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Reed Bed Technology for Waste Water Treatment – A Review

Mr. Aditya Bhandakkar[1], Ms. Dhanashri S. Umbarkar[2], Dipanshi Y. Dongre[3], Prof. Dr S.G. makarande[4] , Ms. Pallavi B. Gadge[5]

B.E Student, Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, India[1]

B.E Student, Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, India[2]

B.E Student, Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, India[3]

Professor, Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, India[4]

Asst. Professor, Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, India[5]

Abstract: In this article, reed bed technology is described in brief.Reed bed technology is a waste water treatment which is natural purifying decentralized process. There are different types of macrophytes present in waste water. Thus various types of reed bed i.e Horizontal flow and Vertical flow type reed bed is use. Also many types of aquatic plant species is used in this technology for treatment of waste water. This technology gives an efficient and satisfying solution to the problem of domestic waste water.

Keywords: Horizontal flow, vaertical flow, Rophytes, Rhizosphere, NitrificationDenitrification, Root-Zone.

I. INTRODUCTION

Day by day increasing scarcity of water required the reuse of water in different rural areas or in those places facing the same problem. Treatment of wastewater so that we can reuse it for a different purpose is required. The reeds bed system is one of the most widely accepted wastewater treatment methods. Rural areas can easily afford this method as it is cost-effective than any other conventional wastewater treatment method. A reed bed wastewater treatment system works according to the law of nature, to effectively purify domestic effluent. It is a biological treatment that works on the combined action of plants and bacteria. Reeds bed system consists of a layer of sand, gravel and planted with the macrophytes i. e Phragmites Australis. Wastewater passes through the basin and undergoes treatment. The filtering action of soil bed, biological and physical interaction between wastewater, plant, micro-organisms, oxygen, and gravel takes place. This mechanism is known as root zone technology or Bio-filter or Constructed Wetland (CWs). Reed Bed System is highly effective, eco-friendly, cost-effective, maintenance-free, and responsible for the reduction of carbon footprint.

II. LITERATURE REVIEW

A huge number of industries produce toxic wastes and discharged into rivers and streams with insufficient treatment or without treatment; an action which increases threats to public and aquatic lives. In this paper, reed bed treatment system for removal of toxic metals from industrial waste water was investigated. Phragmites Karka, a reed palnt was used for the Wetland system while granite and washed sand were used as substrates. Hydraulic retention period for the treatment performed is of 3, 7, 11, 15 and 19 days. The results describes that the retention periods increases with gradually reduction of the biochemical parameters. The removal rate with reed bed lies between 36.8% to 61.5%. These results further confirm the efficiency of the reed plant, phragmites karka, in the treatment of industrial wastewater.
Our objective is to study the performance efficiency of the reed bed system in the removal of harm full chemicals contained in the contaminated water.

III. REED BED SYSTEM

Reeds bed system works on the principle of Root Zone Technology (RZT). Reeds bed systems are known as Constructed Wetlands (CWs), when common reeds, phragmites australis have been planted as the main macrophytes. It is one of the most cost-effective methods of wastewater treatment & affects the environment minimally. On other hand, we can say it is an eco-friendly method of sewage treatment. It works on the principle that reeds can transfer the oxygen from leaves

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to their rhizomatous root, promote the growth of bacteria in the bed and help break down the organic matter in the root zone.

A. TYPES OF REED BED

There are different types of reeds bed exist based on their hydraulic flow, such as Horizontal flow reeds bed, Vertical flow reeds bed, Surface flow reeds bed, Hybrid flow reeds bed. Horizontal flow reeds beds are the most common type for tertiary treatment of sewage at small work. Meanwhile, vertical flow reeds bed are widely used as it deals with strong effluents. Due to the extra availability of oxygen, Vertical flow reeds bed provide good nitrification, ammonia removal, as well as the removal of (Biochemical Oxygen Demand) BOD pollutants. While Horizontal flow reeds beds are efficient to reduced BOD (Biochemical Oxygen Demand) and Suspended Solids.

B. MACROPHYTES AND ITS ROLE

Microphytes are phytoplankton and are also known as microalgae generally found in fresh and marine water. An interesting step for wastewater treatment offered by microalgae culture. As they provide tertiary biotreatment along with the production of potentially valuable biomass, which can be used for several purposes. Microalgae use inorganic material (such as nitrogen and phosphorus) for their growth. Hence, microculture can be treated as tertiary and quandary treatment for wastewater. Also, they have the ability to remove heavy metals and some toxic organic compounds. Thus, it does not lead to secondary pollution. Microphytes are very important for life on the earth. Approximately half of the atmospheric oxygen has been produced by them. They are responsible for the reduction of greenhouse gas carbon dioxide.

