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Constructed Wetland for Low- Cost Waste Water Treatment

A Anil[1], K Sumavalli[2], S Charan[3], M Mounika[3] , P Praveen[3], A Gayathri[3], V M Ganesh[3]

[1]HOD & Assistant Professor, Department of Civil Engineering, Annamacharya Institute of Technology and Sciences (Autonomous), Tirupati, India

[2]Assistant Professor Department of Civil Engineering, Annamacharya Institute of Technology and Sciences (Autonomous), Tirupati, India

[3]UG Students, Department of Civil Engineering, Annamacharya Institute of Technology and Sciences (Autonomous), Tirupati, Andhra Pradesh, India

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ABSTRACT

Engineered and managed wetland systems that are receiving increasing global attention for wastewater treatment and reclamation. Compared to conventional wastewater treatment plants, constructed wetlands are inexpensive and easy to operate and maintain, and they have strong potential for application in a small community. Constructed wetlands for wastewater treatment have developed significantly in recent decades. As an environmentally friendly treatment method, constructed wetlands can enable effective, economic and ecological treatment of agricultural, industrial and municipal wastewater.

Built-up wetlands are very effective in removing organic matter and suspended matter, while nitrogen removal is relatively low, but could be improved by using a combination of different types of built-up wetlands that meet irrigation reuse standards. Phosphorus removal is usually low unless special media with high sorption capacity are used. Removing pathogens from wetland effluent to meet irrigation reuse standards is a challenge unless additional lagoons or hybrid wetland systems are used. This paper examines and also describes various case studies related to wetlands in Indian cities, including systems that include both built and natural wetlands, habitat creation and restoration.

Keywords: Economic, Ecological Treatment of Agricultural, Municipal Wastewater

I. INTRODUCTION

Globally, most developing countries are geographically located in those parts of the world that are experiencing or will experience water scarcity in the near future. In addition, existing water sources are being polluted as untreated sewage and industrial effluents are discharged into surface waters, leading to degradation of water quality. Constructed Wetland (CW) treatment of wastewater 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 soil surface long enough each year to maintain saturated soil conditions along with associated vegetation. Marshes, swamps, and marshes are examples of naturally occurring wetlands. India's rapid population growth is affecting the rate of pollution of natural resources as well as the unavailability of good water and air. Water also plays an important role in the water cycle and in human survival. Controlling pollution and using water properly is everyone's responsibility.

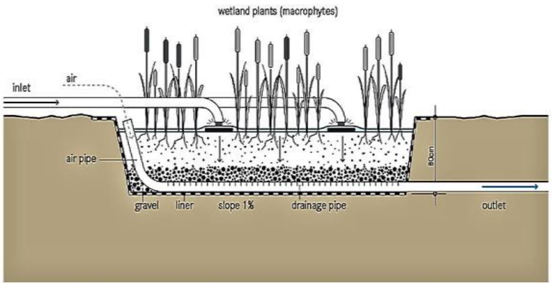
1.2 Objectives:

- The main goal of wetlands is to continuously and effectively treat the wastewater coming from different sources.
- The quality of the waste water is identified.
- The discharge capacity of the effluent from the source is analysed.
- Less cost and labour are required. No environmental damage.
- Improves water filtration and does not harm the water table.
- Treated water for plantations.
- A detailed wastewater quality report is attached.
- Aesthetic view.

1.3 Constructed Wetlands:

A engineered wetland is defined as a wetland specifically created for environmental protection and waste management purposes at a location different from existing natural wetlands. Wetlands can be used for the primary, secondary, and tertiary treatment of domestic wastewater, stormwater, combined sewage overflow (CSF), overland runoff, and industrial effluents such as landfill leachate and petrochemical industry wastewater. The most common systems are designed with horizontal subsurface flow (HF CWs), but vertical flow systems (VF CWs) are becoming more popular these days. The most commonly used species are hardy types of emergent plants such as common reeds, bulrushes, and bulrushes.

