

# Experimental Analysis of Wastewater in Shahu Campus of Pune City

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**Abstract** - Water pollution of surface water bodies is a major environmental issue in India. The largest source of water pollution in India is untreated sewage, originating from domestic, commercial and institutional activities. There is a large gap between generation of waste water and treatment facilities available to treat that water, due to lack of funds and space. In today's scenario, waste water treatment is a challenging task. Technically as well as economically the present study will base on developing modification in conventional Root Zone technology system. The aim of the study was to study cost effective treatment of wastewater i.e. by Root Zone Technology. The study is done on Jedhe More Hostel situated in "ABMSP'S" Campus, Pune. The study investigated effectiveness and feasibility for treatment of wastewater in Hostel. Some physio-chemical parameters such as Biological oxygen demand (BOD), Chemical oxygen demand (COD), Dissolve oxygen (DO), Where analyzed by standard methods. After treatment and analysis the treated water can be used for recreational activities. The result indicates that Root Zone system works effectively for wastewater treatment.

**Key Words:** Waste Water, Root zone, Low Cost Treatment, BOD, COD, DO, PH, Ferrocement

## 1. INTRODUCTION

Now a days water is used for various purposes for domestic as well as industrial purpose. Due to rapid growth of population, industrialization and urbanization water becomes impure with many insoluble materials and ingredients it becomes as wastewater. Hence wastewater can be reutilized after doing certain activities by suitable treatments. These increase in urbanization and human activities exploits and affect quantity as well as water resources.

Fresh water is becoming is one of the most limited source available for us. Nearly about 80% of water supplied to the society returns as municipal wastewater as sewage drainage system. Wastewater carries hazardous chemicals carries chemicals and high loading of organic matter, solids both dissolved and suspended solids.

There are total 150 students living in hostel situated in "ABMSP'S" campus according to per capita demand 135 lpcd is supplied by corporation and out of this 48,6000 lit/year is wastewater is generated.

Due to high cost of conventional treatment processes, this wastewater generated result in cause of pollution. Therefore cost effective treatment process such as Root Zone treatment process is beneficial in both parameters i.e. economy and environmental friendly.

## 2. LITERATURE REVIEW

**Rajendra Waghmode<sup>[1]</sup> (2017)** The paper reviews on developing modification in conventional Root zone Technology system. This system was developed on the basis of quality of effluents and space requirement constraints. The study was carrying by using pilot scale reactor. Study covered the sewage treatment of conventional sewage treatment plan, Low cost sewage treatment by modified Root Zone Technology and will conclude the necessity of onsite and non-mechanized treatment system.

**Akshay Gaikwad<sup>[2]</sup> (2017)** The present paper describes the theoretical basis if wastewater treatment in Root Zone of wetland plants, so called "Root Zone method". This paper reviews that for reusing the wastewater it should be treated and for treating the treatment process should be cost effective and have less maintenance cost. Therefore Root Zone Treatment system was used has effective treatment method which has the great control on BOD, COD, TDS, TSS and DO. The water treated by this method was use for gardening purpose. After the overall use of this system it resulted that Root zone system is effective method for small villages, Towns and city to overcome excess pressure of local authority due to urbanization, many modern techniques in development of many infrastructure projects. This was carried out in College Of Engineering, Phaltan and treated water was used for safe disposal or to use the water in agricultural purpose or gardening.

**Kalpna Kumara Thakur<sup>[3]</sup> (2014)** This study investigated the effectiveness and feasibility for horizontal surface flow/ Root Zone unit which was constructed by Environmental Planning and Coordination organization (EPCO) at Ekant Park, Bhopal. In present study sample of wastewater from inlet and outlet of Root Zone system situated at Ekant Park were collected quarterly from June 2011 to May 2012. Some physio-chemical parameter 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 and treated water can be used for recreational activities like washing clothes, Fishing,

Swimming and Educational purpose. The study clearly proved that the water quality during Root Zone Treatment improves a lot which is indicated by reduction in BOD, COD, Nitrate and Phosphate value and increase in DO value. Thus it stands effective in treating the wastewater.

**Dr. Shweta Verma<sup>[4]</sup> (2016)** Water pollution has become one of the most serious environmental problems in recent years. The Mula, Mutha and Pavana rivers, flowing through the Pune city and Pimpri-Chinchwad Industrial area, are polluted with untreated domestic sewage and partially untreated industrial waste from nalas. The river water quality has deteriorated with respective some of measure water quality parameters like DO, BOD, Phosphate level. Therefore the study was carried out to outcome from above parameter by treating domestic wastewater using Wetland Techniques. The pilot scale experiment was setup to test the effect of Vetiver for the removal of pollutants from the grey water collected from household. Sample was collected from household in Bhosari, Pimpri-Chinchwad. This technique was economical, eco friendly and locally manageable for treating the wastewater.

