ABSTRACT

In this Environment the water containment is more important to survive their life of human being and all other living organisms. So, the wastewater is reused for using purpose. The generated wastewater is treated by different Treatment process. In this way the stagnant water contaminant and wastewater contaminant are removed by providing or build a Wetland Structure .In low-income regions and small/medium communities, the use of conventional/mechanical methods for wastewater treatment is not always financially and technically feasible. Thus, nature-based solutions such as constructed wetlands (CW) appear as a more appropriate option. Additionally, there is limited application and reporting on the use and efficiency of this sustainable technology. In order to get a better insight into the feasibility of CWs and socio-economic context, a lab-scale demonstration CW facility was built and monitored for the first time at a TCE campus. The facility consists of an baffled reactor, a vertical flow CW . The goal was to evaluate the system's efficiency and investigate the need for CW stages to reach the national effluent reuse standard. The CW were planted with local species *(CANNA INDICA)* . 66.5%, and 65.7% of BOD, COD, TSS, PO4-P, NH-N, and NO-N, respectively, while the effluent complied with the reuse standard. This study showed that hybrid CW can be effectively using native plant species providing a technically feasible, cost- effective, and sustainable wastewater treatment solution.

INTRODUCTION

1.1 General

Globally, most of the developing countries are geographically located in those parts of the world that are or will face water shortages in the near future. Moreover, the existing water sources are contaminated because untreated sewage and industrial wastewater is discharged into surface waters resulting in impairment of water quality. The treatment of wastewater using Constructed Wetland (CW) is one of the suitable treatment systems, used in many parts of the world. Wetlands are defined as land where the water surface is near the ground surface long enough each year to maintain saturated soil conditions, along with the related vegetation. Marshes, bogs, and swamps are all examples of naturally occurring wetlands.

1.2 NATURAL WETLANDS VS. CONSTRUCTED WETLANDS

A natural wetland is an area of ground that is saturated with water, at least periodically. Plants that grow in wetlands, which are often called wetland plants or saprophyte, have to be capable of adapting to the growth in saturated soil. Constructed wetlands, in contrast to natural wetlands, are man-made systems or engineered wetlands that are designed, built and operated to emulate functions of natural wetlands for human desires and needs. Engineered to control substrate, vegetation, hydrology and configuration. It is created from a non-wetland ecosystem or a former terrestrial environment, mainly for the purpose of contaminant or pollutant removal from wastewater.These constructed wastewater treatments may include swamps and marshes. Most of the constructed wetland systems are marshes. Marshes are shallow water regions dominated by emergent herbaceous vegetation including cattails, bulrushes, and reeds.

1.3 CONSTRUCTED WETLAND

Constructed Wetlands A “constructed wetland” is defined as a wetland specifically constructed for the purpose of pollution control and waste management, at a location other than existing natural wetlands. Wetlands can be used for primary, secondary, and tertiary treatments of domestic wastewater, storm wastewater, combined sewer overflows (CSF), overland runoff, and industrial wastewater such as landfill leachate and petrochemical industries wastewater. The most common systems are designed with horizontal subsurface flow (HF CWs) but vertical flow (VF CWs) systems are getting more popular at present. The most commonly used species are robust species of emergent plants, such as the common reed, cattail and bulrush. wetlands are constructed for one or more of four primary purposes: creation of habitat to compensate for natural wetlands converted for agriculture and urban development, water quality improvement, flood control, and production of food and fiber (constructed aquaculture wetlands). Constructed wetlands are based upon the symbiotic relationship between the microorganisms and pollutants in the wastewater. These systems have potential to treat variety of wastewater by removing organics, suspended solids, pathogens, nutrients and heavy Metals

1.4 MEDIA SELECTION

A constructed wetland is a shallow basin filled with some sort of filter material (substrate), usually sand or gravel, and planted with vegetation tolerant of saturated conditions. Wastewater is introduced into the basin and flows over the surface or through the substrate, and is discharged out of the basin through a structure which controls the depth of the wastewater in the wetland. A constructed wetland comprises of the following five major components: • Basin • Substrate • Vegetation • Liner • Inlet/Outlet arrangement system