In addition to improving water quality and saving energy, CW a have other functions related to environmental protection, such as: B. promoting biodiversity, providing habitat for wetland organisms and wildlife (e.g. , hydrological functions, bioaccumulation of heavy metals and biomethylation) reported that the roots of some aquatic plants could retain both coarse and fine organic materials in water bodies that hinder their growth support conversion of natural wetlands resulting from agriculture and urban development Serves as a flood control centre and produces food and fibres. Mainly used to treat wastewater to improve water quality.



1.4 Advantages:

- Use of natural processes
- simple construction (can be built with local materials)
- simple operation and maintenance, economy (low construction and operating costs)
- process stability.
- Low energy requirement
- Low environmental impact

1.5 Natural vs Artificial Wetlands :

A natural wetland is an area of land that is at least temporarily saturated with water. Plants that grow in wetlands, often referred to as wetland plants or saprophytes, must be able to adapt to growing in saturated soil. Engineered wetlands, as opposed to natural wetlands, are man-made systems or man-made wetlands that are designed, built, and operated to mimic the functions of natural wetlands for human wants and needs. Designed to control substrate, vegetation, hydrology and configuration.

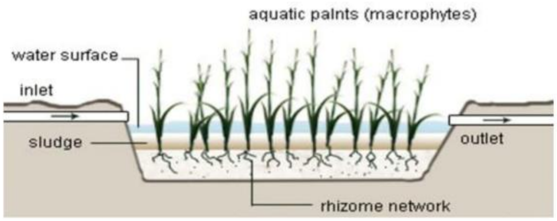
It is created from a non-wetland ecosystem or former terrestrial environment primarily for the purpose of removing contaminants or pollutants from wastewater. These built sewage treatments can include swamps and marshes. Most built-up wetland systems are swamps. Swamps are shallow-water regions dominated by emerging herbaceous vegetation such as cattails, rushes, and reeds.

II. Types of Wetlands:

According to the flow system of the water, constructed wetlands can be divided into three main categories, which are discussed below.

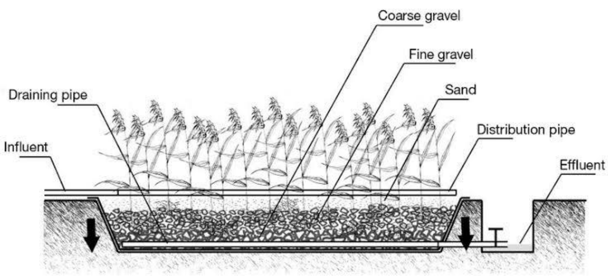
2.1 Surface Flow Wetland

Engineered wetlands are also known as free water surface wetlands (FWS). Various activities take place mainly in the top layer of soil and in the water. Impregnation is not always used. Because it is on the surface, there may be a chance of mosquitoes and other small insects



2.2 Vertical Flow Wetland

The vertical flow type (VF) consists of a sand or gravel bed layer planted with predominant macrophytes. The water filters into filter media such as sand and then moves on the bed to the outlet by the action of gravity. This type of wetlands can be operated upstream by disabling the inlet conditions and outlet pipe.



III. Research Significance

- Wetlands perform numerous valuable functions such as recycling nutrients, purifying water.
- buffering floods, replenishing groundwater.
- and also serve to provide drinking water, fish, forage, fuel, habitat for wildlife.
- control runoff in urban areas and
- recreation for society protection aquifer recharge and stream flow conservation.

IV. Materials Used

4.1 Coarse Aggregate

The coarse aggregates, ranging in size from 8 mm to 40 mm, are collected and thoroughly washed. The amount of water that leaks out depends on the size of the aggregate used. It is gravel and crushed stone that is mostly retained on the 4.75 mm screen. Size of aggregates used: 20 mm to 40 mm.

