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A TESTING STUDY OF WASTE WATER TREATMENT USING REED BED SYSTEM

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ABSTRACT:

Following industrialisation, a number of companies generate poisonous waste materials are carelessly dumped into streams and rivers, harming both aquatic and terrestrial life. In this study, a reed bed system for harmful metal removal from industrial waste water was examined. In the Amrutha water treatment plant, a vertical subsurface flow wetland was created to remove hazardous metals from industrial effluent. For the Wetland system, phragmites Karka was employed, and the substrates used were granite and washed sand. Hydraulic retention times of 5, 9, 10, 14, and 18 days were used to record treatment performance. You can create a waste water treatment facility in your own garden with a reed bed sewage system. It must be used in conjunction with a septic tank in order to function as a sewage system. Two reed beds are required for a reed bed sewage system to function properly. One bed must fill for a while while the other drains, and then the process must be reversed. The results indicated that the hazardous metals gradually decreased as the retention times increased. The reed bed rate removal ranges from 36.8% to 61.5%. These findings support the phragmites karka reed plant's ability to effectively treat industrial effluent.

Keywords: Reedbed, Phragmtes karka, wetland and sewage system

INTRODUCTION

One of the biggest hazards to the world that our Environmental contamination is a problem that the world faces today. Rising every day and resulting in serious and damage to the atmosphere that is unrepairable. Soil contamination and A water that contains numerous types of waste waters standard procedure. Treatment of waste water before discharge is the only solution to this issueThe artificial wetland systems have proven to be effective at treating a range of urban sewage in rural and suburban locations in many developed countries. The process of treating wastewater results in a disposable effluent that is safe for the environment. Metals include contain in industrial effluents Lead, Nickel, Manganese, Zinc, Cadmium, and very poisonous substances (Dhanya and Jaya, 2013).

The vegetation employed in built wetlands (CWs) is crucial for the treatment of wastewater. Recent studies (15 years ago) examined the usage of perennial herbaceous plants in CWs, including the use of various colourful flowers to make the systems more aesthetically pleasing and increase the likelihood that they will be adopted and replicated. However, several physiological traits shared by beautiful blooming plants and wetlands plants that are capable of removing contaminants from waste water are physiologically related. According to a survey, phragmites karka reed plant's were the genera of flowering ornamental vegetation that were most frequently employed. Both naturally occurring wetlands and flowering ornamental wetlands exhibit comparable removal efficiency. However, employing decorative plants improved removal efficiency. However, removal efficiency was better in using ornamental plants than in unplanted CWs.

The average annual availability of freshwater per person has decreased as a result of the growing population and overall growth of the nation. Consequently, a sizeable amount of wastewater is not treated and is eventually dumped into surface water bodies, causing the water quality to deteriorate because it is not given the proper priority. This causes the contamination of surface water bodies to increase more quickly. Industrialization, urbanisation, and land use patterns all contributed to the contamination of major rivers (Jindal and Sharma, 2011).

In rainy areas, coarse grasses called reeds grow. One of the organic and affordable techniques for treating home, commercial, and agricultural liquid wastes is reed beds. In situations where land area is not a significant obstacle, reed beds are recognised as an efficient and reliable secondary and tertiary treatment alternative (Wood, A. and L.C.Hensmann.1988). Usually, drain pipes are built in a bed of lime stone pieces and reed beds are made in tiny holes filled with pebbles and graded sand (Crites R.W., 1994). Reed plants with hollow roots are typically placed in this sandy area to provide oxygen for the filter bed (Lawson, G.J. 1985).

MATERIALS, METHODS AND PROCEDURES

First, a laboratory examination of the concentration of hazardous metals contained in the industrial effluent was performed on an untreated wastewater sample from the waste industry.

Wetland Design

The next step is to construct a small-scale prototype plant with two plastic tanks that will be used to treat wastewater. While the second pilot bed is a control bed set up to measure the reed plant's removal efficiency rate, the original bed functioned as an evaluation of the reed plants with retention durations of 5, 9, 10, 14, and 18 days in order to determine the retention period. Sand and granite were used as substrates in the beds to help the plants filter and assimilate nutrients. These beds had a 1200 mm x 600 mm size. Phragmites karka was cultivated in the first bed while there was no reed in the control bed. Wastewater was used to supply the control bed.

