Experimental Study of Wastewater Treatment using Phytoremediation Method

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Abstract

Phragmites Australis (Reed) is a naturally abundant wetland plant. This kind is continuing, and fast-growing in the nutrient-generous saturate and marshes. Although it has all the potential to be important Constructed Wetland (CW) plant. The study was conducted to contaminant removal efficiency of the Reed plant in a lab-scale Vertical Constructed Wetland (VCW). In addition to food and shelter, clean water is a basic requirement for human survival. The main sources of clean water are surface and subsurface water. The review focused on Domestic Wastewater Treatment using Phytoremediation on Constructed Wetland (CW). The results indicate higher reduction capable in the planted CW: 380 mg/l total solid (TS), 0.8 mg/l total phosphate (TP), 5.4 mg/l dissolved oxygen (DO), 7.6 (pH), 6.4 mg/l biochemical oxygen demand (BOD), 2.10 mg/l Nitrate, the removal efficiency of enhance in the control. After all, the study suggests that Phragmites Australis has significant organic reduction efficacy in the VCW system for efficient CW plant.

Keyword-Phytoremediation, Constructed Wetland, Phragmites Australis

Introduction

Day to day during the summer season in most part of India facing issues of water scarcity due to the debilitated group water level, uneven rainfall during rainy season and facilities of water. One of the solutions for the problems regarding increasing water scarcity and pollution of water resources can be wastewater reuse. Phytoremediation process are a sustainable and cost-effective technology for wastewater treatment. Nowadays many technologies are using for treatment of wastewater but phytoremediation is a green technology also economical. As per aquatic media as a fundamental and critical part of human environment have main role in water resources and food chain. In this chapter we present different aspect and types of phytoremediation in aquatic media purification of wastewater treatment. The Phytoremediation is conducted on Constructed Wetland systems work with reed plant, and naturally available material (eg. sand, gravel, pebble) this system is more economical as compare to conventional method. The selected aquatic plant for Phytoremediation is Phragmites Australis (Reed) to help absorb the contaminated present in waste water. It is the ability of reed plant to secret oxygen to the soil,with the help of plant roots, and to clean the waste water with their properties also to improving the water quality.Moreover, the plant referee treatment processes are economical, sustainable and aquatic ecosystem. In the constructed wetland systems, wetland plant important role in the phytoremediation process.

Phytoremediation technique is a branch of bioremediation that uses the application of aquatic plants for the remediation of wastewater. It utilizes the ability of plant roots to absorb nutrients from wastewater. Selected plant like reed, cattail for phytoremediation have the ability to treatment the wastewater with their characteristic. Phytoremediation technique are more efficient and cost effective than the conventional method or water treatment plant. Phytoremediation is encouraging economical, effective and ecofriendly technology that uses plants root for the remediation of heavy metals contaminated by pollutants affected water.

Objective

1. To finalize the method for the treatment of waste water.
2. To test the various essential parameters of domestic waste water before and after treatment through wetland reactor.
3. To suggest the effective treatment material for hybrid constructed wetland reactor for the treatment of waste water.

Methodology

The experiment were conducted on CW using a Phytoremediation process. The CW 15-litre capacity is prepared with an aluminum frame reactor. The Reactor according to the dimension of (L*W*H) = 30 * 40 * 60 cm) and therefore, inserted into a similar dimensioned aluminum frame. Both systems were prepared with different layers of materials (Gardening soil, fine sand, pebble activated charcoal, aquatic plant). Moreover, Aqua Plant is used to secret oxygen through soil, to remove excessive nutrients from water and clean the water. The bottom layer (0-8 cm) of the CW reactor was filled with Activated carbon. The next 3.5 cm layer was Polyester fibre sheet, and the next 10 cm layer was filled with washed pebble. Moreover, there is a8 cm fine sand layer. The next layer was filled with soil 8 cm and a 15 cm free space for sustain the CW. Afterward, Phragmites australis (Reed) species was selected for planting at CW for experiment. This wetland species is mostly available in Maharashtra in the Eastern Asian region. After the plantation experiment, followed construction of the wetland structure by incorporating gravel, sand, charcoal material. Planting the aqua plant in prepared wetland structure for biological activities. Analysing the DO, TS, PHOSPHATE parameters of treated water form conventional waste water treatment. Analysing samples from wetlands systems to find the efficiency of constructed wetland system. Various methods to treat the waste water, such as coagulation, flocculation, sedimentation, filtration, disinfection, constructed wetland. We use the constructed wetland it is a suitable and economical method of treating waste water. Constructed wetland compared to standard treatment structures is low in working and conservation cost and also easily treats wastewater. The water treated by this method can be used for gardening, flushing, construction purposes, and decorative purposes.

