EXPERIMENTAL METHOD TO TREAT WASTEWATER IN REFERENCE WITH CONSTRUCTED WETLAND

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***Abstract*— Constructed wetlands (CW) are a technology for eliminating contaminants from wastewater that is ecologically beneficial and has been used to treat municipal wastewater, wastewater from oil refineries, drainage from agricultural operations, acid mine drainage, etc. There have been a rather large number of advancements in the microbiology discipline, which is expanding quickly. With an emphasis on recent developments in the last three decades, this book provides a comprehensive assessment of important CW elements, including the many types of CW, contaminants and their removal processes, degradation routes, difficulties and possibilities, materials, applications, and theory. Additionally, an effort has been made to predict future developments in the field of CW and to encourage these developments by framing significant unresolved CW challenges.**

Keywords— constructed wetland; wastewater; plants; microorganisms; remediation; degradation

1.Introduction

Environmental awareness has grown over the past ten years and concerned political entities from all over the world have made treating environmental degradation and contamination their top priority. The efficacy of the degrading process and the method's cost are typically considered when choosing an appropriate environmental remediation technique for a particular kind of waste. The environmental effect of the chosen remediation strategy is of particular significance since, in certain cases, the daughter product of the degradation process is more harmful than the initial contamination. Wetlands are often defined by the soaking of soil over an extended period. Anaerobic conditions emerge. Wetlands are classified into two types: natural fresh and salt-water wetlands and manmade wetlands. Wetlands built for Contaminant remediation incorporate complex inclusive processes including water, substrate (soil), plants, animals, microbes, and the environment. Constructed wetlands used a variety of remediation approaches, including biodegradation, phytoremediation, and natural attenuation. Wetland processes include physical processes such as filtration and sedimentation, chemical processes such as adsorption and precipitation, and biological activities such as biodegradation and plant assimilation.The great majority of wetlands have a dense population of vascular plants.

High-density vegetation slows water flow, creates microenvironments, and provides sorption sites for pollutants as well as attachment sites for microbes [5]. As plants die and fall into the water, the plant portions above the water produce new sorption and exchange sites. Furthermore, plant debris is an excellent source of organic carbon as well as nutrients (nitrogen and phosphorus) for microorganism metabolism. Wetlands have relatively low oxygen concentrations owing to soil saturation. As a result, the vegetation in wetlands is restricted to species (vascular plants) that can flourish in low oxygen environments.

Constructed wetlands have been utilised to treat wastewater all around the world. For example, CWs have been utilised in Europe since the second part of the past century; Germany was the first country to deploy CWs in Europe . CWs are also in use in several other countries, including the United Kingdom, Austria, Slovenia, Switzerland, and Denmark. Some African countries, including South Africa, Tanzania, Kenya, and Seychelles, have used CWs. According to certain figures, the cost of subsurface CWs for wastewater treatment in Africa is approximately US $5 per person, as opposed to mechanical wastewater treatment (activated sludge system), which costs around US $50 per person . According to a recent research, the overall cost (including sludge operation, maintenance, and disposaL)

2. OBJECTIVES

To analyze the characteristics of wastewater.To treat wastewater using constructed wetland coupled with various substrates and macrophytes.

To find the removal efficency of pollutants.to test quality of wastewater by using constructed wetlands for other benificial uses.

A. WET LAND TREATMENT SYSTEM

According to several factors, including hydrology (surface-flow and subsurface-flow), macrophyte kinds (free-floating, emergent, and submerged), and flow route (horizontal or vertical), manmade wetlands may generally be divided into distinct categories. As previously stated,

There are several different kinds of artificial wetlands, such as surface flow (SF) wetlands, subsurface flow (SSF) wetlands, and hybrid systems that combine the two. The hybrid system is a multistage system where the treatment is carried out in many units, each with a purpose. For example, certain wastewater treatment units are made to encourage aerobic reactions whereas other units are made to work in anaerobic environments. Aerated CW is a type of wetland that has an air pump and is linked to a network of underground air distribution pipelines.

B. SURFACE FLOW.

According to several factors, including hydrology (surface-flow and subsurface-flow), macrophyte kinds (free-floating, emergent, and submerged), and flow route (horizontal or vertical), manmade wetlands may generally be divided into distinct categories. As previously stated, there are several different kinds of artificial wetlands, such as surface flow (SF) wetlands, subsurface flow (SSF) wetlands, and hybrid systems that combine the two. The hybrid system is a multistage system where the treatment is carried out in many units each with a purpose. For example, certain wastewater treatment units are made to encourage aerobic reactions whereas other units are made to work in anaerobic environments. Aerated CW is a type of wetland that has an air pump and is linked to a network of underground air distribution pipelines.

