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# Waste Water Treatment by using Root Zone Technology: Using Colacassia Plant

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**Abstract -** *The water quality on the earth is depleted due to over increasing human development activities that over exploits and affect the quality and quantity of water resources. The rapid urbanization has resulted in pollution of fresh water bodies due to increased generation of domestic waste, sewage, industrial waste etc. This paper reviews that Root Zone Technology is one of the low cost and eco friendly method to treat the wastewater. Root zone treatment system uses a natural way to effectively treat the domestic and industrial effluents. This technology has been successfully running in several countries like Europe and America. The wetlands bed will be divided into three zones as soil layer, sand layer and aggregate layer respectively. On top layer colacassia trees will be planted. When waste water will pass through the top and intermediate layer all suspended solids will get trapped in pores of soil and sand and remaining solids will get removed with the help of bacteria. This technology are easy to operate having less installation, low maintenance and it is beneficial as compared to costly conventional treatment systems. There is a need to exploit this technology in a developing country like India to its maximum to gain its benefits and for sustainable development.*

***Key Words:*** **Root zone Technology, Colocassia Esulenta, Vertical sub surface flow, PH, BOD, COD.**

## 1. INTRODUCTION

Root Zone technology is a solution to the modern industrialized world which causes water pollution problems. Growth of wetland plants called reeds in specially designed beds provides eco-friendly mode to use nature to "Protect Nature".The root zone i.e. a filter plant is a biological filter, where biological treatment of wastewater takes place in a soil volume, which is penetrated by the roots of *Phragmites australis*. This technology is also called as Root-zone system or Bio-Filter or Reed Bed System or Constructed wetland(CW) system[constructed includes "man-made", "engineered" or "artificial" (Vymazal, 2005, 2007)] or Treatment wetland system. Natural Wetlands are defined as areas which are in undated or saturated with surface or groundwater, saline or fresh, which supports vegetation adapted for living in saturated soil conditions. Wetlands exist in a broad variety of environmental conditions and have plant communities, soil and hydrology that differ from most upland plant communities. Constructed wetlands (CWs) are examples of non-mechanised treatment systems which are easy to build and operate and are sustainable. Aquatic plant systems consist of free floating growths and emergent vegetations. Emergent vegetations may be of natural wetlands like mangroves or Macrophytes such as water hyacinths, alligator weeds, duckweeds, hydrilla, mart, solms, etc., rooted in constructed wetlands which are mainly applied in reed bed and root zone systems. Aquatic plant ponds consisting of aquatic plants, free floating macrophytes, have been cultured in ponds either for their ability to remove hazardous chemicals.

## 2. LITERATURE REVIEW

### 2.1 Introduction to waste water treatment by root zone technique.

AUTHOR: Mahesh Mane, Bhupen Patil, Mohit Pawar, Yatin Gohil, Akshaya Ghalimath.

The root zone technique is very useful for small scale work while we can plan it for huge network also. This has resulted in pollution of fresh water bodies due to increased generation of domestic waste, waste, industrial waste etc. This Seminar reviews the Root Zone Treatment System (RZTS) which are planted filter beds consisting of soil.

### 2.2 Domestic Waste Water Treatment using Modified Root Zone Technology.

AUTHOR: Mr. Rajendra B. Waghmode Mr. Sanket N. Mandale Dr. Purushottam S. Dange

Study covered the waste treatment of conventional waste treatment plant, low cost waste treatments by modified root zone technology and concluded the necessity of onsite and non-mechanized treatment system. As on to player maximum number of suspended solids gets settled and the organisms get oxygen from roots of plants. There dissolved solids act as a food for the microorganisms and then it convert that in to suspended biomass, which is helpful for degradation of organic matter. As this system does not require any external energy sources and only minimum chemicals are required for disinfection, hence it does not create any foot print. Also, it give extra income from that plant.

### 2.3 Wastewater treatment by root zone technology: Option for domestic waste.

AUTHOR: Surekha thorat (P.G (Environment) Civil department, Pune university), Prof. V. V. Sasane (Department of civil department, Pune university).