1.5 PLANT SELECTION

The role of wetland vegetation as an essential component of CW is well established. Emergent plants contribute both directly and indirectly to the treatment processes. In spite of the fact that the most important removal processes in CW are based on microbial processes, the macrophytes several functions in relation to the water treatment. They influence treatment process in CW by their physical presence and metabolism. In general, the most significant functions of wetland plants (emergents) in relation to water purification are the physical effects brought by the presence of the plants. The plants provide a huge surface area for attachment and growth of microbes. The physical components of the plants stabilise the surface of the beds, slow down the water flow thus assist in sediment. Plants also provide microorganisms with a source of Carbon. However, not all wetland species are suitable for wastewater treatment since plants for CW must be able to tolerate a combination of continuous flooding and exposure to wastewater or storm water containing relatively high amounts of pollutants. A portion of the nutrients is retained in the undecomposed fraction of the plant litter and accumulates in the soils. Plants oxygenate the root zone by release of oxygen from their roots, and provide aerobic microorganisms a habitat within the reduced soil. Plants have additional site-specific values by providing habitat for wildlife and making wastewater treatment systems aesthetically pleasing. Wetland species of all growth forms have been used in treatment wetlands. However, the most commonly used species are robust species of emergent plants, such as the common reed, cattail and bulrush

1.6 Removal Mechanism

A constructed wetland is a complex assemblage of wastewater, substrate, vegetation and an array of microorganisms (most importantly bacteria). Vegetation plays a vital role in the wetlands as they provide surfaces and a suitable environment for microbial growth and filtration- Pollutant are removed with in the wetlands by several complex physical(sedimentation,filtration,adsorption and volatisation) chemical (precipitation, adsorption hydrolysis, oxidation/reduction) and biological (bacterial metabolism ,plant metabolism, plant absorption ,natural die off processes as depicted. Settleable and suspended solids that are not removed in the primary treatment are effectively removed in the wetland by filtration and sedimentation. Particles settle into stagnant micro pockets or are strained by flow constrictions. Attached and suspended microbial growth is responsible for the removal of soluble organic compounds, which are degraded biologically both aerobically (in presence of dissolved oxygen) as well as anaerobically (in absence of dissolved oxygen). The oxygen required for aerobic degradation is supplied directly from the atmosphere by diffusion or oxygen leakage from the vegetation roots into the rhizosphere, however, the oxygen transfer from the roots is negligible.

1.7 ADVANTAGES OF CONSTRUCTED WETLAND

Wetlands can be less expensive to build than other treatment options • Utilization of natural processes, • Simple construction (can be constructed with local materials), • Simple operation and maintenance, • cost effectiveness (low construction and operation costs)

1.8 LIMITATION OF CONSTRUCTED WETLAND

Larger area required wetland treatment may be economical relative to other options only where land is available and affordable. • Design criteria have yet to be developed for different types of wastewater and climates.

2. LITERATURE REVIEW

2.1 GENERAL

To analyse the performance of different wetland system with respect to remove of containments by statistical analysis

2.2 REVIEW OF LITERATURE

Mahesh Prasad Barya et . al.,

The present investigation, vertical subsurface flow constructed wetlands (VSSFCWs) planted with macrophytes treated domestic sewage in an environmentally sustainable manner. Treatment of domestic sewage with wetlands is an alternative method that decreases energy consumption and economic costs involved in the treatment of environmental contaminants. This study evaluates the potential efficiency of VSSFCWs using two different macrophytes, Acorus calamus and Canna indica for the treatment of domestic sewage. To perform this study, two chambers of VSSFCWs of dimensions 2.48 m , 1.24 m ,1.54 m were built. The wetland was fed with the primary treated sewage at a hydraulic loading rate (HLR) of 0.67 m^3 /h (hours) in a batch flow. Treat ment of primary sewage was observed from day 1 to day 6; once a day (i.e. 24 h to 144 h). The treatment of sewage was found to be significant up to day 6 (144 h); beyond this time, no significant removal was observed. The results revealed that both the wetland setups performed significant removal of TDS, BOD_5, total nitrogen, and phosphate. The wetland planted with Canna indica was a better performer for the removal of TDS (22.31%), BOD_5 (81.79%), total nitrogen (60.37%), and phosphate (80%)

