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Natural Reed Bed Wastewater Treatment System

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ABSTRACT:

Fresh water is becoming a scarce commodity. Even areas with high rainfall are experiencing fresh water scarcity, during summer, every year. In this situation, it is necessary to conserve as much fresh water as possible. Wastewater recycling is one solution for fresh water scarcity. Various kinds of treatment systems based on site-specific operating conditions are available. The aim of any wastewater treatment system is to reduce the obnoxiousness of the wastewater. This is done by reducing the Organic Matter (BOD and COD), Colour, Odour and Microbial Pathogens. The above aim can be achieved by using various technologies. Principally all these technologies have one common feature which is digestion of the organic matter by suitable microbes. These systems use various kinds of supports for growing the microbes. They can be (i) coarse aggregates as in Reed Bed, or (ii) Fixed Film forming supports as in Submerged Aerobic Fixed Film Reactor (SAFF), or (iii) Suspended Supports as in Moving Bed Biofilm Reactor (MBBR), or (iv) virtually no medium as in Membrane bioreactor(MBR).

Keywords *- Conventional techniques, reed bed system, wastewater treatment, water reuse*

I. INTRODUCTION

Water is the basic source of life. Due to increasing population and all-round development in the country, water demand is increased and the per capita average annual freshwater availability has been reducing. Wastewater treatment is not given the necessary priority it deserves and therefore, a significant volume of wastewater is not subjected to any treatment and is ultimately discharged into surface water bodies leading to the deterioration of water quality. This leads to an accelerated increase in the pollution of surface water bodies. Major rivers were contaminated through industrialization, urbanization and land use pattern [1].

However, there are higher risk associated to human health and the environment on use of wastewater especially in developing countries, where rarely the wastewater is treated and large volumes of untreated wastewater are being used in agriculture. In the metro polities city facilities are provided wastewater treatment plant, but in a rural area, sewage drains are directly connected to water bodies [2]. Hence, there is an urgent need for efficient water resource management through enhanced water use efficiency and wastewater recycling

II. CONVENTIONAL TECHNIQUES

Generally, waste water is defined as a combination of the liquid or water-carried wastes removed from residences, institutions, and commercial and industrial establishments, together with such groundwater, surface water, and storm water as may be present. The main aim of waste water treatment is the removal of contaminants from waste water so that treated water can be safely let out in rivers or streams. The waste water

treatment is carried out in three states: (1) Primary treatment– to remove suspended solids, odour, colour, and to neutralise the PH, (2) Secondary treatment – a biological treatment of effluents obtained from primary treatment to remove BOD of waste water and (3) Sludge disposal – to remove the solids as much as possible and stabilise the solids into stable products. There is a great possibility for waste water treatment in India. The sanitary or municipal wastewater from an urban population of roughly 45 million people in India is systematically collected through sewers [3]. The estimated wastewater volume thus collected is nearly 1137.5 million gallons per day (MGD) or179361m^3/day.

III. INTRODUCTION TO REED BED SYSTEMS

Fresh water is becoming a scarce commodity. Even the areas with high rainfall are experiencing fresh water scarcity, during summer, every year. In this situation, it is necessary to conserve as much fresh water as possible. Wastewater recycling is one solution for fresh water scarcity. Reed Bed System, a simple, user-friendly method of wastewater treatment. It does not require complex setups or high energy or complex instrumentation. Maintaining such systems is very easy, as it does not need highly trained manpower and complicated equipment. Conventional wastewater treatment systems on the contrary, are essentially complicated and require lot of energy for aeration, complex equipment and trained manpower for maintenance. Thus, Reed Bed System is a clean, economic and eco-friendly method of domestic sewage treatment as an alternative to the conventional systems.