Constructed Wetlands are being extensively used in developing countries to treat domestic, agricultural and industrial waste water and urban and highway runoff or current status of application of the root zone system especially used for domestic waste water. It is concluded from the above project that the method of RZT is capable to reduce pollutant levels.

### 2.4 Root zone technology for campus waste water treatment

AUTHOR: G. Baskar ,V. T. Deeptha and A. Abdul Rahaman

The waste water discharged in a campus setting was analyzed to determine its characteristics. Unlike in a municipal area, the waste water from campus shows variation in concentration according to student strength. TSS, BOD and TN particularly show large variations. The Root zone method (constructed wetland) was employed on a lab scale to treat the waste water. The results were compared with the conventional treatment.

## 3. WORKING

### 3.1 Working of Root zone technology:

Root Zone technology originated from research conducted in Europe by Seidel and Kickuth at the Max Planck Institute in Plan, Germany starting in 1952 (Bastion and Hammer, 1992). By 1995, over 200 units had been built in Europe (Denmark, Germany and UK) and another 200 in USA and in smaller numbers elsewhere. Only about 50–60 units were reported to be exist in India in 2005.

The Root Zone process functions according to the laws of Nature, to effectively purify domestic and Industrial effluent. Root Zone encompasses the life interactions of various species of bacteria, the roots of the reed plants, Soil, Air, Sun and of course water. Reed Plants have capacity to absorb oxygen from ambient air and creating numerous bacteria. Same bacteria oxidize and purify the waste water. Since the process occur underground inducing different types of chemical reactions, the process functions as a mirror of self-regulating, purifying process found in nature.

The process involves the raw effluent (after removing grit or floating material) which is passed horizontally or vertically through a bed of soil having impervious bottom. The effluent percolates through the bed that has all the roots of the wetland plants spread very thickly. The filtering action of the soil bed, the action with fungi etc. and chemical action with certain existing or added inorganic chemicals help in finally obtaining very clear and clean water. The system of plants regenerates itself as the old plants die and form useful humus. Hence the system becomes maintenance free and can run efficiently for several years.

## 4. METHODOLGY

### 4.1 Uses of Colacassia plant:

Colacassia esculenta is a tropical plant grown primarily for its edible corms, the root vegetables most commonly known as taro.It is believed to be one of the earliest cultivated plants. Taro's essential utilize is the utilization of its consumable corm and clears out. In its crude frame, the plant is poisonous because of the nearness of calcium oxalate, and the nearness of needle formed raphides in the plant cells. In any case, the poison can be limited and the tuber rendered tasteful by cooking or by soaking in cool water medium-term. The leaves are wealthy in vitamins and minerals.

**Fig.1** Colacassia esculenta

### 4.2 Types of flow system used :

1) Horizontal surface flow system

In this system, water is fed in and moves through the bed media under the surface of the bed until it achieves the outlet zone. The waste water will come into contact with system of high impact zones will be around the roots and rhizomes of the wetland vegetation that brake oxygen into the substrate and waste water goes through the rhizosphere, the waste water is spotless by microbiological squalor by physical and chemical processes. Horizontal surface flow wetland consist of a shallow basin constructed of soil or other medium to support the roots of vegetation, and water control structure that maintains a shallow depth of water. This kind of wetlands looks and acts much like natural marshes, and they can provide wild life habit and aesthetic benefits as well as water treatment.

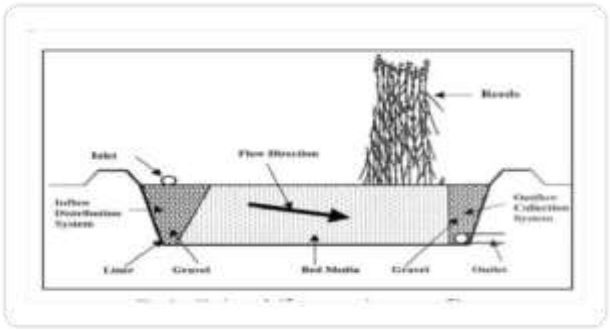


**Fig.2**. Horizontal root zone filter

2) Vertical subsurface flow system

In vertical subsurface flow system waste water is fed intermittently and it flows in direction of vertical through the channel funnels and it is gathered by seepage system at the base. Vertical flow treatment flow wetlands are composed of gravel topped withsand, with reeds growing at the same sort of densities as in the horizontal flow system. The liquid is dosed on the bed in a large batch, flooding the surface. The liquid then gradually drains vertically down through the bed and is collected by drainage network at the base. The bed drains completely free, allowing air to refill the bed.