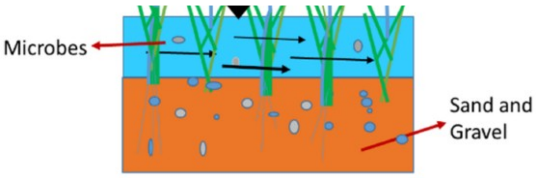

Figure 1. Schematic layout of free surface flow.

3. MATERIALS USED

1. Coco peat: Since coco peat is freely abundant,locally available,low cost adsorbent and has a considerable high adsorption capacity, itMay be treated as economically viable for removal of metal ions from industrial landfill leachate.

2. Sand: Inorganic fine grain soil are used for backfilling 0.8mm to1.25mm dia sand is used as filter.it helps to remove the suspended matter.

3. Charcoal: A layer of charcoal is used to layer the medium as it is light weight black carbon residue. Charcoal have high efficiency to remove chlorine, sediment, ammonia from water.

4. Clams: Waste shell contains 66.7% calcium carbonate to absorb the heavy metal lead.

5. Macrophytes, Algae: Algae helps in absorbing excess nitrogen in wastewater. Increase the emission of Oxygen and helps aerobic bacteria to breakdown complex contaminent.The roots of Macrophytes stabilise the surface of bed provided for good filtration medium. The root gives rise to the development of rhizome bacteria.

METHEDOLOGY:

A prototype in reference with constructed wetland are created.The surface of wastewater flow is above the substrate medium. 4 layers of substrate are layered in which first layer contain sand of dia 0.8mm to 1.25mm. The second layer is clam shells which absorbs heavy metals and the third layer contains charcoal which removes chlorine. The fourth layer is covered with cocopeat, this layer are confined, wastewater are poured over this layer and microphytes and algaes are grown in this layer.

This macrophytes are grown in the prototype. The initial pollutant level of water is tested before the water is poured in the prototype. The test are carried out 3 times to check the pollutant level in water. Mainly turbidity of water, Nitrogen content of wastewater, BOD and COD rate of wastewater are calculated.

Maintenance:

To guarantee that the wetland performs at the desired level, a strategy and schedule for routine maintenance should be created and closely adhered. Making sure that the waste to be treated has enough contact time with the wetlands' plant, soil, and microbial inhabitants is crucial. To obtain the best possible degradation of pollutants, a suitable habitat for the growth of microorganisms and plants should always be maintained.

4. MICROORGANISM USED IN THE WETLAND

The substrate (the soil matrix), the hydrology (the water flow and water control structures), and the plants are all designed as parts of a wetland. However, vital wetlands elements like invertebrate and microbial populations emerge naturally. The breakdown of pollutants and their transformation between the environment and the plant are primarily carried out by bacteria. Bacteria that are heterotrophic and autotrophic in nature each play a part in the breakdown of contaminants.

In aerobic digestion, oxygen acts as an electron acceptor while the organic contaminant acts as an electron giver. This process involves the generation of daughter products of the parent contamination as the pollutant decomposes to CO2 along a specific pathway. It is crucial to note that, occasionally, some of these processes' daughter products are more harmful than the initial pollution. Therefore, it is crucial to make sure that the processes' last stages of degradation (i.e., the production of CO2 and H2O) occur. A appropriate environment (i.e., oxygen concentration) is provided by the shallow surface of surface flow constructed wetlands and the top layers of subsurface flow constructed wetlands for the aerobic breakdown of pollutants.

The success of the treatment procedure can be directly impacted by temperature since it affects the microbial activity in the wetlands. Microorganisms are more active at low temperatures, while they are less active at very high temperatures. The temperature has an impact on the processes of sorption and sedimentation as well. The dissolved oxygen content and oxidation-reduction potential of the water are directly influenced by temperature. Low levels of dissolved oxygen are a result of high temperatures. Both bacterial and plant growth are possible at temperatures between 20 and 30 C.

5. RESULT:

SL NO	*Parameters*	*Removal Efficiency*
1	Turbidity	40-50%
2	Nitrogen	50%
3	Ammonia	60%
4	Oil and Grease	50-60%
5	Chloride	>50%

6. CONCLUSION:

With the help of detailed analysis for 3 months, there is only a slight variation in the pollution level of wastewater.

As it is natural process and requires more time to show great difference in pollution rate. The time required for the growth of macrophytes is of long duration and 3 months analysis is not sufficent to conclude.

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