To provide wastewater to the created wetland on demand, was chosen with a vertical subsurface flow over a reed bed. For the retention periods of of 5, 9, 10, 14, and 18 days, the treatment efficacies of the two beds were documented. The concentration of these metals in the effluents from the beds is measured, and the results are contrasted with those from untreated wastewater.

Two experimental reed beds measuring 1200 mm by 1000 mm by 600 mm are built into a 1000 litre rectangular plastic tank as part of the designed wetland system. Granite makes up the 450mm bottom layer of the bed's support media, while 150mm of washed sand makes up the top layer. The control bed is the second bed, which is built of washed sand and granite but without the reed plant. It is designated as CONTROL BED and RB1, respectively. Phragmites karka were planted in the first bed, which was known as the Reed bed, which also had drain outlets at the bottom of the tank. Various inorganic and organic materials from domestic sources can be found in wastewater. The wastewater's COD, TDS, BOD TSS, and pH characteristics were observed. The standardized techniques of the APHA are used to calculate the parameters (APHA,1992).

Plant Cultivation

Phragmites karka seed was acquired and planted 150 mm apart in reed plants. To promote speedy and proper growth before the addition of wastewater, 40 litres of potable water were used to irrigate them each day for ten days.. The reed plants' stems were divided into two nodes, one of which entered the earth and the other of which was exposed to the air. Each cutting length was roughly 250mm long. As the buds emerged from the stem nodes, the plants were watched carefully.

The experiment could start after 16 days of seeding the stalks when some reed buts started to develop from the stem nodes.The benefit of root zone treatment is that it has no smell and high treatment efficiency and doesn't need frequent maintenance. No mechanical, electrical, or chemical equipment is required.

ACTIVITIES OF PHRAGMITES AUSTRALIS:

First, the root zone system itself makes pathways for water to flow through. Second, the roots supply oxygen deep into the soil, creating a favourable habitat for aerobic microorganisms to flourish. These organisms are required for the oxidation of ammonia to nitrate, which is the initial step in the biological degradation of nitro compounds, as well as the breakdown of many different types of chemicals. Thirdly, the nitrification process occurs, in which the plants themselves absorb a specific quantity of fertiliser from the effluent.

This root zone treatment accounts for 15% of the sewage effluent's treatment capacity in the spring and summer. The majority of nutrient breakdown is, however, carried out by bacteria. There is now a lot of research being done on the plants' capacity to accumulate specific heavy metals (Babbit, H.E. and E.R. Baumann, 1960). In short, reed beds can improve water quality by removing a high amount of bacteria and viruses, reducing the need for biological oxygen, and reducing suspended particles.

Figure (i) Reed bed system

Figure 1: Ph Testing

Figure 2 Experimental Reed bed crop 2

THE REED BED SYSTEM

Reed beds' guiding principles

Phragmites australis, a common reed, has the capacity to transfer oxygen to the root zone. The root zone has a substantial population of microorganisms. pollutants that are ingested by a variety of species similar to those found in conventional sewage systems, and then rendered harmless. Aquatic reeds, common reeds, and aquatic plants are some of the different reeds.Neither fuel nor electricity are needed for operation. There are no mechanical systems in play. Reed beds don't decompose. The setup is aesthetically pleasing and allows for the growth of microorganisms.The plants provide a quick and affordable way to treat wastewater, especially those species that thrive in tough environments.Small amounts of municipal wastewater can also be treated efficiently by root zone plants, especially when a sewage collecting line to an adjacent waste water treatment facility needs to be built.

Bhagiratha chemicals (ongole, A.P.) industrial wastewater was employed in this investigation. A total of 60 litres of effluent were used to irrigate RB1 and CONTROL BEDInfluence was removed after 5, 9, 10, 14, and 18 days. For the length of the study, the irrigation technique was performed daily. The two plots received irrigation in the morning (Sangotola,T. M et al 2015).

Reed bed construction and operation

Different bricks (or brick bats), stone chips, sand, and stone dust were layered to create the structure. Plants were then placed within the container once the layers were in place. Plant growth was also seen. For the entire month-long growing phase, only pure water was

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sprayed. After the outflow was sampled and sewage water was introduced, the root zone system was examined.

Reed beds come in two varieties: horizontal reed beds and vertical reed beds. The horizontal reed bed is depicted in Figure 1 as the one where the filter water is collected in a horizontal form.. The filtrate is gathered in the bottom of the equipment in the vertical reed bed.