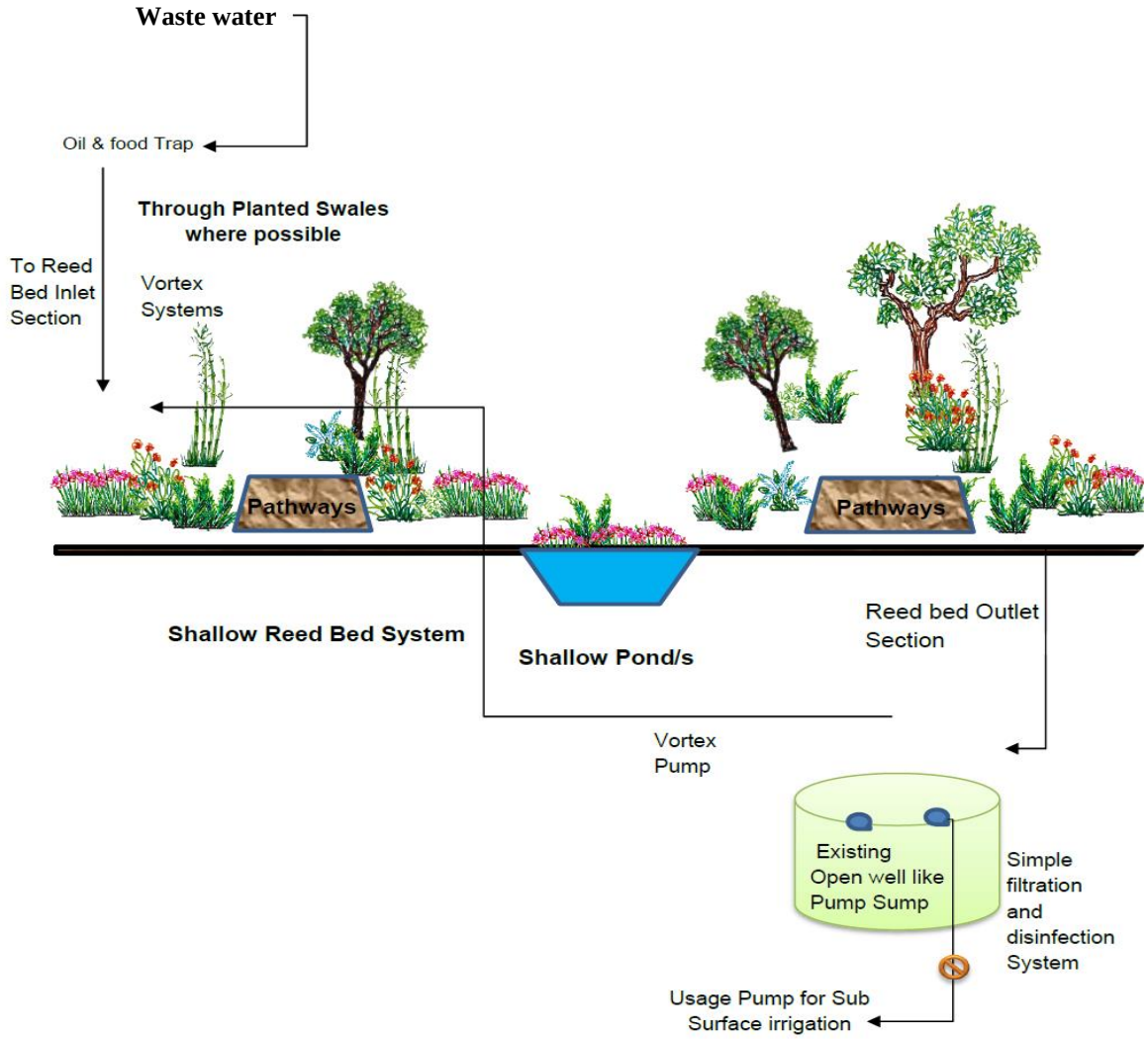
Reed Bed System is the artificial wastewater treatment system consisting of shallow ponds or channels which have been planted with aquatic plants, and which rely upon natural, biological, physical and chemical processes to treat wastewater. It typically has impervious clay or synthetic layer and engineered structures to control the flow direction, water level and liquid retention time. These plants can be used to treat variety of wastewaters including urban run-off, municipal, industrial, agricultural and acid mine drainage[4]. Reed beds have positive characteristics of a natural wetland and can also be controlled to eliminate the negative aspects of natural wetlands. There are two basic types of reed beds, viz., free water surface reed bed and subsurface reed bed. Salient Features are i) fit it and forget it system ii)No foul odors iii)No flies and mosquitoes iv)Picturesque garden like appearance v) No need of electricity for aeration vi) No mechanical moving parts, hence very low maintenance and no replacement cost vii) The treated water can be recycled for industrial use, for agriculture, aquaculture or ground water recharge. There are more than 100 such Natural Reed Bed systems operative in India and a few thousand the world over.

