Journal of Ecology and Environmental Sciences

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Aim & Scope

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Municipal waste,
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APPLICATION OF MODIFIED ROOTZONE TREATMENT SYSTEM FOR WASTE WATER TREATMENT WITHIN NALLAH AREA

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Abstract- The rapid urbanization has resulted in putting excess pressure on infrastructure facilities resulting in low level of services provided by local authorities. The sewage flowing through nallahs joins rivers in untreated condition and creates heavy risk of river pollution. The city sewage treatment plants also do not produce treated sewage of expected quality standards and is similar to nallahs waste water. This study investigated the effectiveness and techno economical feasibility for RZTS (Root zone treatment system) along with it's modification. Other objective of the study was to work out with BOD, COD and TSS removal efficiency of modified RZTS and trickling bed model. The suggested modification in RZTS overcomes the limitations of huge area requirement for application of conventional RZTS (Constructed Wetland) and as such the modified constructed wetland (modified RZTS) can be effectively used within the nallah area to treat incoming waste water in nallah with techno economical feasible option.

Keywords- Root Zone Treatment System (RZTS), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Cx. Coefficient.

Introduction

There is close to 5100 odd municipalities across India wherein the problem of municipal domestic waste water management has reached critical dimensions Municipal agencies spend 5 - 25% of their budget on municipal domestic waste water management, which is Rs. 75 - 250/capita/year. In India the data indicates dismal scenario of waste water treatment. 71% of the total waste water generated is collected, only 31.5% of waste water collected is treated and rest is left without treatment, i.e. about only 23% generated waste water gets treated and rest 77% waste water disposed off without any treatment, which pollutes surface water and ground water aquifers as well. More serious is the issue of waste water collection and treatment in small and medium towns (sustainable sanitation solutions 2008). This has resulted in health problems such as diarrhea, cholera and other epidemics among the masses. So this is quite important to analyze and change the methods used by the municipal corporations. Unfortunately most of the cities in India have under drainage system provided to part of the population and lot of sewage flows unsewered through open drains and nallahs. In case of Kolhapur (Maharashtra, India) city the central sewerage system covers only 30% of the city area as per (City Development Plan ) CDP report of Kolhapur Municipal Corporation. The rest of city area is either having other sanitation system (septic tank, soak pit) or no system at all. With the existing systems there are chances of ground water contamination or water pollution. The joining of this waste water with under drainage system creates significant changes in the characteristics of waste water due to addition of clay, solid waste, debris which leads to choking and malfunctioning of the system. The maintenance of the sewerage system is again not satisfactory due to scarcity of funds and requires manpower, required machines; as a result there is increased load on sewage treatment plants which degrades its treatment efficiency. Of the total urban population in Maharashtra spread over 250 cities
1) No dilution of high strength wastes with clean water.
2) Maximum of recovery and re-use of treated water and by-products obtained from the pollution substances. (i.e. irrigation, fertilization)
3) Application of efficient, robust and reliable treatment/conversion technologies, which are low cost (in construction, operation, and maintenance), which have a long life-time and are plain in operation and maintenance.
4) Applicable at any scale, very small and very big as well.
5) Leading to a high self-sufficiency in all respects.
6) Acceptable for the local population.

One approach to sustainability is through decentralization of the wastewater management system. This system consists of several smaller units serving individual houses, clusters of houses or small communities. Black and gray water can be treated or reused separately from the hygienically, more dangerous excreta. Non-centralized systems are more flexible and can adapt easily to the local conditions of the urban area as well as grow with the community as its population increases. This approach leads to treatment and reuse of water, nutrients, and byproducts of the technology. In developing countries, 300 million urban residents have no access to sanitation and it is mainly low income urban dwellers who are affected by lack of sanitation infrastructure.