**Rajnikant Prasad<sup>[5]</sup> (2017)** Due to rapid urbanization and industrialization there is severe environmental pollution in last few decades due to which there an adverse impacts the nature. Therefore the aim of this study was to find out the economical method of treatment of domestic wastewater and to compare the efficiency of naturally aerated and artificially aerated constructed wetland. Two lab scale model was setup in a bucket of dimension 400mm x 300mm one lab scale model was provided with the artificially aerated system. The wastewater parameter was checked after 12 hrs. 24hrs and 48 hrs. The present study was done for Mundhwa area by constructing lab scale model. The parameter like colour, odour, pH, COD and DO was checked. The result obtained was that the treatment efficiency of artificially aerated constructed wetland is more compare to naturally aerated constructed wetland. The treated wastewater does not have any odour, it is clear and the colour becomes blackish to colourless.

**G. Baskar<sup>[6]</sup> (2014)** The aim of this research was to study the effectiveness of wetland plant *Phragmites australis* in the treatment of wastewater generated in SRM University premises. A pilot wetland unit of size 1.5m x 0.6m x 0.3m was constructed in the campus grounds. *Phragmites australis* species were grown in the field with fresh water. 3 x 3 rows of plants were transplanted into the pilot unit and subjected to wastewater from hostels and other campus buildings. The raw wastewater and treated wastewater were collected periodically and tested for quality. It was seen that this pilot unit is reducing the concentration of TSS, TDS, TN, BOD, COD 90%, 77%, 85%, 95%, 69% resp. on average.

**Prof. S.R. Manasa<sup>[7]</sup> (2012)** This experiment deals with eco-friendly treatment of grey water by adopting Reed Bed

Technology. This is done by using Wetland plants, reeds that has extensive root system. The characteristics of grey water before and after treatment are analyzed and compared. The plant used for this eco-friendly treatment is Aquatic plant that is collected from agricultural land near Halekote. The unit was constructed by placing separate layers of coarse aggregate, stone dust and sand. After treating with the Root zone treatment using Aquatic plant, the characteristics of treated sample includes pH, TSS, TDS, BOD, COD, Hardness, Turbidity and DO were analyzed and it showed temporal variation. Results show that the concentration of BOD before treatment is 138mg/l whereas after treatment, the removal efficiency is 76.81% which indicates the use of greywater can be put to use in agricultural practices

**Varne Ashok L<sup>[8]</sup> (2014)** The study was conducted to assess the feasibility of Root Zone Technology for sewage treatment. The study was conducted with pilot scale reactor on different types of plant species. The reactor of size 1.m x 0.65m x 0.40m made in PVC pipe material was for study. Plants species were planted in the reactor and were irrigated initially with tap water. After steady state is reached, hydraulic interval of 3 days and growth of plants was observed. The reactor was found to be very effective for sewage treatment COD reduction of 88.18%, BOD reduction of 88% and solids reduction 69.23% was observed during the study. The cost economics of Root Zone Technology was assessed to Rs. 4.13 per 1000 liters. This reveals the economical and efficient method for sewage treatment and disposal which will be useful to the small towns and isolated institute.

**Vinita Vipat<sup>[9]</sup> (2017)** The paper under reference therefore is an attempt to evaluate performance efficiency of field scale Horizontal Subsurface Flow constructed Wetland unit was constructed at Ekant Park, Bhopal. The unit is designed to treat 70,000 liters/day of wastewater of nalla passing through the park. The unit comprises of pre treatment followed by root zone bed with gravels and reed plants i.e. *Phragmites karka*. The pollution removal efficiency of the system gradually increased and as the system stabilized to large content after 18 months the result clearly indicated removal efficiency of 100% for organic Nitrogen 98.7% for Caliform bacteria, 88.4% for Turbidity, 79% for TSS, 70.7% for total solids, 71.23% for TDS, 77.8% for COD, 65.7% of BOD and DO level increased by 139% and reached 3.1 mg/l. Result established that the overall removal efficiency of the system studied range from 65% to 90% for various pollutants.