Junmei Wu et . al.,

Layered combined bio-ceramic, zeolite, and anthracite were used as substrates in vertical-flow constructed wetlands (VFCWs) for enhancing contaminant removal from synthetic municipal wastewater. Plant growth and propagation and the removal of organic matter, nitrogen, and phosphorus as well as its spatiotemporal variation were evaluated systematically. The results demonstrated that three different substrates were adequate for the establishment of Canna indica L., especially for zeolite. All small-scale VFCW units were simultaneous efficient in removing COD_{Cr} (73.9–78.7%), NH_4^+-N (83.8–89.9%), TN (88.3– 91.5%), SRP (93.8–98.6%), and TP (87.1–90.9%) with a little significant difference on treatment performance. Different pollution removal processes followed a different trend because of their different removal mechanisms driven by the synergy of substrate, plant, and microorganism. Purification space moved down due to the adsorption capacity consumption of upper layer substrate over time. It was concluded that VFCWs filled with layered combined bio-ceramic, zeolite, and anthracite had great potential for treating municipal wastewater

Aysenur Ugurlu et . al.,

The main purpose of this study was to investigate the removal of ammonia, orthophosphate, and COD present in landfill leachate using vertical subsurface flow constructed wetland systems (VFCW). The effect of different types of plants (Typha latifolia and Canna indica) in the removal of pollutants was also investigated. The systems were operated identically at a flow rate of 5 l/day and a hydraulic retention time (HRT) of 22 days in the T. latifolia reactor (R1), C. indica reactor (R2), and Control reactor (R3). Concentration-based average removal efficiencies for R1, R2, and R3 were NH4-N; 60.0%, 56.0%, and 46, COD; 81.0%, 84.0%, and 79.0%, PO4-P; 45.0%, 46.0%, and 32.0%, respectively. These results show that the model is a good predictive tool for determining the plant lengths using the growth equations. It is also revealed that the Logistic and Cubic models are suit able for the R1 and R2 reactors.

Jinhui Zhaoa et . al.,

In this study, a lab-scale baffled horizontal sub-surface flow constructed wetland (HSSF-CW) with adsorptive media/substrate was constructed and operated for one year to assess its performance for highway runoff (HRO) pollution control. Based on the results of isothermal adsorption experiments, a hybrid of zeolite, expanded vermiculite, vesuvianite was chosen out of five candidate media as the optimal com bination in terms of adsorption efficiency. The performance of the constructed wetland (CW) with the predetermined hybrid media was tested under different hydraulic loadings (HLs) with continuous and intermittent flow conditions. The results show that ammonia nitrogen (NH4 +-N) and total phosphorus (TP) adsorption by the media fitted very well with the Langmuir isothermal equation. 2D contour plot analysis is a useful tool, which can give a visible pollutants removal law in CWs and help to understand how such a system works along the horizontal direction. Results from intermittent operation indicate that an average removal efficiency of 86.5%, 68.1%, 78.25%, 95.2% and 64.85% were achieved for total suspended solids (TSS), chemical oxygen demand (COD), total nitrogen (TKN), NH4 +-N and TP, respectively. The performances during continuous flow under different HLs illustrate that HLs have little influence on COD, NH_4^+-N and TP removal under HLs lower than 0.56 m^3/m^2 d, while the removal rates are remarkably decreased at a high HL of 1.12 m^3/m^2 d, especially for TP. Moreover, media/substrates adsorption is the main process for NH_4^+-N and TP removal, while plants uptake plays a limited role. The findings suggest that the baffled adsorptive media HSSF-CW is a promising system for HRO pollution control and shows potential for field application.

