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Introduction to Waste Water Treatment by Root Zone Technique

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Abstract - *Increasing urbanization and human activities exploit and affect the quality and quantity of the water resources. This has resulted in pollution of freshwater bodies due to increased generation of domestic waste, sewage, industrial waste etc. This paper reviews the Root Zone Treatment System which are planted filter beds consisting of soil gravel, sand and fine aggregate. This Technique uses a natural way to effectively treat domestic and industrial effluents. RZTS are well known in temperate climates and are easy to operate having less installation, low maintenance, and operational costs and incorporates the self-regulating dynamics of an artificial soil eco-system. This technology has been successfully running in several countries. Use of constructed wetlands can now be recognized as an accepted low-cost eco-technology, especially 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 Technique,BOD,COD,DO,PH

1. INTRODUCTION

The term root zone emphases the life interactions of bacteria, the roots of the wetland plants, soil, air, the sun, and water. Root zone treatment is an engineered method of purifying wastewater as it passes through the artificially constructed wetland area.. The pollutants are removed by various physical, chemical and biogeochemical processes like sedimentation, absorption, and nitrification as well as through uptake by wetland plants. Root zone systems are reported to be most suitable for schools, hospitals, hotels and for smaller communities. The aim of this research is to study the effectiveness of the wetland plant Canna and Alocasia in the treatment of waste water generated. A pilot wetland unit was constructed on the campus grounds. Canna and Alocasia species were grown in the field with fresh water. Rows of plants were planted into the unit and subjected to waste water from the hostels and other campus buildings. The raw wastewater and treated wastewater were collected periodically and tested for quality. It is seen that this pilot unit is reducing the concentrations of TSS, TDS, BOD, COD by, respectively on an average. Root zone system achieves standards for tertiary treatment with no operating costs, low maintenance costs, enhances the landscape, provides a natural habitat for birds, and does not have any odor problem.

1.1 Objective of the research

The objectives of this Project were to
(1) Analyze and characterize the wastewater from sewage water.
(2) To investigate the feasibility of applying a constructed wetland system to treat the Sewage waste water.
(3) To compare the treatment efficiency of root zone system with conventional treatment plant.

1.2. The Research Motivations

The cost effectiveness of all waste water treatment technologies needs to be improved new design of mechanical systems which addresses this concern are been introduce by treatment plant manufacturing industry.
As it is natural process of water being recycled useful in various small scale works.

2. LITERATURE REVIEW

Literature 1: Journal of Environmental Research And Development Vol. 3 No. 3, January-March 2009.

- This study demonstrated that the designed sub-surface horizontal flow constructed wetland system could be used for treatment of the campus waste water. A constructed wetland system can be an effective treatment facility for campus waste water.
- Regarding the performance achieved, the sub-surface horizontal flow constructed wetland was able to reduce further the level of the main parameters.
- The treatment level was affected by the change of seasons, also by the variation in influent quality and quantity.
- The overall experimental results demonstrated the feasibility of applying sub-surface horizontal flow

constructed wetland unit to treat campus waste water.

Literature 2: International Journal of Applied Science and Engineering 2014. 12, 3: 169-175

- The present study clearly proves that the water quality during Root Zone treatment improves a lot which is indicated by reduction in BOD, COD, nitrate & phosphate value and increase in DO value. Thus it stands effective in treating the wastewater.
- It is concluded that the Root Zone System at Ekant Park, Bhopal is working effectively to treat the wastewater and the treated water can be reused for secondary purposes like fishing, swimming, irrigation etc. and safe disposal in nearby water bodies.

Literature 3: Global Journal of Environmental Research 4 (2): 90-100, 2010 ISSN 1990-925X © IDOSI Publications, 2010.

- It can be concluded that the future of Root zone technique is still in research and development phase and there are many technical barriers which need to be addressed.
- Plant Typha sp. based constructed wetland has proved as a promising technology for dairy effluents.
- Its rooted nature of reeds has favoured increased rhizosphere activity, thereby enhancing nutrient and metal uptake. Among the floating plants, Eichhornia sp. and Salvinia sp. were found to be more effective for treatment of industrial effluent, particularly heavy metal uptake, than the other plants studied.

Literature 4: The 12th Lake Conference: 995-1003, Sengupta M and Dalwani R (Editors 2008)

- The waste water efficiency of the root zone system was significant within one year of its operation. The adjustable outflow helped in maintaining the water level below the surface in the root zone system.
- It is very cost effective, low maintenance, eco engineering technology.
- A well designed, properly maintained and operated root zone system can be viable future technology in developing tropical country like India.
- It is Economical viable option for treating the municipal waste water at community level, small and medium sized towns and treated water can be recycled and reused for the secondary purposes and safe disposal in nearby water bodies.
- Thus it stands effective in treating the domestic waste water. The pre- treatment , i.e. screening and settling tank facilitated the function of the system by preventing clogging , odour , flies nuisance and etc.

