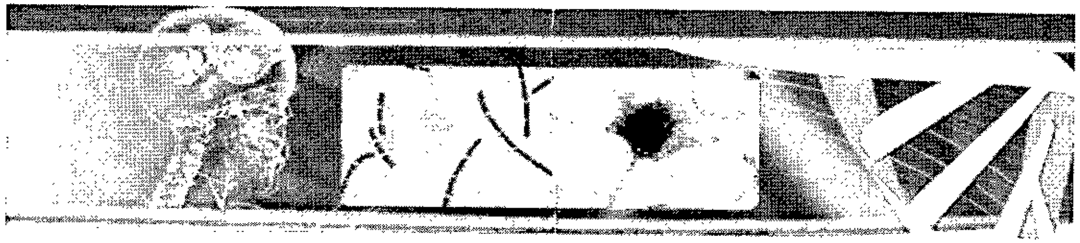
bio INFO

Home Journals by Subject ‣ Books Journals Publications Catalogue ‣ Support ‣ News / Conferences Contact us



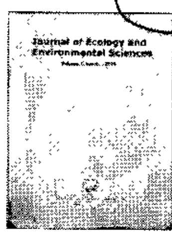
9962

Journal of Ecology and Environmental Sciences

- Aim & Scope
- Editorial
- Instruction for Authors
- Contents & Abstract
- Open Access Publishing
- Editorial Policy
- Benefits for authors
- Copyright Form
- Journal Subscriptions
- **Manuscript Submission**
- Indexing
- Editorial Member Signup
- Articles in Press
- Special Issues

Contents

Impact factor value: ICV: 4.53



Journal of Ecology and Environmental Sciences
Editor-in-Chief: Dr Kazunori Hironaka, (JAPAN); Dr Li HE, (CANADA)
Category: International Journal
Publisher: Bioinfo Publications
ISSN: 0976-9900 (Print) & E-ISSN:0976-9919 (Online)
Frequency: Tri-Monthly
Marketed by: EBSCO Publishing, USA; Ovid Technologies, USA; ProQuest, USA
Subject: Ecology and Environmental Sciences

| Indexing | Editorial Board | Archive | Instruction for Authors | Manuscript Submission | Benefits for authors | Copyright |

The Journal of Ecology and Environmental Sciences (IJEES),ISSN: 0976-9900 & E-ISSN: 0976-9919, aims to publish all the latest and outstanding research articles, reviews and letters in all areas of pure and applied ecology (i.e., plant, animal, microbial and human ecology) and environmental science including environmental pollution, conservation, resource management, sustainable development and global change. Each issue contains a series of timely, in-depth written articles by leaders in the field, covering a wide range of the integration of multidimensional challenges of research including integration issues of the Ecology and Environmental Sciences research.

The journal focuses on the articles in advances in key compound classes and research areas of Techniques of–
Any novel approaches Ecology and Environmental Sciences
Composting,
Evolutionary biology of chemically-mediated biotic interactions,
Industrial waste,
Landfill,

Mechanistic approaches as well as environmental aspects.
Municipal waste,
Recycling,
Residual waste and other MSW -municipal solid waste management and technology subjects,
Waste collection,
Waste economics,
Waste policy,
Waste reduction,
Waste transfer,
Waste-to-energy,

Journal of Ecology and Environmental Sciences (IJEES), ISSN: 0976-9900 & E-ISSN: 0976-9919, is an essential journal for all academic and industrial researchers who want expert knowledge on all major advances research areas in the molecular biology research.

The journal aims to provide the most complete and reliable source of information on current developments in the field. The emphasis will be on publishing quality articles rapidly and openly available to researchers worldwide. All published articles will be deposited immediately upon publication in widely and internationally recognized open access repository. Moreover, it is providing the maximum exposure to the articles.