Samara T. Decezaro et . al.,

The oxygen transfer rate (OTR) has a significant impact on the design and operation of vertical flow constructed wetlands (VFCWs) intended for organic matter removal and nitrification. Despite its key role, the information on real oxygen input in VFCWs is limited, being usually estimated by mass balance (stoichiometry), through which is calculated only the oxygen consumption rate (OCR). In this study, for the first time, the gas tracer method was applied to evaluate the oxygen transfer capacity of a real-scale VFCW (24.5 m^2) applied to the treatment of do90po/i87mestic wastewater. Propane was used as tracer. The OCR and the OTR were evaluated in VFCW under hydraulic loading rates (HLR) of 60, 90, and 120 mm d^{-1} corresponding to recirculation rations of 0%, 50%, and 100%. The OTR in standard conditions (20 °C) ranged from 120 to 176 g O_2 m^{-2} d^{-1} . The highest OTR was found for the lowest HLR. For the operating conditions tested, the OTR obtained with gas tracer were higher than the OCR cal culated by stoichiometry in VFCW, which ranged from 20.6 to 27.8 g O_2 m^{-2} d^{-1} . Besides, the OTR were sufficient to satisfy the VFCW oxygen demand for organic matter removal and nitrification. These results show that the gas tracer method for OTR determination may allow advances on the understanding of treatment processes and on the design of new VFCWs since its treatment performance requires aerobic conditions.

S. Kantawanichkul et . al.,

A subsurface vertical-flow laboratory scale wetland system was designed to investigate the wastewater treatment efficiency by Vetiveria zizanioides Nash, a common grass in Thailand. Diluted pig farm wastewater was fed intermittently. The removal efficiencies in terms of organic carbon, nitrogen and suspended solids were satisfactory under hydraulic and organic loading rates of 36 mm1d and 55 kgCODIha.d, respectively. A comparison ofthe performance ofthe systems with Vetiveria zizanioides Nash and Cyperus flabelliformis Rottb, to treat domestic wastewater was made. It was found that both plants are suitable for wastewater treatment by vertical-flow constructed wetlands in tropical areas under hydraulic and organic loading rates within 121 mmld and 198 kgCODlha.d

Quan Quan et . al.,

while phosphorus is a significant restrictive factor that influences primary productivity of fresh-water system. It’s rather significant to conduct phosphorus control in waste water with engineering measures. This research, based on material balance research of phosphorus in artificial wetlands, HRT (hydraulic retention time) and analysis of wetland plant photosynthesis and removal rate of phosphorus, simulates purification of phosphorus in urban runoff sewage by artificial wetland system. Experiment shows that removal rate of total phosphorus in urban runoff sewage by artificial wetland system reaches 42.23%-60.89%, and contribution rate in removal of phosphorus which is assimilated and absorbed by plants is 14.74%; contribution rate in removal of phosphorus which is accumulated and absorbed by substrates is 43.22%; contribution rate in removal of phosphorus which is absorbed by means like microorganisms is 2.93%. Pollutant absorption by substrates is a process of dynamic equilibrium. With extension of HRT, phosphorus removing effect of wetlands present an increasing and then decreasing tendency; Net photosynthetic rate and TP removal rate of canna and reed have significant positive correlation, and correlation coefficients are respectively 0.941(P

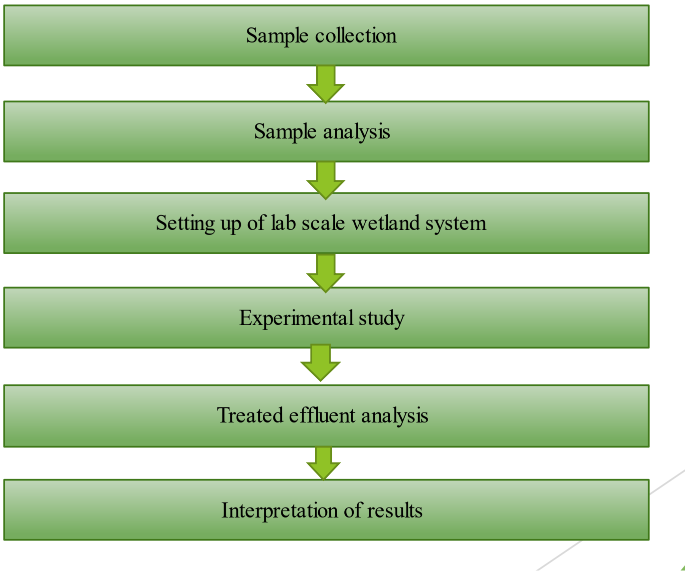
3.0 NEED FOR THE STUDY

In order to construct the STP it cause high capital cost and skilled labour required and also mostly the STP are used in urban areas and to treat industrial effluent. STP requires large area. So, in order to consider these above factors .We construct the constructed wetland and which will be more economical