IV. METHODOLOGY AND DESIGN

Reed Bed System employs natural principles for treatment of domestic sewage. Specially selected plants are made to combine their aeration strength with highly efficient microbial cultures. The treated water can be recycled or reused for low end uses like irrigation, toilet flushing etc.

The design of the entire Reed Bed System will be kept very simple, practical and as low maintenance as possible. The wastewater is brought to a suitable site. A tank or a pit of suitable dimension is constructed - the dimensions depend on the site conditions and volume of the wastewater to be treated. The tank or pit is lined by soling-PCC or LDP lining. If necessary, other types of civil structure can also be made into the treatment tank.

The tank is filled with coarse mixture of high porosity, efficient sewage treating bacteria and supporting media. Specially selected acclimatized plants are then planted. The roots of these plants form an association with the bacteria to give effective sewage treatment. This system remains functional for many years with very low maintenance. It looks like a beautiful flowering garden and not like ugly smelly aerosol spewing. The treated water can be taken out from the polishing pond - in this case from their wastewater collection Sump Well with the help of suitable pump. Passed through simple filtration system and then used for irrigating the local landscape as subsurface irrigation. This subsurface irrigation will also be part of the treatment. The entire system will take approximately 3 months to construct and the plants will take another 3-6 months to stabilize, grow tall and flourish with dense growth. Once the system is well established then the plants will naturally grow and regenerate with minimum maintenance and supervision.



"Fig.1.Schematic Diagram for The Nature Based waste water Recycling System"

V. ADVANTAGES & DISADVANTAGES OF REED BED OVER CONVENTIONAL SYSTEM

Reed beds are low-cost technology; it is easy to construct, operate, and maintain. It also has ecological values [5]. They need not require any machineries and electricity treatment under gravity. Constructed wetlands were

found to have significantly lower total lifetime cost and often lower capital costs than conventional treatment systems. Plants used in this system enhance the efficiency of nutrient removal, raise microbial diversity, do not alter the esthetics of the landscape and can be used for composting. Reed bed has better adaptability and flexibility of treatment, tolerates fluctuations in flow and does not involve additional pollutants. This technology can be worth and less expensive to build other than treatment options [6]

The main drawback of this system is the requirement of a larger area than the conventional system. Construction should have proper planning and implementation. The reeds are sensitive to nutrient concentration and toxic levels and require a constant water supply. Plants may have plant stress, mortality symptoms, susceptible to nitrogen burn, heat stress, ammonia toxicity and damage by aphids. The chances for developing negative micro-organisms and may lead to the accumulation of heavy metals in plants [7].

VI. CONCLUSION

Reed bed treatment is an efficient method for treating domestic wastewater and very suitable for arid climate areas. It can be used for saving fresh water, mitigating climate change effects and environmental issues, produce quality fertile water which can be used for irrigation purposes. In future, improved construction with different lining materials, an adaptation of different plants for purification and studies on the biological process required for maximum utilization so that quality of shallow water can be improved which leads to future sustainability. The interaction between pollutant, medium, plants and also microbes plays an important role in treating wastewater using the reed bed system.

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