C. AQUATIC SPECIES PLANT

There are various species of aquatic plants but should prefer one of the native species grows locally in that area. The species should have a relatively rapid growth rate, be able to withstand wetland conditions, and be tolerant of rich feeds. In India, the *Phragmites Australis* also known as common reeds and locally known as 'Nanal' in Tamil Nadu, has been proven to be most effective for wastewater treatment. Their heights range up to 3m -4m at full of their growth. These species of aquatic plants have the ability to transfer the oxygen from the leaves of the plants to their roots via stem from the atmosphere, where a part diffuses into the liquid substrate. They have deep root and the main stem that's run underground horizontally called 'rhizome' which provide the growth of microorganism to form their colonies. Microorganism used oxygen from the plants and helps to stabilize the organic matter. Thus plants promote the growth of microorganisms, Promote nitrification, denitrification along with the stabilization of organic matter.

D. REED BED SYSTEM PROCESS

The 'Root Zone Technology' works on the principle of nature to effectively purify the domestic effluents. It consists of the live interaction of various species of bacteria, soil, roots of plants, air, sun, and of course water. Reeds plants have the characteristics ability to absorbed oxygen from the atmosphere and promote the growth of microbial organisms. Most of the microorganisms oxidized and help to purify the wastewater also use nitrogen and phosphorus to multiply their colonies. It is one of the most eco-friendly methods of purifying, a self-regulating process found by nature itself. Some important component is essential in this system are

1] Aquatic plant use *(Phragmites Australis)*
2] Set up of reeds bed
3] Microbial organism or Microphytes.

The raw effluents pass through the bed of soil horizontally or vertical having an impervious bottom. The roots of reeds plants spread very thickly under the ground where the effluents percolate. Nearly about 2,500 types of bacteria and 10,000 types of fungi, received oxygen from the weak membrane of the root and aerobically oxidized the organic matter of effluent. These plants absorbed oxygen from the atmosphere with the help of their leaves transfer it to the roots through the stem while the roots of these plants are deep and having pores in them which makes oxygen dispersed under the ground. Thus, it can be utilized as a bio-pump. Far from the roots, anaerobic digestion also takes place. Self-filtering action of soil bed, the action of microbial organism help to treat the wastewater and finally obtaining clean and clear water that's all it compasses. This system has the ability to regenerate from the death of old plants and creates some useful humus. Hence, it is one of the most efficient, maintenance-free, cost-effective and run-for several-year methods.

E. GUIDELINES FOR REED BED TECHNOLOGY

1. Site selection

a. The site selected should not impairs the drinking Water sources.

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b. The site should not be a flood prone area.
c. The flat ground surface should be selected which is at lower level that nearby water bodies.
d. f design and location is proper, CW does not generate any order or nuisance in the vicinity.
e. Now-a-days it is possible to treat a waste water at the already selected site by the standars parameters od concerned authority.
f. Selected sites should be easily assicible for maintaince.

2.Shape:-
a. This allows an increase in the flow path that helps in increases contact period.. This ultimately increases the flow path and efficiency of treatment is also increases.
b. Space constraint case gives an alternative shape to the filter bed such as Zigzag or vertical flow are generated.

3. Selection for suitable filter media:-
a. Gravel should be of rounded in shape.
b. Filter sixe should be in between . Effective grain size should be> .2 mm.
• Different size of filter media in a cm. - proportion of 1:3 is used that provides effective pore space of 30 percent .

4. Depth and Dimension:-
Two factored are considered for the dimensioning of the planted filter bed,
1. Waste water Volume
2. Load of organic materials

IV. CONCLUSION

Sanitary water is harmful to dispose directly on ground surface. It is necessary to dispose such waste into the pit hole. If it is not possible due to concreting surfaces and increase in transportation cost, Reed Bed system is a good and effective alternative. Now a days, it is a need of every college hostels. In BDCE the sanitary water from hostels are disposed into pits, due to availability on mass land. But it is more effective to clean before going to dispose. In this way, ground water pollution reduces up to great extent. In that case, Reed Bed system is more effective and economical.
The water after treating with Australis phragmities (Aquatic Plant) gives clean and palatable water. The results are taken from above mention research paper. The BOD removal efficiency is approx. 76.81%. This indicates that use of such water is allow for agricultural practices. The value of COD for treated water is 25.5 mg/l, which is much lesser than 250 mg/l. pH of treated water is 7.8, which is most suitable for cleaning purposes with no colour. In such a way, HARDNESS, TDS, TSS, SS, TURBIDITY, CHLORIDES are under usable value. This indicates that Reed Bed system is effective way for treatment of water.

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