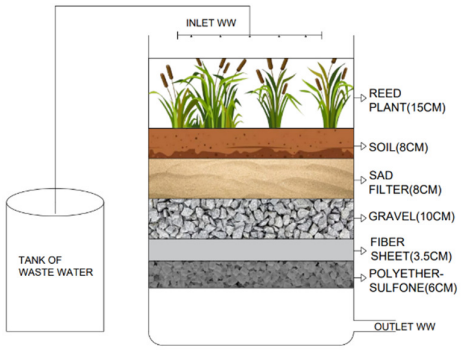


Fig.1- Vertical Constructed Wetland with Phytoremediation Process

Properties of Materials:-

Phragmites australis (Reed): - To help absorb the contaminated present in waste water. It utilizes the ability to reed secret oxygen to the soil, with the help of plant roots, improving the water quality.

Sand: - These sand beds are used to filter media. Filter the desired impurities also does not pass fine suspended matter and bacteria. sand bed increases the filtration rate of fresh water. Sand is very essential and economical and easily available (diameter 0.3 to 0.35 mm).

Gravel: - The sand bed is kept up on the gravel bed. The gravel is very effective for the formation of bacteria and also reduces BOD level and removal of sediment and heavy metal (4.5 to 4.75 mm).

Activated charcoal: - It is a highly porous material and effectively absorbent. To removal nitrate and phosphate from wastewater and increase the filtration rate of CWs.

Soil: - Soil is the role the plant. It can be removed TDS, colour and odour from wastewater with the help of plant roots.

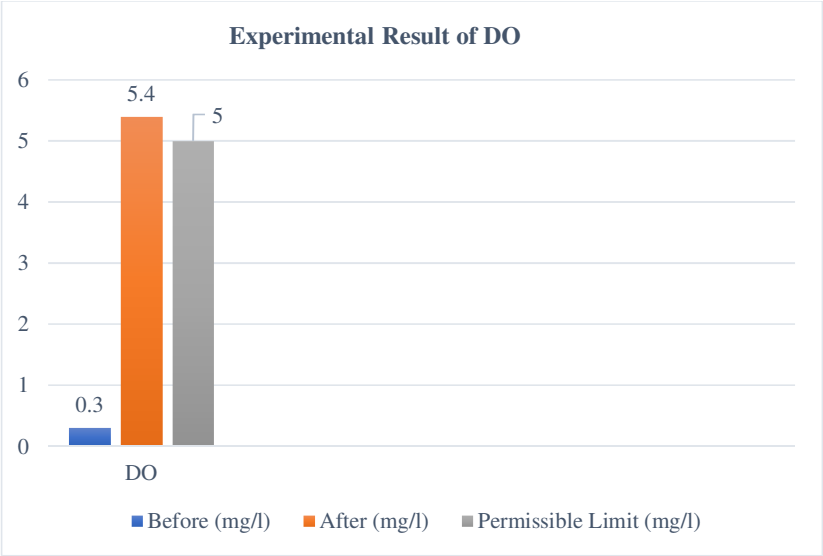
Result

Sr No	Parameters	Inlet	Outlet	Unit
1	Dissolved Oxygen	0.18	5.4	-
2	Total Solids	460	380	mg/L
3	Total Phosphate	0.180	0.080	mg/L
4	Nitrate	5.76	2.1	mg/L
5	Biochemical Oxygen Demand	60	6.4	mg/L
6	pH	7.2	7.6	-