Literature 5: International journal of environmental sciences Volume 3, No 1, 2012

- The waste water discharged in our campus setting was analysed to determine characteristics.
- The wastewater from campus shows differ in concentration according to student's strength. TSS, BOD and COD particularly show a large temporal differ.
- The root zone method was employed on a lab scale to treat the waste water. The results were compared with the conventional treatment.
- It is seen that the root zone treatment can be utilized independently for a small scale unit or as an additional unit to conventional treatment system for complete treatment of waste water.

Literature 6: International journal of current microbiology applied science (2015) 4(7): 238-247

- Considering the above facts we can say that the application of constructed wetlands in small towns, district and area can now be recognized as an accepted low cost eco technology, especially beneficial as compared to costly conventional treatment systems.
- Hence Root Zone Technology scores over the conventional chemical treatment of waste water and sewage water on these counts.
- Today constructed wetlands are recognized as are liable wastewater treatment technologies and represent a suitable solution for the treatment of many types of wastewater including industrial effluents, to treat storm-waters, industrial, mining and agriculture wastes.
- In this way the population that can be served is dependent on the land area available, the media used, climate, and other factors.

Literature 7. Journal of Environment Science & Engineering Volume 50, No.3, P.241-248, July 2008.

- CWTS seems to be an attractive option for the abatement of nutrient induced pollution in India. Compared to the use of RZTS abroad, the acceptance and development of this technology is relatively poor in India.
- The relevant gap can be bridged if the on-going technical research is directed to identification of wetland plants, supportive bed materials, their combination specific comparative performance

under similar conditions and their associated mechanism for nutrients removal.

- The development strategy should give due contributions of other countries so as to avoid unnecessary repetition of work which will in turn save time , money and efforts , and will help for the real acceptance of RZTS for Indian conditions .

Literature 8. Journal of Ecology and Environmental Sciences ISSN: 0976-9900 & E-ISSN: 0976-991, Volume 3, Issue 1, 2012, pp.-46-49.

- The present study was undertaken in order to have engineering insight, design and cost analysis of RZTS application with modification so as to treat waste water incoming to various nallahs of Maharashtra throughout the nallah area which will also prove multiple point waste water treatment (multistage treatment) in an economic manner to control intense waste water pollution problem of state.
- It also gives immediate & simplified solution to the waste water pollution control. Based on the outcomes of this study similar type of modified design of RZTS with trickling bed can be useful to other medium size cities of India.

Literature 9: International Journal of Advanced Research in Engineering and Applied Sciences ISSN: 2278-6252 Volume 1, No.6

- Phytoremediation with the appropriate assortment of locally adaptive aquatic plant is an assured, more trust worthy and sustainable technology for better treatment of sewage in local environment.
- It is concluded that Canna indica is a suitable aquatic plant for sewage treatment. This is an adaptive plant in western region of India.
- It has considerable capacity of pollution reduction from the sewage and the capacity of generating treated water. The treatment efficiency increases with dilution.

3. METHODOLOGY

3.1 Water sampling and analysis

1. Water samples were taken once from inlet chamber and outlet chamber of the wetland unit.
2. The samples were collected by putting a clean plastic bottle below the inlet or outlet pipe of constructed wetland.
3. The samples were analyzed for pH, Total Dissolved Solids ,DO, BOD and COD according to Standard Methods for Waste and Waste water Examination.

3.2 Construction and Working of Reed bed.

1. The unit was constructed by placing separate layers of stone chips, sand, stone dust, after arranging the layers the plants were planted in the unit.
2. Further the growth of plants was monitored.
3. During the growth period of one month, only plain water was sprinkled.
4. Then sewage water was let into the root zone system and the samples were collected.

3.3 Action of reeds with waste water.

First, the very existence of root zone system creates space for the water to pass through. Secondly, the roots introduce oxygen down into the body of soil and provide an environment where aerobic bacteria can thrive. These organisms are necessary for the breakdown of many types of compounds in particular in the oxidation of ammonia to nitrate; this is the first step in the biological breakdown of nitro compound. Thirdly, the process of nitrification takes place i.e. the plants themselves take up a certain amount of nutrient from the wastewater.
Reed beds can help to achieve a better standard of water quality through.

1. High level of bacterial and viral removal
2. Decreased biological oxygen demand and reduction of suspended solids.
3. Reduction of nitrogen concentrations and removal of metals.

4. APPLICATIONS

1. Best recommended For Septic tank outlet treatment.
2. Treatment of polluted streams, nallas, rivulets and water-bodies (floating beds may be recommended) water-bodies (floating beds may be recommended).
3. Bathroom water recycling. In combination with specific / simple pre-treatments it can be used as polishing treatment for treatments
4. It can be used as polishing treatment for any waste water. E.g.–Brewery, Sugar factories.

5. CONCLUSIONS

The root zoning 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, sewage, industrial waste etc. This Seminar reviews the Root Zone Treatment System (RZTS) which are planted filter beds consisting of soil. This

Technology uses a natural way to effectively treat domestic and industrial effluents.

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