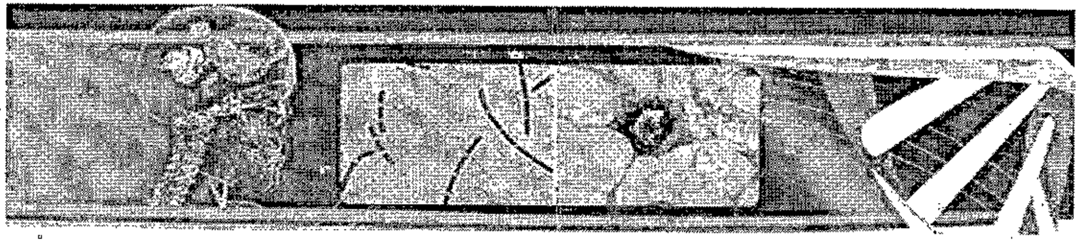
The journal will be essential reading for scientists and researchers who wish to keep abreast of the latest developments in the field. The publishers are confident of the journal's rapid success.

Bioinfo Journals are indexed in:

Biblio [Vrije Universiteit Brussel], Bioinfopress, Cabell Publishing, Inc., USA, CAS [Chemical Abstracts Service], CSA, Directory of open access journals [DOAJ],EBSCO Publishing, eLibrary, ERIC [The Education Resources Information Center], Genamics JournalSeek, Geneva Foundation for Medical Education and Research, GeonD, Google Scholar, Google, IBID, IndexCopernicus, Informatics, IRNEM, J-Gate, Lippincott Williams & Wilkins, Lupton Library [The University of Tennessee at Chattanooga], NewJour [Electronic Journals and Newsletter], OCLC, OhioLINK, Open Access, Open J-Gate, Ovid, ProQuest, PubsHub, QSpace, SCIRUS, Smithsonian Institution Libraries, Socolar, Tulips [University of Tsukuba Library], UCSD Libraries-NewJour Project, Universe Digital Library Sdn Bhd,URMC [University of Rochester Medical Center], Wolters Kluwer Health Medical Research, Revistas Electronicas [Universidad Veracruzana], Biblioteca de Recursos, Biblioteca.Net, Sistema Bibliotecario di Ateneo [Università degli Studi di Padova], River Campus Libraries [University of Rochester Libraries], York University Libraries, Ulrichsweb™ [Global Serials Directory], Georgetown University Library, The University of the District of Columbia, ALADIN services, WorldCat is the world's largest library catalog, German National Library of Science and Technology, Univeristy Library Hannover - TIB/UB, Columbia University Libraries, Chabot College Library, Academic Index, Infotopia, CABI Abstracts, Global Health databases

***

Top



Journal of Ecology and Environmental Sciences

- Aim & Scope
- Editorial
- Instruction for Authors
- Contents & Abstract
- Open Access Publishing
- Editorial Policy
- Benefits for authors
- Copyright Form
- Journal Subscriptions
- **Manuscript Submission**
- Indexing
- Editorial Member Signup
- Articles in Press
- Special Issues

Contents

Academic Index, ALADIN, Biblioteca, Cabell, CAS, CSA, EBSCO Publishing,ERIC, Genamics JournalSeek, Geneva-FMER, GeonD. Georgetown University Library, Global Health databases, Google Scholar, IndexCopernicus, Infotopia, IRNEM, NewJour, OCLC, OhioLINK, Open J-Gate, Ovid, ProQuest, PubsHub, QSpace, SCIRUS, Socolar, Tulips, UCSD, Ulrichsweb™, URMC, UDL, UL-Hannover-TIB/UB, WorldCat.

Impact factor value: ICV: 4.53

Journal of Ecology and Environmental Sciences

Editor-in-Chief: Dr Kazunori Hironaka, (JAPAN); Dr Li HE, (CANADA)
Category: International Journal
Publisher: Bioinfo Publications
ISSN: 0976–9900 (Print) & E-ISSN:0976–9919 (Online)
Frequency: Tri-Monthly
Marketed by: EBSCO Publishing, USA; Ovid Technologies, USA; ProQuest, USA

Subject: Ecology and Environmental Sciences

Journal of Ecology and Environmental Sciences
ISSN: 0976-9900 & E-ISSN: 0976-9919 , Volume 3, Issue 1, 2012, pp.-46-49.
Available online at http://www.bioinfo.in/contents.php?id=41

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

PAWASKAR S.R.