**Prof. Hangargekar P.A<sup>[10]</sup> (2015)** These case studies on Common Effluent Treatment Plant (CETP) for Textile industry are considered as one of the viable solution for small to medium enterprises for effective wastewater treatment. An effluent treatment plant is operating on physical, chemical and biological treatment method with average waste water in flow of 3MLD has been considered for case study. The wastewater is analyzed for the major

water quality parameters, such as Biological Oxygen Demand (BOD), pH, Chemical Oxygen Demand (COD), Total suspended solid (TSS) and Total Dissolved Solids (TDS). The effluent samples were collected on a daily basis for a period of one month. The raw waste water pH was highly alkaline it was then bringing down to neutral which was helpful for chemical and biological treatment. The BOD, COD of the treated effluent reduced significantly, whereas very small reduction was observed in dissolved solids. Most of all the parameters were within the permissible limits of Maharashtra Pollution Control Board, India.

**Gawande et. al.<sup>[11]</sup> (2017)** Water plays an important role in human development and are on important finite natural resource. The physio-chemical characteristics of water determined to examine the water quality. The study of water quality involves a description of occurrence of various contaminants in water use. The present study was undertaken to carry out a quality assessment and analysis of phosphate on behalf of wastewater of river Mutha. Parameters like BOD, COD, pH, DO are Tested It is found that concentration is higher than permissible limit and it is factor to blame eutrophication.

**Ruchira Shinde<sup>[12]</sup> (2016)** ,Aquatic life is a vast resource, providing food, medicine and raw materials, in addition to recreation and tourism all over the world. It helps in determining the very nature of our planet. Marine life forms a very important part of the ecological cycle, and also they contribute significantly to the supply of oxygen, thus involved in the regulation of the earth's climate. Nowadays there is an increasing trend towards eutrophication of water bodies worldwide. Eutrophication is a process which takes place where water bodies receive excessive nutrients which results in excessive plant growth. These plants include algal blooms, and which in turn have a cascade effects on the ecosystems.

**Niharika S. Belwalkar et.al.<sup>[13]</sup> (2017)** Surrounding the qualities of environment there are a large number of issues that are calling for big solutions. There is an important need for investment of time and resources in the development and up gradation of innovative ideas and experiments that stop or decrease resource exploitation and possibly help to conserve the resources. The human relationship with the natural world is deeply intertwined with the human conscious and subconscious mind, which made this relationship difficult to analyze.

### 3. OBJECTIVES

1. To study waste water treatment.
2. To examine characteristics of wastewater in campus.
3. To suggest suitable treatment for above study.
4. Compare the wastewater and treated water and find out the efficiency.
5. High level of bacterial and viral removal.

## 4. METHODOLOGY

### 4.1 Experimental Setup

In experimental setup, three Ferro-cement tanks are constructed which are cost effective, most durable and light in weight than R.C.C tank.

- Material used for constructing above tank are :  
Weld mesh, chicken mesh, PVC pipe, cement mortar of 1:3 proportions.
- Capacity and dimension of tank: Three tanks each having 60 liters capacity. Dimension of tank is diameter is 2m and height is 3m.



**Fig-1** : Experimental setup of wastewater treatment

### 4.2 Process

The process in root zone system to treat the sewage begins with passing the raw effluent horizontally or vertically through the bed of soil having impervious bottom the effluent percolate through the bed that as all roots of wetland plants sprayed very quickly. In this experimental setup the sewage or wastewater generated from hostel is allowed to flow horizontally and it is collected in tank 1 i.e. wastewater collecting tank. After collecting the wastewater it is allowed to flow in tank no 2 which is filled with soil media. The wastewater in this tank is percolated through the soil media that has the roots of plant in it and around this roots number of bacteria and fungi are present to get oxygen from weak membrane of the roots and aerobically oxidize the organic matter present in wastewater the characteristics of plant of absorbing oxygen through their leaves and passing it down to roots through their stems which are hollow are utilized as Bio-pump. Away from the roots anaerobic digestion also takes place. The filtering action of soil bed, the action with fungi and bacteria helps in obtaining clean water and then this clean water is collected from the pipe situated at the bottom of tank 2 for use. The remaining wastewater flowing through collecting tank flows through pipe which is connected to tank number 3 from the top. The tank number 3 is filled with the layer of aggregates or gravel and remaining wastewater percolates through this bed of



gravel and aggregate and the clean and clear water is obtained and collected through the outlet at bottom of tank.



**Fig-2** : Constructed Ferrocement Tank

### ACKNOWLEDGEMENT

It is my great pleasure to present this project report. We take this opportunity to convey our sincere thanks to our guide Prof. S. M. Gawande, for his encouragement that made the project a great success. I would like to thank our project for helping us whole heartedly Dr. S. B. Thakare. We express our thanks to our respected Head of the Department, Prof. A. B. Shelar whose advice and valuable guidance helped us in making this project interesting and successful one. We also thank all those who have directly or indirectly guided and helped us in preparation of this project.

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