cost Effective Treatment Of Waste Water By Using Root Zone Treatment Theory

Mr. Gaikwad Akshay Satish., Mr. Kadam Akshay Suresh, Mr.Jagtap Ashish Sanjay, Mr.Karande Karan Tarachand
College Of Engg Phaltan
akshaykadam3388@gmail.com, jagtapashish43@gmail.com, karankarande19@gmail.com

***Abstract*—**More and more people throughout the world are living in urban centers the trend of urbanization represents important challenges in terms of water supply and wastewater management in developed as well as developing countries. So to fulfill the need of water in urban areas, it is necessary to make the reuse of the wastewater, But in case of reuse of the wastewater it is also keep in mind that treatment process should be of cost effective and should have less maintenance cost. Now a day's root zone treatment system is effective method of treatment of the wastewater, which has the great control on the BOD, COD, TDS, TSS and DO. The water treated by this system is used for gardening purpose mostly. So the wastewater treatment by the root zone treatment system is effective method for small villages' towns and cities to overcome the excess pressure on the local authorities due to the urbanization, many modern techniques in the development of infrastructure projects. The present paper describes the theoretical basis of wastewater treatment in the root zone of the wetland plants, the so called "root- zone method

Keywords- *BOD, COD, TDS, TSS, DO &root- zone method*

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I. INTRODUCTION

Urbanization is one of the most important demographic trends of our time. In 2008, the number of people living in urban centers worldwide has for the first time surpassed the number of people living in the rural areas. It is estimated that by 2050, the percentage urban population will reach nearly 70%. Urbanization represents a challenge for water and sanitation management in developed as well as developing countries. While cities in developed countries often struggle with high operation and the maintenance costs and decay of existing infrastructure, rapid urban growth in the developing world is seriously outstripping the capacity of most cities to provide adequate services for their citizens.

Urban settlements are the main source of the point source pollution. It is estimated that 90% of sewage in the developing world is discharged directly into the rivers, lakes without treatment of any kind. In case of the India data indicates the dismal scenario of the wastewater treatment. 71% of the total wastewater generated is collected, only 31.5% wastewater collected is treated and rest is left without treatment, i.e. about 23% generated wastewater gets treated and rest 77% wastewater disposed off without any treatment, which pollutes surface water and ground water aquifers as well. Unfortunately most of the cities in India have under drainage system provided to part of the population and lots of the sewage flows unsewered through open drains and nallahs. Also the maintenance of the sewerage system is again not satisfactory due to scarcity of funds and requires manpower, required machines as a result there is increased load on sewage treatment plants which degrades its treatment efficiency.

So to get efficient treatment of the wastewater root zone system is widely used now days. Root zone systems are the artificially prepared wetlands and vegetation growing on gravel/ sand mixtures and also known as constructed wetlands. This method combines the mechanical filtration, chemical precipitation and biological degradation in one step of the treatment of the wastewater. A number of factors like low operating cost , less energy required and also the less maintenance cost attribute to making root zone treatment system an attractive alternative for wastewater management. The process in the root zone treatment system to treat sewage begins with passing of raw effluent (after removing floating material and grit) horizontally or vertically through a bed of soil having impervious bottom. The effluents percolate through the bed of the soil that has all the roots of the wetland plants very thickly, nearly 2,500 types of bacteria and 10,000 types of fungi, which around roots, get oxygen from the weak membrane of the roots and aerobically oxidize the organic matter of the effluent**.**

The characteristics of the plant absorbing the oxygen through their leaves and passing it down to roots through their stems which are hollow, it utilize as the bio-pump. Away from the anaerobic digestion also takes place. The filtering action of the soil bed, the action with the fungi and chemical action with certain existing or added inorganic chemicals help in finally obtaining very clear and clean water. The root zone system is the complete biological and eco-friendly method of treatment of wastewater.

II. LITERATURE REVIEW

A..PAWASKAR S.R. Department of Advanced Studies and Research NIMS univer- sity, Jaipur, Raj., India.CorrespondingAuthor:

Email- satishrpawaskar11@gmail.com "APPLICATION OF MODIFIED ROOTZONE TREATMENT SYS- TEM FOR WASTE WATER TREATMENT WITHIN NALLAH AREA",Journal of Ecology and Environmental Sciences ISSN: 0976-9900 and E-ISSN: 0976-9919 , Volume 3, Issue 1, 2012, pp.-46-49. Available online at http://www.bioinfo.in/contents.php id=41

In this paper the modification in area required for bed is less than that of con- ventional RZTS.The various mofification

in conventional RZTS is made.The sewage flowing through nallahs joins rivers in untreated condition and cre- ates heavy risk of river pollution. The city sewage treatment plants also do not produce treated sewage of expected quality standards and is similar to nallahs waste water. This study investigated the effectiveness and techno economical feasibility for RZTS (Root zone treatment system) along with its modification. Other objective of the study was to work out with BOD, COD and TSS removal efficiency of modified RZTS and trickling bed model.