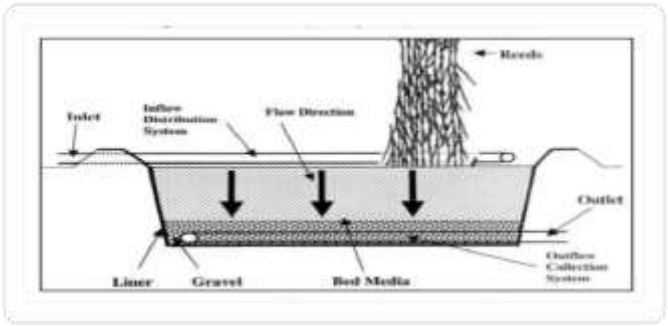


**Fig.3.** Vertical root zone filter

### 4.3 Construction and Working of Wetland

- The unit was constructed by placing separate layers of soil, sand and aggregates after arranging the layers the plants were planted in the unit.
- Further the growth of plants was monitored.
- During the growth period of one month plain water was sprinkled.
- Then sewage water was let into the root zone system and the samples were collected.

### 4.4 Water sampling and analysis

- Water samples were spread evenly on the top layer of wetland system and samples were taken once from outlet chamber of the wetland unit.
- The samples were collected by putting a clean plastic bottle below the outlet pipe of constructed wetland.
- The samples were analyzed for pH, Turbidity, TSS, DO, BOD and COD according to standard methods for wastewater examination.

## 5. ADVANTAGES

- It achieves standards for tertiary treatment with low cost, such as no electricity, no chemicals for pH adjustment.
- Low maintenance cost, since it involves no machinery and its maintenance.
- It requires negligible attendance for operation and monitoring.
- It has no sludge handling problem.
- It enhances the landscape and gives the site a green appeal.
- It provides natural habitat for birds and after few years gives an appearance of bird sanctuary and also provides recreational and educational areas.
- Though it is a sewage treatment plants it does not have odour problems.
- It becomes a green Zone and it does not have mosquito problem.
- Above all it provides ecofriendly solution to waste water treatment "Naturally".

## 6. DISADVATAGES

- Relatively large area requirements for advanced treatments.
- Currently precise design and operating criteria not available
- Biological and hydrological complexity and our lack of important process dynamics.
- Possible problems with pests.

## 7. CONCLUSION

The 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. The Root zone technique is very useful for small scale work. This study reviews RZTS which are planted filter beds consisting of soil. As on top layer maximum number of suspended solids will get settled and the organisms will get oxygen from roots of plants. Remaining dissolved solids will act as food for microorganisms and then it will convert into suspended biomass, which is helpful in

degradation of organic matter. As this system does not require any external energy source and chemicals ,hence it will create a low cost sewage treatment. This Technology uses a natural way to effectively treat domestic and industrial effluents.

**8. REFERENCES**

[1] Csilla T., Garay T.M. and Bratek Z., et al, "The use of reed in waste water treatment on construction wetlands"Proc. 8th Hungarian Cong. Plant Physiol and the 6th Hungarian Conf. Photosynth., 49, (2005).

[2] Vipat V., Sing U.R. and Billore S.K., "Efficiancy of rootzone technology for treatment of domestic waste water"Field scale study of apilot project in Bhopal, Proceedings of Taal 2007 : The 12th World Lake Conf., 995-1003, (2008)

[3] Preetha R. and T. Senthil Kumar, "Rhizosphere treatment technology for community waste water treatment"Electronic J. Environ. Agri. Food Chem., 14(1), 1-2, (2009).

[4] Pawaskar S.R., "Application of modified root zone treatment system for waste water treatment within Nallah area", J. Eco. Environ. Sci., 21 (2),22-29, (2012).