J. H. J. Ensink, S. Brooker, S. Cairncross and C. A. Scott, In their paper entitled, 'Wastewater use in India: the impact of irrigation ways on water quality and farmer health', have studied the impact of irrigation ways on water quality and farmer health. In 2001 it was estimated that 73% of India's wastewater was disposed of untreated into rivers, irrigated canals and other surface water bodies and that an investment of US$ 65 billion would be needed to build the required wastewater treatment facilities. Based on literature review & earlier research work on root zone treatment system (RZTS), RZTS treatment is better low cost waste water treatment method but going through the designs for calculation of area requirement of RZTS, it is found that from Bhopal project design it is about 100 l/ m² & from Santa Elena project developed formula for area calculation is

\[ A = \frac{(Q_{\text{ave}})(l)}{(n)(\text{dw})} \]

Where,

- \( A \) = Area required for root zone bed to effectively treat grey water (square meters)
- \( Q_{\text{ave}} \) = Average daily input (cubic meters)
- \( t \) = Retention time (days)
- \( n \) = effective porosity of root zone bed medium (what percent of the volume is left for the water after gravel or plastic has been put in)
- \( \text{dw} \) = Depth of bed (meters)

Going through this formula it is found that from Santa Elena project, the area requirement is about 100 m². So area requirement is the basic hurdle in using this treatment system in low cost waste water treatment and this can be overcome by modifying conventional root zone treatment system.
Modifications suggested
In conventional RZTS to minimize the area requirement which is major constraint while using conventional RZTS.
1. Lower 0.5 m depth bed will be acting as constructed wetland (RZTS), as anaerobic treatment.
2. Upper 1.5 m depth bed will be designed as trickling bed, act as aerobic treatment.

Figure showing Schematic Diagram of the of the experimental setup for suggested Modification in conventional constructed wetland (RZTS) system.

Developed Mathematical formula
To calculate area requirement for use of modified constructed wetland system (Modified RZTS) is

\[ A = CK \left( \frac{Q_{\text{total}}}{t} \right) \left( \frac{1}{n} \right) (dw) \]

Where,
- \( A \) = Area of treatment bed in nallah area in m²
- \( Q_{\text{total}} \) = Total waste water flow generated in Kolhapur city and joining various nallahs in m³.
- \( t \) = Retention time in days (2.5 days)
- \( n \) = porosity of bed media (0.6) root zone bed.
- \( dw \) = Depth of root zone bed 0.5 m
- \( CK \) = Coefficient (Varies with different nallahs) (For Kolhapur value of CK is 0.100618, and is calculated after analysis of results from various nallahs of Kolhapur.)

Discussion
The present study was undertaken in order to have engineering insight, design and cost analysis of RZTS application with modifications so as to treat waste water incoming to various nallahs of Kolhapur (Maharashtra, India) city throughout the nallah area which will also prove multiple point waste water treatment (multi-stage treatment) in an economic manner to control intense waste water pollution problem of Kolhapur city. 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.

The suggested modification in RZTS overcomes the limitations of huge area requirement for application of conventional RZTS (Constructed Wetland) and as such the modified constructed wetland (modified RZTS) can be effectively used within the nallah area to treat incoming waste water in nallah with techno economical feasible option.

Salient features of modified constructed wetland (Modified Root Zone Treatment) system-
- Require simple construction methods,
- No machinery (pumps, aerators, etc.) and no inputs of energy or chemicals are required for the treatment process,
- In the modified constructed wetland (Modified Root Zone Treatment) system process no sludge is generated, therefore the sludge handling and disposal problem is restricted only to primary sludge this is a unique and remarkable feature of modified constructed wetland (Modified Root Zone Treatment) system.
- Can accommodate significant variations in hydraulic and pollution loads without significant loss of efficiency
- Can handle a large variety of pollutants,
Application of Modified Rootzone Treatment System for Waste Water Treatment within Nallah Area

- Does not require skilled personnel for operation maintenance,
- Low operation and maintenance costs; typically in root zone systems these are less than 1% of the cost of the system per year,
- Can be built to suit both decentralized and centralized sewage treatment systems; in decentralized situations considerable drainage costs may be saved
- Can be easily and cost-effectively expanded to accommodate increased loads,
- High efficiency in removal of pathogens; no other treatment system, without the use of additional chemicals or physical processes, can ensure the extensive elimination of pathogenic germs,
- Allows re-cycling and safe re-use of waste water,
- Capital costs comparable to other similar wastewater treatment systems.
- Long life span of systems.

Thus modified constructed wetland (Modified Root Zone Treatment system) is not only eco-friendly but have low operational costs, producing high water quality (up to bathing water standards) suitable for re-use. These features make RZT systems low-cost, environment-friendly, and reliable in both the short and long term applicability.

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References