Department of Advanced Studies and Research NIMS university, Jaipur, Raj., India.
*Corresponding Author: Email- satishrpawaskar11@gmail.com

Received: February 28, 2012; Accepted: March 06, 2012

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), C_K-Coefficient.

Citation: Pawaskar S.R. (2012) Application of Modified Rootzone Treatment System for Waste Water Treatment within Nallah Area. Journal of Ecology and Environmental Sciences, ISSN: 0976-9900 & E-ISSN: 0976-9919 , Volume 3, Issue 1, pp.-46-49.

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 chocking 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

a. About 18% urban citizens resort to open defecation.
b. About 30-35% depends on public toilets and condition of these public toilets is bad.
c. About 60-72% of the latrines is onsite and is not connected to sewerage networks.
d. About 70-80% of total sewerage generated is disposed in unsafe manner.
e. Citizens and institutions do not demonstrate full understanding on the issue and there is an all around apathy to addressing the issue (proceedings of urban sanitation consultation workshop 10th July 2008).

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. Moreover due to extension of city limits and conversion of old houses into large population residential complexes there is increased load of sewage on existing sewerage system this has lead to complete failure of city sewerage system.

The solution for the improvement of this system is generally considered in terms of providing new under drainage system or extension of existing drainage system on the similar principles. However replacement of existing drainage system involves huge cost, may disrupt the roads development and have long project period. Project sanction also gets delayed due to various social, legal problems, again causing increase in estimate of the schemes.

There is necessity to explore the ways to reducing the cost and time of these projects to make them techno economically feasible this can be achieved by using the existing nallahs as sewage, collection devices by converting them in open channels sanitary sewers equipped within place treatment options.

The Constructed Wetland Treatment system also known as the reed bed system or root zone treatment system (RZTS) is a sealed filter bed consisting of a sand / gravel/ soil system, occasionally with a cohesive element, planted with vegetation that can grow in wetlands. After removal of coarse and floating material, the wastewater passes through the filter bed where biodegradation of the wastewater takes place. The functional mechanisms in the soil matrix that are responsible for the mineralization of biodegradable matter are characterized by complex physical, chemical and biological processes, which result from the combined effects of the filter bed material, wetland plants, micro-organisms and wastewater.

Materials and Methods

Dr. D. R. Ranade in his paper entitled 'Industrial and Hazardous Waste Treatment and Management', have studied Chlorine or chlorine aided bleaching of pulp in the paper making industry generates formation of variety of organ chlorines termed as Absorbable organic halides (AOX). In his paper he has developed an eco friendly method for AOX removal from wastewater.

Sarah Volkman (April 2003) in her paper entitled, 'Sustainable Wastewater Treatment and Reuse in Urban Areas of the Developing World' have verified The increasing scarcity of water in the world along with rapid population increase in urban areas gives reason for concern and the need for appropriate water management practices.

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 weirs on water quality and farmer health', have studied the impact of irrigation weirs 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 lit/m² & from Santa Elena project developed formula for area calculation is

$$A = \frac{(Q_{ave})(t)}{(n)(dw)}$$

Where,
A= Area required for root zone bed to effectively treat grey water (square meters)
Q_{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)
dw =Depth of bed (meters)

Going through this formula it is found that from Santa Elena project also the area requirement is about 100 lit/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.

Modification 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.

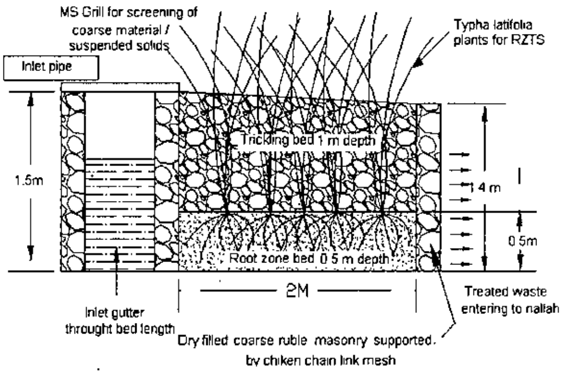


Fig. 1- shows Typical constructional details of designed module for waste water treatment within nallah area.

Hourly variation in waste water flow incoming nallah will help in spreading wastewater through tricking bed intermittently as horizontal flow system which is reflected going through the following graph.