4.0 OBJECTIVES

- To investigate the characteristics of institutional wastewater
- To assess the removal efficiency of organic matter, nutrients, suspended solids and FC concentration under varied operating condition
- To analyse the performance of different wetland system with respect to remove of containments by statistical analysis

5.0 METHODOLOGY



6.0 EXPERIMENTAL SETUP

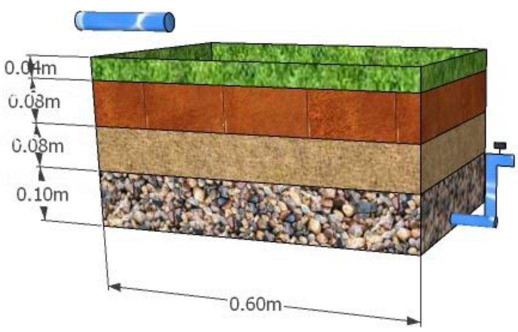
6.1 COMPONENT

6.1.1 REACTOR

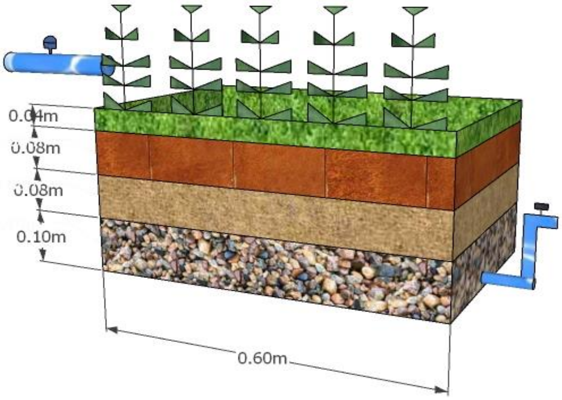
Reactor length 60cm

Reactor breadth 40cm

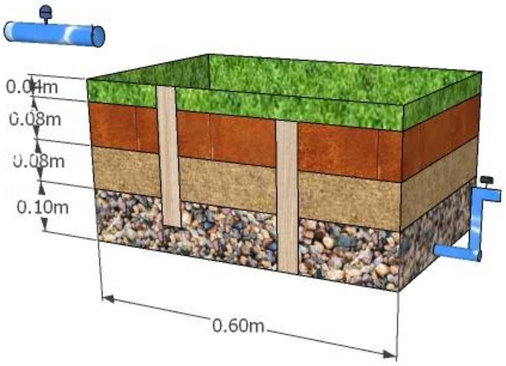
Reactor depth 30cm



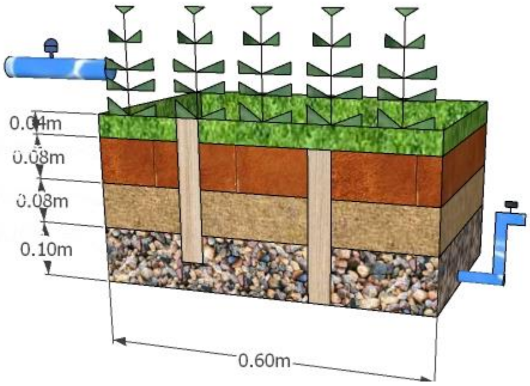
Vertical control



Vertical constructed wetland



Baffled control



Baffled constructed wetland

7.0 CONCLUSION

The treatment of sewage by constructed wetlands is a technically simple, eco-friendly and sustainable option as compared to the existing traditional sewage treatment technologies. Beside this, CW has low construction cost, and requires a minimum maintenance and operation cost. To analyse the characteristic of wastewater and parameter that present in TCE STP

8.0 REFERENCE

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