



# **iJRASET**

International Journal For Research in  
Applied Science and Engineering Technology



---

# **INTERNATIONAL JOURNAL FOR RESEARCH**

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

---

**Volume: 9      Issue: VI      Month of publication: June 2021**

**DOI: <https://doi.org/10.22214/ijraset.2021.34937>**

**[www.ijraset.com](http://www.ijraset.com)**

**Call:  08813907089**

**E-mail ID: [ijraset@gmail.com](mailto:ijraset@gmail.com)**

# Design of Portable Hybrid Constructed Wetland Reactor for the Treatment of Wastewater

Swapnil Hiwrale<sup>1</sup>, Prof. Nilesh R Pal<sup>2</sup>, Pawan Zode<sup>3</sup>, Gourav Bhoyar<sup>4</sup>, Swati Atram<sup>5</sup>, Bhojraj Raut<sup>6</sup>

<sup>1, 3, 5, 6</sup>Department of Civil Engineering, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, Maharashtra

<sup>2, 4</sup>Head of Department of Civil Engineering, J D College Of Engineering and Management, Nagpur, Maharashtra, India

**Abstract:** *The idea of the project is predicated on the methodology of preventing the wastewater and the way to form the water pure by using various techniques to form water purification. Nowadays the matter of water shortage increases especially we face the water problem in summer seasons only. we are designing and portable hybrid water solution for the treatment of wastewater during this study, pilot-scale hybrid constructed wetlands (CWs) and multistage horizontal subsurface flow CWs (HF CWs) are studied and compared for the treatment of raw urban wastewater. Additionally, the sand became clogged, while the mulch failed to. The effect of water height on the average pollutant removal wasn't determined but HF10 performed better regarding compliance with legal regulations. With this idea of the project, we could see how we will purify the wastewater and the way much we can see the index of the water purification. A survey of the magnitude of water-related stress at villages on the subject of a college campus or Maharashtra villages affects rural life. Especially in the summer seasons. Problems of availability, accessibility, and quality of Water In Maharashtra 17 districts are that which is laid low with water crises. Maharashtra had approved over R.s 7000 corer to complete the potable project in the scarcity hit area. In India 4% of water resources available from 18% water available in word. Wetland technology can provide cheap and effective wastewater treatment in both temperate and tropical climates and is suitable for adoption in both industrialized likewise as in developing nations this method is utilized for the removal of a range of pollutants and a broad verity of wastewater worldwide. it's one of the simplest methods to treated wastewater at source premises, effectively and economically. This general term accustomed describe different degrees of treatment, so as of skyrocketing treatment levels are preliminary, primary, secondary, and tertiary or advance wastewater treatment. Disinfection to get rid of pathogens sometimes follows the last treatment steps. After treatment of wastewater from constructed wetland reactor, 90 to 95% BOD is going to be satisfied than 85 to 90% Turbidity is going to be removed, and 70 to 80% Nutrient are going to be removed by phytoremediation method. Constructed wetland technology has played a vital role in achieving the changes in wastewater.*

## I. INTRODUCTION

This project is intently used to design and constructed the hybrid constructed wetlands to prevent the wastewater from raw and urban cities of Maharashtra Sand and gravel are the most extracted group of materials worldwide, exceeding both fossil fuels and biomass [3]. The environmental impact of sand extraction includes coastal and river erosion, coral reef degradation, biodiversity loss, and the spread of invasive species. These environmental impacts have a profound effect on the local human population in terms of seawater intrusion in coastal aquifers, thus a reacting domestic water supply and increasing salinization of cultivated land, the increase in potential breeding sites for malaria-transmitting mosquitoes, etc. All these effects can result in social and political conflicts [4], particularly in developing countries [5]. Thus, more sustainable materials for CW beds should be found. Problems of availability, accessibility, and quality of Water In Maharashtra 17 districts are that which is suffering from water crises. Maharashtra had approved over R.s 7000 corer to complete the drinking water project in the scarcity hit area. In India 4% of water resources available from 18% of water available in the word. Constructed wetland technology has played an important role in bringing about changes in wastewater. wastewater treatment in both temperate and tropical climates and is suitable for adoption in both industrialized as well as in developing nations this method is utilized for the removal of a range of pollutants and a broad variety of wastewater worldwide.

## II. PROBLEM STATEMENT

- A. A survey of magnitude of water related stress at villages near to college campus or Maharashtra villages, it affects to rural life. Especially in summer seasons. Problems of availability, accessibility and quality of water. During summer season college face a huge scarcity of water to satisfy institutional water demand.
- B. We observe generation of waste water in campus of JD college of engineering on daily basis We inspired plan to take care of all above issue by utilizing one technique that is constructed wetland.