The soil should be prepared for sewage flow by providing a longitudinal slope of 1 in 40 from the inlet to the outlet. Phragmites australis is the species that is utilised in the system. From the leaves all the way up the stem to the root zone, this species contains holes. It transports oxygen from the atmosphere to the root zone. As a result, the root zone has adequate oxygen to support the growth of aerobic bacteria. Those microorganisms break down organic molecules while consuming oxygen. The bacteria can easily reproduce and proliferate in the current environment. Because the anoxic zone in the system is relatively small, there is little annoyance from anaerobic decomposition.

Sewage is continuously transferred from the collection tank to the filter. It enters the prepared bed where the therapy occurs after filtering through the layer of graded stone. The down end filter is then allowed to filter the cleaned sewage after it has passed through the bed. It increases to the initially maintained level. It is gathered in a tank using a pump, then dumped into agricultural land. The debris that is present above the stone strata is scraped off and thrown away.

The reed develops enormous clumps of dense rhizomes and grows swiftly; oxygen transport through the roots may be enough. Because of its strong and dense rhizomes, it is planted to aid with soil control. The reeds contain several linear-shaped leaf blades.

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PARAMETERS	Date 21.08.22*	Date 20.09.22*	Date 26.09.22*	Date 10.10.22*	Date 30.10.22*
SAMPLES	**1**	**2**	**3**	**4**	**5**
pH	7.16	7.25	7.10	7.22	7.35
TSS in mg/L	132	556	472	162	193
TDS in mg/L	972	726	820	838	759
BOD in mg/L	132	398	622	142	101
COD in mg/L	392	894	1256	515	332

RESULTS AND DISCUSSION

TABLE: 1 – Conc. of various parameters collected (Before Treatment):

* The date inscribe the samples taken from sewage line

PARAMETERS	Date 21.08.22*	Date 20.09.22*	Date 26.09.22*	Date 10.10.22*	Date 30.10.22*
SAMPLES	**1**	**2**	**3**	**4**	**5**
pH	6.7	7.00	6.82	6.9	7.05
TSS in mg/L	86	113	105	90	92
TDS in mg/L	675	585	635	655	603
BOD in mg/L	24	29	28	25	26
COD in mg/L	246	250	240	245	248

TABLE: 2 various parameter concentrations (After Treatment)

* The date inscribe treated samples are taken at equal intervals (like 20-02-09, the treated water is taken from bed after 5 days)