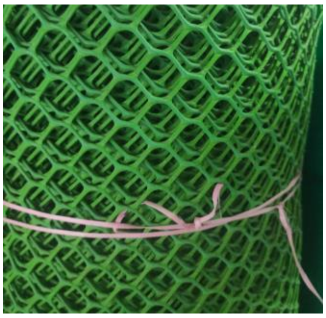
4.2 Fine Aggregate

The fine aggregates, ranging in size from 2 mm to 4.75 mm, are collected using sieves and washed. The size of the particles leads to an increasing proportion of voids, which increases the permeability of the water. They are made of sand or gravel and fit completely through the 9.5mm screen.

4.3 Coal

Good and perfect sized particles of charcoal are used for cleaning purposes.

4.4 Geotextile



A non-percolating layer is used to prevent water from reaching the water table and geotextiles are used as a separating function between the layers of coarse coal and fine layers of aggregate.

4.5 System Used

4.5.1 Electrical Motors

The electric motor used to convert electrical energy into mechanical energy to pump treated water from the pit. The capacity of the engine is 1800 rpm from -1 hp.

4.5.2 Swer Pipes

The outlet pipe which is 2m long horizontally and uses an L bend to protrude vertically up to connect the motor. From the whistle 38mm.

V. Methodology

5.1 Selection of suitable site

Choosing a suitable location depends on several factors, such as: B.: Availability of land, people and material, close to the source of sewage, slope of the ground, no damage to the environment, easy access, good transport and pumping system.

5.2 Excavation of Wetland

Excavation of wet land for the suitable dimensions of 200cm (length) 300cm (width) on the earth's surface. And a depth of 2.7 m at the level upstream and 2.9 m at the level downstream follows the maintenance of a slope of 20^0 .

5.3 Laying Of Non Percolating Layer

The non-percolating layer helps resist water intrusion into the water table. This reduces the damage caused by sewage seepage.

5.4 Laying of Coarse Aggregate

The coarse aggregates are used with a size of 8 mm to 40 mm. Before coarse aggregates are spread, the aggregates are cleaned and dried. After drying, the aggregates are distributed on top of the non-seeping layer.

5.5 Laying of Geotextile

Placement of geotextile on the surface of pre-placed coarse aggregate. The geotextile acts as a separator and resists mixing of one layer with the other layer.

5.6 Laying of Coal

The well sized and shaped char product is placed over the geotextile layer. This charcoal has the ability to absorb the toxins and pollutants present in the wastewater, resulting in purification of the water.

5.7 Laying of Geotextile

Placement of geotextile on surface of upstream coal. The geotextile acts as a separator and resists mixing of one layer with the other layer.

5.8 Laying of Fine Aggregate

The fine aggregates are used with a size of 2 mm to 4.75 mm. Before spreading fine aggregates, the aggregates are cleaned and dried. After drying, the aggregates are spread on top of the geotextile layer.

5.9 Final Layer Of Geotextile

Placement of geotextile on surface of upstream coal. The geotextile acts as a separator and resists mixing of one layer with the other layer.

5.10 Piping System

The 1.5 inch diameter polyvinyl chloride pipe is used at the wetland outlet and an L-bend is used to run the pipe up and a similar pipe is connected at the other end.

VI. Results and Discussions

The constructed wetland for domestic sewage treatment was performed with different operating variables by monitoring various parameters such as pH, Conductivity, Acidity, Alkalinity, Chloride, Total Dissolved Solids, COD, BOD, turbidity, etc. with vertical flow systems and horizontal flow systems, and the results were tabulated as follows.

S. No	Name of Experiment	Results	
		Waste water	Treated water
1.	pH	8.85	7.2
2.	Conductivity	2	1
3.	Acidity	165mg/l	109mg/l
4.	Alkalinity	91mg/l	107mg/l
5.	Chloride	370mg/l	303.5mg/l
6.	Total Dissolved Solids	0.012mg/l	0.0015mg/l
7.	Turbidity	42NTU	15NTU
8.	Biological Oxygen Demand (BOD)	7mg/l	3mg/l
9.	Chemical Oxygen Demand (COD)	300mg/l	80mg/l
10.	Most Probable Number (MPN)	2200 per/lit	120 per/lit

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