- C. Treated water can be used for domestic purposes excluding drinking. Minimum treatment cost is required to treat wastewater from constructed wetland reactor. The typical substrate depth of subsurface flow CWs is 0.5 m, but several authors have found that's hallow constructed wetlands (SCWS) can improve the removal of nitrogen, organic matter, and estrogenic disruptors by a more eff client dissolved oxygen transfer to the media Additionally, an SCWS require fewer building materials, and consequently a lower cost of construction, operation, and maintenance
- D. The problem arises of water shortage to due lost of wastage water in India .many people waste lots of water and many people don't know how much PH value of the water is safe for them we are constructing this project based on preventing wastewater a by constructing and portable and hybrid constructor of wetland and we can also purify the wastewater through various technique our institution face lots of water shortage and waste lots of water After treatment of wastewater from constructed wetland reactor 90 to95% BOD will be satisfied than 85 to 90% Turbidity will be removed, and 70 to 80% Nutrient will be removed by phytoremediation method

### III. OBJECTIVE

- A. To satisfy different parameters of waste water using constructed wetland system.
- B. To reuse waste water after treatment through constructed wetland reactor
- C. To design effective and economical reactor for the treatment of waste water using locally available fitter material.
- D. To check the efficiency of newly made hybrid constructed wetland reactor.
- E. To compare advance reactor with conventional waste water treatment facility

### IV. METHODOLOGY

- 1) The quantity of atomic number 8 needed by the microorganism whereas stabilizing complex organic matter beneath aerobic conditions. complex implies that organic matter will function as food for the microorganism and energy springs from its reaction.
- 2) Biochemical atomic number 8 demand may be alive of the amount of atomic number 8 employed by microorganisms (e.g., aerobic bacteria) within the reaction of organic matter."
- 3) Constructed treatment wetlands are built systems, designed and created to apply the natural functions of soil vegetation, soils, and their microorganism populations to treat contaminants in surface water, groundwater or waste streams" one + two. substitutable terms of CWs include synthetic, engineered, artificial, or treatment wetlands.
- 4) There also are a variety of terms used for submarine flow CWs, which might be confusing for novices:
  - a) *Planted Soil Filters*: Their vegetation consists of macrophyte plants from natural wetlands and this sets them except for the unplanted soil filters, conjointly referred to as submarine biofilters, percolation beds, infiltration beds or intermittent sand filters
  - b) *Reed Bed Treatment System*: A term used in the main within the United Kingdom, Europe, ensuing from the fact that the foremost oft used plant species is that the genus *Phragmites* (*Phragmites australis*).
  - c) Vegetated submerged beds, vegetated gravel-bed, and gravel bed agriculture filters. . Phytorestation: a term covering all technologies mistreatment plants to revive soils, ecosystems, and/or water integrity.
- 5) *Oxygen*: atomic number 8 in soil systems is vital for heterotrophic microorganism reaction and growth. it's a necessary element for several soil waste product removal processes, particularly nitrification, decomposition of organic matter, and alternative biological mediated processes.
- 6) It enters wetlands via water inflows or by diffusion on the water surface once the surface is turbulent. atomic number 8 is also created photosynthetically by the alga. Plants conjointly unleash atomic number 8 into the water by root exudation into the foundation zone of the sediments. several aborning plants have hollow stems to permit the passage of atomic number 8 to their root tissues.
- 7) The atomic number 8demand processes in wetlands embrace sediment-litter oxygen demand (decomposition of detritus), respiration (plants/animals), dissolved chemical element physical body, and dissolved gas that utilizes atomic number 8 through nitrification processes (Kadlec & Knight, 1996).
- 8) The atomic number 8 concentration decreases with depth and distance from the water flow into the soil. it's usually high at the surface, grading to terribly low within the sediment-water interface. . pH scale:
- 9) The pH of wetlands is related with the twenty  
[metallic element| metal} content of water (pH seven = 20 mg Ca/L). soil waters typically have a pH scale of around 6-8 (Kadlec and Knight, 1996). The biology of wetlands particularly will be impaired by fast changes in pH scale. .



- 10) *Temperature*: Temperature may be a widely fluctuating abiotic issue that may vary each diurnally and seasonally. Temperature exerts a robust influence on the speed of chemical and biological processes in wetlands, as well as physical body decomposition, nitrification, and denitrification.