B..Kalpana Kumari Thakur, Avinash Bajpai, and Shailbala Singh Baghel Depart- ment of Chemistry, Sarojini Naidu Govt. P.G. College, Bhopal, (M. P.), India Makhanlal Chaturvedi University, Bhopal, (M. P.), India ""WASTE WATER TREATMENT THROUGH ROOT ZONE TECHNOLOGY WITH SPE- CIAL REFERENCES TO SHAPURA LAKE OF BHOPAL (M. P.), India" ,International Journal of Applied Science and Engineering 2014. 12, 3: 169-175

Horizontal surface flow constructed wetland/Root Zone Unit which was con- structed by Environmental Planning and coordination organization (EPCO) at Ekant Park, Bhopal. In this study samples of Waste Water from Inlet and Outlet of Root Zone System situated at Ekant park, Bhopal (M. P.) were collected quarterly from June 2011 to May 2012. Some physico-chemical pa- rameter namely dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), nitrate and phosphate were analyzed using standard methods. The result obtained indicates that the Root Zone System works effectively.

A. *Varne Ashok L. and Wagh K. K.Civil Engineering Department, Institute of En- gineering Education and Research, Nashik,Maharashtra (INDIA) "LOW COST TREATMENT OF SEWAGE USING ROOT ZONE TECHNOLOGY",J. Environ. Res. Develop. Journal of Environmental Research And Development Vol. 9 No. 02, October-December 2014.*

The operation and maintenance cost in case of conventional sewage treatment plant is estimated to about Rs 12 per 1000 litres. The study is conducted with pilot scale reactors on different types of plant species. The reactor of size 1.3m x 0.65m x 0.40 m made in PVC material was used for the study. Plants species were planted in the reactor and were irrigated initially with tap water. After stabilizing the reactor, different doses of sewage was applied at regular interval of 3 days and growth of plants was observed. After steady state is reached, hydraulic loading was determined to get zero discharge. The quality of treated waste water was assessed when the reactor was loaded with excess hydraulic loading. The reactor was found be very effective for sewage treatment.COD reduction of 88.18 percent, BOD reduction of 88 percent and solids reduction of 69.23 percent was observed during the study. The cost economics of Root Zone Technology was assessed to Rs 4.13 per 1000 Litters.

B. *.R Kaur, SP Wani, AK Singh and K Lal Indian Council of Agricultural Research, New Delhi, India "WASTE WATER PRODUCTION,TREATMENT AND USE IN INDIA", Water Technology Centre, Indian Agricultural Research In- stitute, New Delhi, India International Crops Research Institute for the Semi-Arid Tropics, Hyderabad.*

An estimated 38354 million litres per day (MLD) sewage is generated in ma- jor cities of India, but the sewage treatment capacity is only of 11786 MLD. Similarly, only 60 percent of industrial waste water, mostly large scale in- dustries, is treated. Performance of state owned sewage treatment plants, for treating municipal waste water, and common effluent treatment plants, for treating effluent from small scale industries, is also not complying with prescribed standards. Thus, effluent from the treatment plants, often, not suitable for household purpose and reuse of the waste water is mostly re- stricted to agricultural and industrial purposes.

C. *.Swapnil M. Kamble Assistant Professor, Department of Social Work, Shivaji University, Kolhapur (Maharashtra) "WATER POLLUTION AND PUB- LIC HEALTH ISSUES IN KOLHAPUR CITY IN MAHARASHTRA" ,International Journal of Scientific and Research Publications, Volume 4, Issue 1, January 2014 1 ISSN 2250-3153.*

Water pollution is the outcome of urbanization and overpopulation. Water pollution is caused due to over utilization of fertilizers by farmers, sewage from hotels, hospitals and homes and industries in the city. The polluted water of Panchganga has led to spread some dangerous infectious diseases like Diar- rhea, jaundice, gastro and fever etc. in Kolhapur city. Therefore; there is a need of government intervention with the help of active peoples participation.

