Domestic Waste Water Treatment using Modified Root Zone Technology

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Abstract— In today's scenario, Waste water treatment is a challenging task, technically as well as economically. The present study will base on developing modification in conventional root zone technology systems. In conventional RZTS' there are many problems related to quality of effluents, life span, and maintenance and space requirements. This system will be developed on the basis of effluent quality and space requirement constraints. Study will be carried on a pilot scale reactor having dimensions 1m X 1m X 0.4m. The reactor will be divided in three zones. The top zone will be consisting of soil layer, intermediate zone will consist of sand layer and bottom zone will be consisting aggregate layer of various thicknesses. On top layer Colocasia trees will be planted. When waste water will pass through the top and intermediate layer all suspended solids will get trapped in the pores of soil and sand and remaining solids will be get removed with the help of bacteria. Bacteria that are present in waste water will use the solids as their food and they will get oxygen through the roots of colocasia trees. After detention period water will allowed passing through the outlet valve and it will be analyzed for various factors, such as BOD, COD and solids. After that with proper disinfection water will be discharged on surface water bodies.

Key words: Modified Root Zone Technology, Colocasia, Disinfection

I. INTRODUCTION

Water pollution of surface water bodies is a major environmental issue in India. The largest source of water pollution in India is untreated sewage, originating from domestic, commercial and institutional activities. There is a large gap between generation of waste water and treatment facilities available to treat that water, due to lack of funds and space. The majority of the government sewage treatment plants remain closed most of the time due improper planning, operation and lack of skilled labour. Many of Indian rivers are gets polluted due to discharge of such untreated wastewater.

A. Need of Low Cost Treatments

As the initial and running cost of conventional treatment plants is very high and such treatment plants are performing poorly due to lack of maintenance or due to lack of skilled operational supervision and it also gives poor quality of effluent.

Hence there is a need to study the alternative low cost methods of sewage treatments to reduce operation and maintenance of STP. These alternative methods should be low-cost method and should also have good degree of treatment as compared to conventional treatment. One of the methods which are low-cost method is Root zone technology but it will require some modification.

B. Root-Zone Technology

The term 'Root Zone' consists of the life interactions of various bacteria, the roots of plants, soil, sun, and water. They are also known as constructed wetlands or sub-surface flow systems.

C. Objective

Following are the primary objectives of the study

1) To reduce the initial capital cost.
2) To lower down the operating and maintenance cost.
3) To reduce the skill and expertise labour work
4) To develop a modified reactor for getting maximum efficiency than conventional RZTS.
5) To study the low cost sewage treatment methods.
6) To investigate feasibility of Modified Root Zone Treatment system for sewage treatment.
7) To workout cost economics of Modified Root Zone Treatment system and comparison with conventional sewage treatment methods.

II. METHODOLOGY

The process in a root zone system to treat the sewage begins with passing the raw effluent horizontally or vertically through a bed of soil having an impervious bottom. The effluent percolates through the bed that has all the roots of the wetland plants spread very thickly, nearly 2500 types of bacteria and 10000 types of fungi, which harbor around roots get oxygen from the weak membranes of the roots and aerobically oxidize the organic matter of the effluent. The characteristics of plants of absorbing oxygen through their leaves and passing it down to roots through their stems which are hollow are utilized as a bio-pump. Away from the roots, anaerobic digestion also takes place. The filtering action of 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 up to 50 to 60 years without any loss of efficiency.

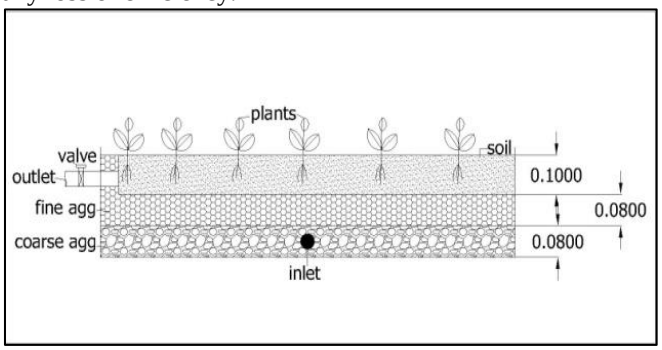

Fig. 2.1: Layout of proposed system

III. PROCESS

The treatment process is based on the activity of microorganisms present in the soil. Smaller the grain size of the filter material and consequently larger the internal surface of the filter bed higher would be the content of microorganisms. The oxygen for microbial mineralization of organic substances is supplied through the roots of the plants, atmospheric diffusion and in case of intermittent wastewater feeding through suction into the soil by the outflowing Wastewater. The roots of the plants intensify the process of biodegradation also by creating an environment in the rhizosphere, which enhances the efficiency of microorganisms and reduces the tendency of clogging of the pores of the bed material caused by an increase of biomass. The filtration by percolation through the bed material is the reason for the very efficient reduction of pathogens, depending on the size of a grain of the bed material and thickness of the filter, thus making the treated effluent suitable for reuse. Conversion of nitrogen compounds (Nitrification / Denitrification) occurs due to the planned flow of wastewater through anaerobic and aerobic zones.

IV. CONCLUSION

Study will cover the sewage treatment of conventional sewage treatment plant, low cost sewage treatments by modified root zone technology and will conclude the necessity of on site and non-mechanised treatment system. As on top layer maximum number of suspended solids will get settled and the organisms will get oxygen from roots of plants. The remaining dissolved solids will act as a food for the microorganisms and then it will convert that into 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 will not create any foot print. Also, it will give extra income from that plant.

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