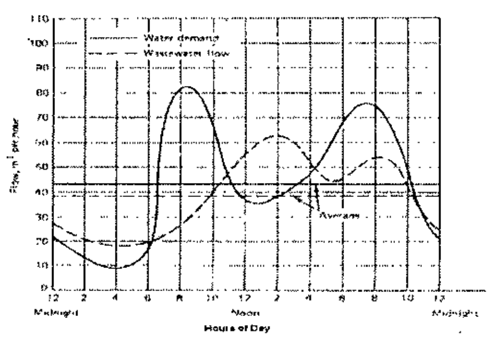


Fig. 2- shows the flow variation graph

Results

Based on experimental results and its analysis modified constructed wetland (Modified Root Zone Treatment System), it is seen that

- The average BOD removal efficiency of designed unit (modified design of RZTS and trickling bed) is 85.25%upto 0.5m root zone bed depth, and is of average 79.45% for total 1.5m combined bed depth.
- The average COD removal efficiency of designed unit (modified design of RZTS and trickling bed) is 85.25%upto 0.5m root zone bed depth, and is of average 79.45% for total 1.5m combined bed depth.
- The average TSS removal efficiency of designed unit (modified design of RZTS and trickling bed) is 91.83% up to 0.5m root zone bed depth, and is of average 83.07% for total 1.5m combined bed depth.

Developed Mathematical formula

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

$$A = C_K \frac{(Q_{total})\ (t)}{(n)\ (dw)}$$

Where ,

A = Area of treatment bed in nallah area in m2
Qtotal= 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 modification 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 (multistage 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 a 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,

- 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.

Acknowledgement

I wish to extend my thanks and gratitude to Dr.Ranade S.V., facilitating discussions and providing guidance during the study. I owe very much to my parent institute, Department of Civil Engineering and Technology, Advanced Studies and Research NIMS University, Rajasthan for providing my candidature, financial assistance and the entire infrastructure for this study. I wish to acknowledge the guidance and supervision during the study, provided by my colleagues and friends, Prof. M. B. Renake , H.O.D.(Mechanical) , Prof. U. B. Koli. & Shri. R. K. Patil (Deputy Engg., Environmental Engg. Dept., Kolhapur Municipal Corporation)

References

[1] Amelia K. Kivaisi (2001) *Ecological Engineering* 16, 545-560.
[2] Chernicharo C.A.L. (2006) *Reviews in Environmental Science and Bio/Technology*, 5, 73-92.
[3] Draaijer H., Maas J.A.W., Shaapman J.E. and Khan A. (1992) *Vat. Sci. & Tech.* 25(7), 123-133.
[4] Eugenio Foresti, Marcelo Zaiat & Marcus Vallero (2006) *Environmental Science and Biotechnology*, 5, 3-19.
[5] Garrett Feddersen (2003) *The Monteverde Institute Ruan-Borlaug Intern, I Dreamt of Africa, but Awoke to Find Myself in Costa Rica My Experiences working at The Monteverde Institute.*
[6] Lucas Seghezzo, Grietje Zeeman, Jules B. van Liel H.V.M. Hamelers and Gatze Lettinga (1998) *Bioresource Technology* 65, 175-190.
[7] MoEF, Evaluation of Ganga Action Plan (1995) *National River Conservation Directorate, Government of India.*
[8] Nobuyuki Sato, Tsutomu Okubo, Takashi Onodera, Lalit K. Agrawal, Akiyoshi Ohashia, Hideki Harada (2007) *Journal of Environmental Management*, 84, 447-460.
[9] Nobuyuki Sato, Tsutomu Okubo, Takashi Onodera, Akiyoshi Ohashi, Hideki Harada (2006) *Journal of Environmental Management*, 80, 198-207.
[10]Nadeem Khalil, Atul Kumar Mittal, Ashok Kumar Raghav, Sinha Rajeev (2006) *Environmental Engineering and Management Journal*, 5(5), 1059-1069.
[11]Okubo T., Kirishima Y., Ohashi A., Harada H. (2004) *International Water Technology Conference*, 229.
[12]Pant A. and Mittal Atul K.(2004) *World Water Congress.*