## V. PROPOSED SYSTEM

- A. After treatment of wastewater from constructed wetland reactor 90 to 95% BOD will be satisfied then 85 to 90% Turbidity will be removed, and 70 to 80% Nutrient will be removed by phytoremediation method.
- B. It will maintain the PH of water after treatment. Satisfied filtration rate will be obtained from constructed wetland reactor. Minimum treatment cost is required to treat wastewater from constructed wetland reactor.
- C. There is no incursion of any poisonous element into the wastewater after treatment of wastewater from constructed wetland reactor. Modern societies have developed large centralized wastewater treatment facilities that treat large volumes of wastewater using both chemical and biological processes but the method of treatment is a costlier one, but the suggested method for treatment of wastewater is economical and feasible to the treated large quantity of wastewater by using locally available materials.
- D. The role of materials, plants, and composition micro-organism have shown and an indication of a better rate of degradation. Constructed wetland method by using Phyto-remediation, are engineered wastewater treatment system filled with porous media and planted with emergent wetland plant. Problems of availability, accessibility, and quality of Water In Maharashtra 17 districts are that which is suffering from water crises
- E. Maharashtra had approved over R.s 7000 corer to complete the drinking water project in the scarcity hit area. In India 4% of water resources available from 18% water available in word. Constructed wetland technology has played an important role in bringing about the changes in wastewater

## VI. REQUIREMENTS

The above diagram shows us the working and the requirement of the projects list of the requirements and working criteria the above contains shows the list of the project which are

- 1) Plants
- 2) Garden soil
- 3) Sand
- 4) Pebbles
- 5) Activated charcoal

### A. Requirements of the Project

- 1) *Typhus*



- a) The typhus is an Aquatic or semi-aquatic plants
- b) Plants help for Phytoremediation
- c) It absorbs the contaminant present in water it plays a major role to absorb nitrate from wastewater.

2) *Sand*



- a) This grained sand is used as a filter media
- b) This sand reducing turbidity from water and maintain the temperature of the water.
- c) It retains the particulate matter on the layer of a sand grain.

3) *Pebbles*



- a) The boulder uses as filter media and Reduces the turbidity of water.
- b) It forms the colonies of water.

4) *Garden Soil*



- a) It helps to grow the plants
- b) The soil is used as a filter media that reduces the turbidity of water.
- c) Particulate matter is retained on the soil layer and ultimately gets removed from the wastewater.

*B. Working of Project*

1) *Preliminary Treatment*



## 2) Primary Treatment



## 3) Tertiary Treatment



## 4) Disinfection



## VII. CONCLUSION AND ROAD MAP

We will contact the industries which are working under the domain of wastewater for productivity. The effluent quality that we got from constructed wetland reactor is highly appreciable hence we decided to bring this project to market for productivity. Initially, we are organizing a seminar or learning session for the people in the water scarcity region to make aware of the benefits of this product village people where there are no facilities for domestic wastewater treatment from this topic we are concluding our project and we are promoting our project to next level where we can save water and prevent the wastage of water through this project

## VIII. ACKNOWLEDGEMENT

The heading of the Acknowledgment section and the References section must not be numbered.

Causal Productions wishes to acknowledge Michael Shell and other contributors for developing and maintaining the IEEE LaTeX style files which have been used in the preparation of this template. To see the list of contributors, please refer to the top of file IEEE Trances in the IEEE LaTeX distribution.

## REFERENCES

- [1] Molinos -Senante, M.; Gómez, T.; Caballero, R.; Hernández-Sancho, F.; Sala-Garrido, R. Assessment of wastewater treatment alternatives for small communities: An analytic network process approach. Sci. Total Environ
- [2] Jose Alberto Herrea -Melian and Ezio Ranieri Multistage Horizontal Subsurface Flow vs Hybrid Constructed Wetlands for the Treatment of Raw Urban Wastewater.
- [3] Vymazal, J. Is removal of organics and suspended solids in horizontal sub-surface flow constructed wetlands sustainable for twenty and more years
- [4] Vohla, C.; Köiv, M.; Bavor, H.J.; Chazarenc, F.; Mander, Ü. Filter materials for phosphorus removal from wastewater in treatment wetlands
- [5] Saeed, T.; Muntaha, S.; Rashid, M.; Sun, G.; Hasnat, A. Industrial wastewater treatment in constructed wetlands packed with construction materials and agricultural by-product. J. Clean. Prod. 2018
- [6] Metcalf, E.; Eddy, E. Wastewater Engineering: Treatment and Reuse; McGrawHill Inc.: New York, NY, USA, 2003



- [7] Ranieri, E.; Gikas, P.; Tchobanoglous, G. BTEX removal in pilot-scale horizontal subsurface flow constructed wetlands. Desalin. Water Treat. 2013
- [8] Petitjean, A.; Forquet, N.; Boutin, C. Oxygen profile and clogging in vertical flow sand filters for on-site wastewater treatment. J. Environ. Manag. 2016.
- [9] Ushijima, K.; Ito, K.; Ito, R.; Funamizu, N. Greywater treatment by slanted soil system. Ecol. Eng. 2013
- [10] Lan, W.; Zhang, J.; Hu, Z.; Ji, M.; Zhang, X.; Zhang, J.; Li, F.; Yao, G. Phosphorus removal enhancement of magnesium modified constructed wetland microcosm and its mechanism study. Chem. Eng. J. 2018,





10.22214/IJRASET



45.98



IMPACT FACTOR:  
7.129



IMPACT FACTOR:  
7.429



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24\*7 Support on Whatsapp)