E.Jayashreeq Dhote, Sangita Ingole and Arvind Chavhan ," REVIEW ON WASTE WATER TECHNOLOGIES", Department of Zoology ,Shri Shivaji Science College ; Narshi road , Amravati-444603,India.
Suggested that There are variety of options that may be used in the recovery and reuse of Waste Water.The natural treatment technologies are viable be- cause of their low capital costs, their easy in maintenance, their potentially longer life cycles and their ability to recover a variety of resources.

G. .Abdullahi Idris-Nda, Humuani Kaka Aliyu,Musa Dalil EFFECT OF RICE HUSK ASH ON PROPERTIES OF THE CHALLENGES OF DOMES- TIC WASTE WATER MANAGEMENT IN NIGERIA", International Journal of Development and Sustainability ,ISSN 2168-8662,VOL 2 NO.2 (2013).
They analyse the risk and challenges associated with domestic Waste Water management. The use of questionnaires, field survey, government documents, Global Positioning System and sampling of the Waste Water for laboratory analysis are the methods are used. The Waste Water collected is treated which involves removal of solids, inorganic and organic compounds, bacteria and algae.The water used as recycled for fire protection.
H.Ramprasad C Raikwar1, Vandana Tare EXPERIMENTAL STUDY ON WASTE WATER TREATMENT USING LAB

SCALE REED BED SYSTEM USING PHARMITIES AUSTRLIES,International Journal Of Environmental Sciences Volume 3,No 1,2012.ISSN 0976-4402.

He compared conventional treatment method with the method of purification using Reed Bed and root zone .The reed bed is one of the natural and cheap method. It is reliable for Secondary and Tertiary treatment method.

I.Desitti Chaitanykumar,Syeda Azeem Unnisa,Bhupatthi Rao and G Vasanth Kumar EFFICIENCY ASSESSMENT OF COMBINED TREATMENT TECHNOLOGIES: A CASE STUDY OF CHARMINAR BREWERY WASTE WATER TREATEMENT PLANT, International Journal of Fun-damental And Applied Sciences ISSN:2231-6345,Vol.1(2)April-June,2011.

They study systems for treatment- Ultarfiltration Anaerobic, Aerobic and Rverse Osmsis.died on the industrial waste water treatment process.They uses three The Ultrafiltration gives TSS free water. Anaerobic has less TSS removal capacity. Anaerobic, aerobic and osmosis shows high removal COD and BOD as compared to the Ultrafiltration

J.Rinki .K. Khot, R. S. Deotale, Abhijeet .R. Narde ”PERFORMANCE EVALUATION OF SEWAGE TREATMENT PLANT BASED ON AD- VANCED AEROBIC BIOLOGICAL FILTRATION AND OXYGENATED REACTOR TECHNOLOGY”, International Journal Of Engineering Science and Innovative Technology Volume 2,Issue 4, July 2013.ISSN:2319-5967.

They used the small scale domestic waste water treatment system. The Var- ious technonolgies which are used in small scale domestic waste water treatment system are sorted out.

III. DESIGN OF WASTE WATER TREATMENT PLANT FOR ROOT ZONE TREATMENT SYSTEM

General information
Location : College Of Engineering,Phaltan
Source : Sewage and Waste Water
Treatment Concept : Collection Tank + Settling tank +Root Zone Treat ment bed + Final water tank
Treatment Objective : To use the water for safe disposal or to use the water in agricultural purpose or gardening

Based on literature review and earlier research work on root zone treatment system(RZTS), RZTS treatment is better low cost waste water treatment method but going through the designs for calcula-tion of area requirement of RZTS, it is found that from Bhopal project design it is about 100 lit/m2 and from Santa Elena project developed formula for area calculation is A = (Qave)(t)/(n)(dw) Where,

Figure1: Typha latifolia cattail

A= Area required for root zone bed to effectively treat grey water (square meters)
Qave = Average daily input (cubic meters)
t = Retention time (days)
n = effective porosity of root zone bed medium (what percent of the volume is left for the water after gravel or plastic has been put in)
dw =Depth of bed (meters)

Going through this formula it is found that from Santa Elena project also the area requirement is about 100 lit/m2 So area requirement is the basic hurdle in using this treatment system in low cost waste water treatment and this can be over-come by modifying conventional root zone treatment system.

CONCLUSION

Treatment of sewage and disposal of treated sewage is a major problem in Indian cities.Construction of treatment facilities require huge capital investment, operation of the conventional treatment plant is very costly.Because of these factors sewage treatment is most neglected aspect in our country. It is resulting into pollution of rivers and also ground water resources.There is a large gap between production of waste water and treatment of waste water. Therefore cost effective sewage treatment is the requirement of the time for protecting the environment. Studies were conducted to find suitability of root zone technology for sewage treatment. .

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