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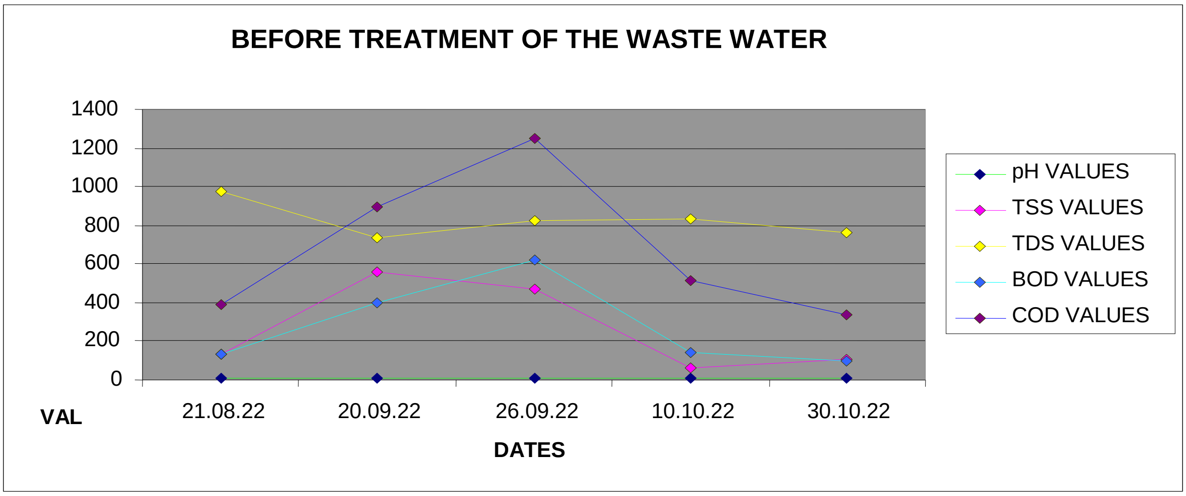
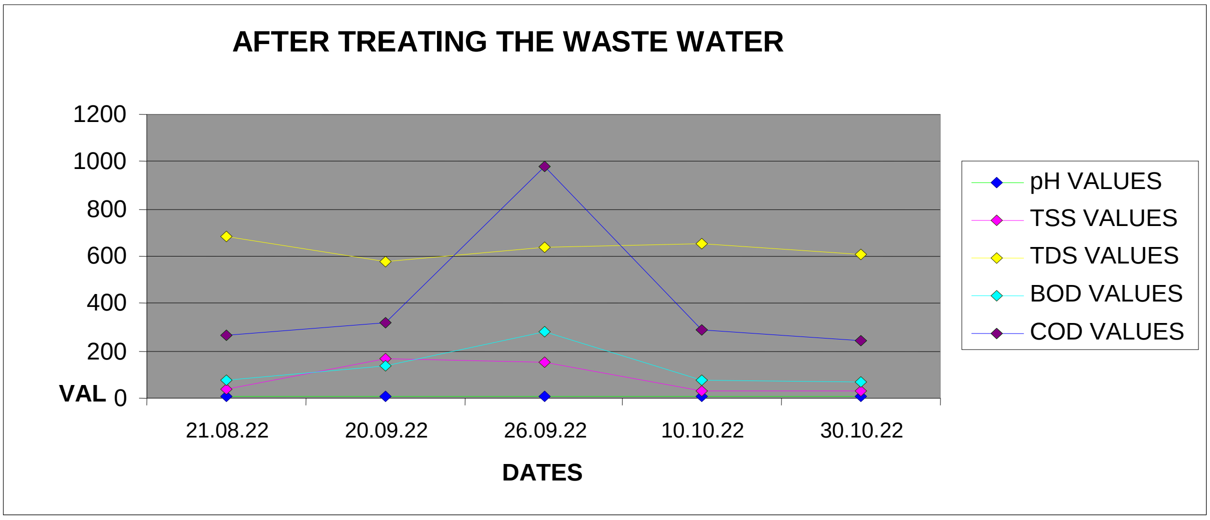


Graph 1: prior to treating the waste water, values



Graph 2: Values after treating the waste water

The outcomes display the concentrations of five parameters for wastewater treated by a traditional treatment facility, a root zone system, and a straightforward filter bed system. When compared to the other two, it is obvious that the Reed bed system is the best for treating all factors. Reed bed treatment results in a notable decrease in pH, BOD, and COD, and Because the concentrations are within permitted limits, the treated water can now be released directly into a receiving water body. Making the end product safe to dump into a natural body of water, the root zone treatment can be employed alone or in combination with conventional treatment. On September 20th and 26th, there was a rapid change in the readings of TSS and BOD.

This is because the activity in colleges peaked over those two days, and there was some rain on the morning of the twentieth. The release of chemicals from our college labs may have caused a dramatic increase in COD levels on September 26th.

According to the study, the Bhagiratha chemical Recycling industry's waste water contains poisonous metals like arsenic, cadmium, chromium, lead, and mercury. A wetland with reed beds and the reed plant Phragmites karka was used to cleanse the effluent. As the hydraulic retention times (HRT) grew, the reed bed's performance efficiency in terms of the removal of hazardous metals gradually improved. The data showing a removal rate of 39% to 70% compared to the removal efficiency of the control bed of 28.7% to 58.3%.

CONCLUSION

At the current stage of wetland technology development, reed bed wetlands have been found to have good removal efficiency for dangerous metals common in an industrial waste water. It is obvious that there are many different types of engineered wetlands for the treatment of industrial wa

stewater. The efficacy of reed bed wetland systems in reducing the amount of metals supports the ability of reed beds to deliver comparable treatment efficiencies for the treatment of industrial wastewaters with substantially less operator input.The results of the investigation showed that Reed beds may be utilised to treat industrial wastewater. As a result, it is advised that Phragmites karka and Reed bed vegetation be used for the treatment of industrial effluent. The concentration of the effluent from the industry varies. Particularly, TSS, BOD, and COD exhibit significant temporal fluctuation. The root zone method was used in a lab setting to treat the waste water. The results were compared to the industry standard of care. As is evident, the root zone treatment can be utilised as a stand-alone method for a small unit or as an addition to a regular treatment method to thoroughly treat waste water.

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