Sample Analysis Report Result

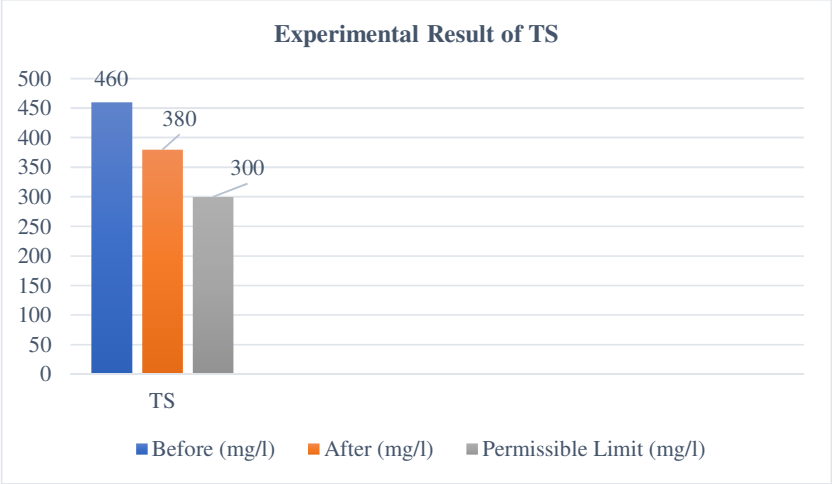
Result in graphical form

1. Graph for Dissolved Oxygen Result :-



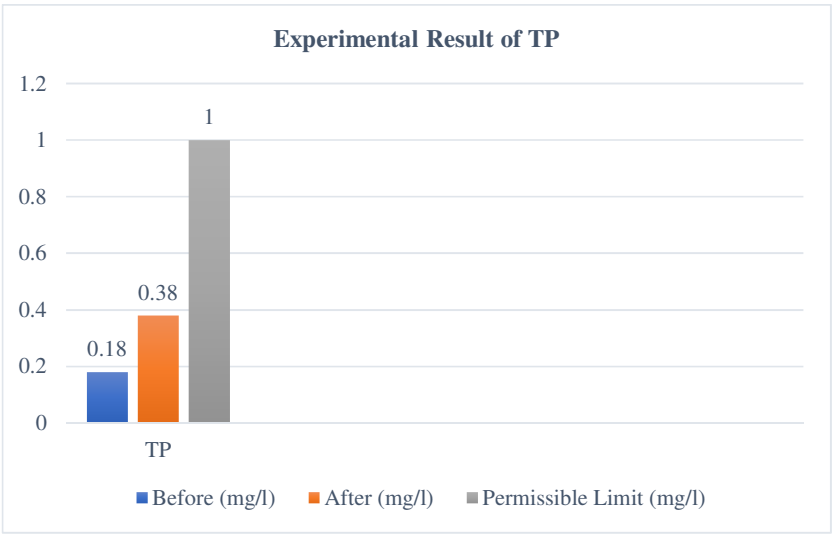
DO:-(Dissolved Oxygen) is the wastewater parameter. The removal efficiency of the CW reactor is before passing the reactor wastewater reading is 0.3 mg / l, after passing through the reactor wastewater reading is 5.4 mg/l. Hence the increasing the result of dissolving oxygen after wastewater passes through the reactor.

2. Graph for Total Solids Result :-



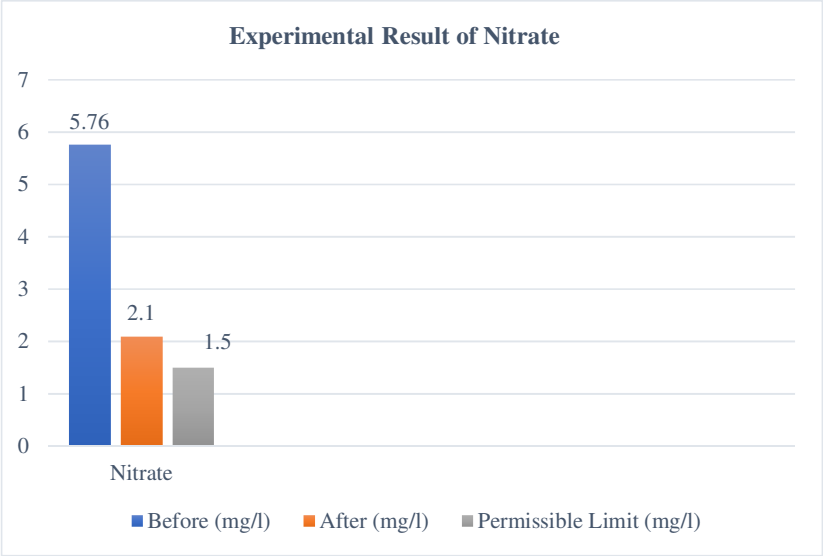
TS:-(Total Solid) is the wastewater parameter. The removal efficiency of the CW reactor is before passing the reactor wastewater reading is 460 mg / l, after passing through the reactor wastewater reading is 380 mg/l. Hence removed the Total solid after wastewater passes through the reactor.

3. Graph for Total Phosphate Result :-



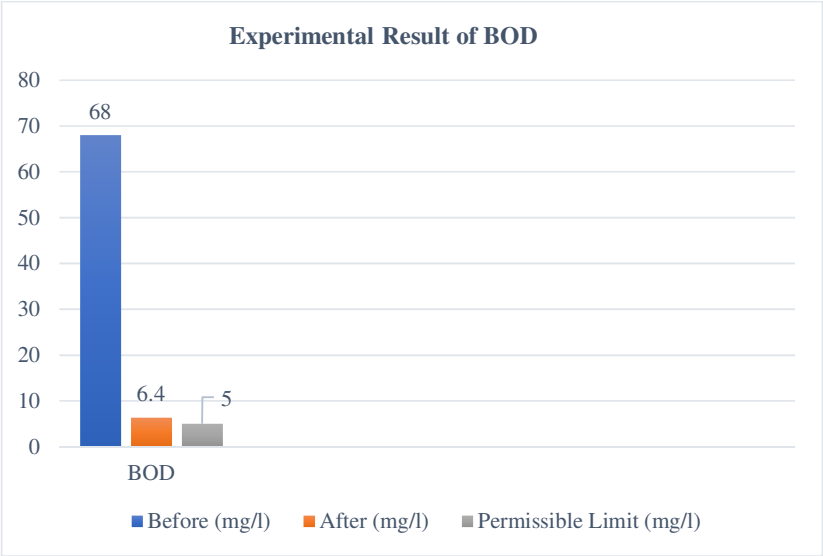
TP:-(Total Phosphate) is the wastewater parameter. The removal efficiency of the CW reactor is before passing the reactor wastewater reading is 0.18 mg / l, after passing through the reactor wastewater reading is 0.38 mg/l. Hence increasing the Total Phosphate after wastewater passes through the reactor.

4. Graph for Nitrate Result :-



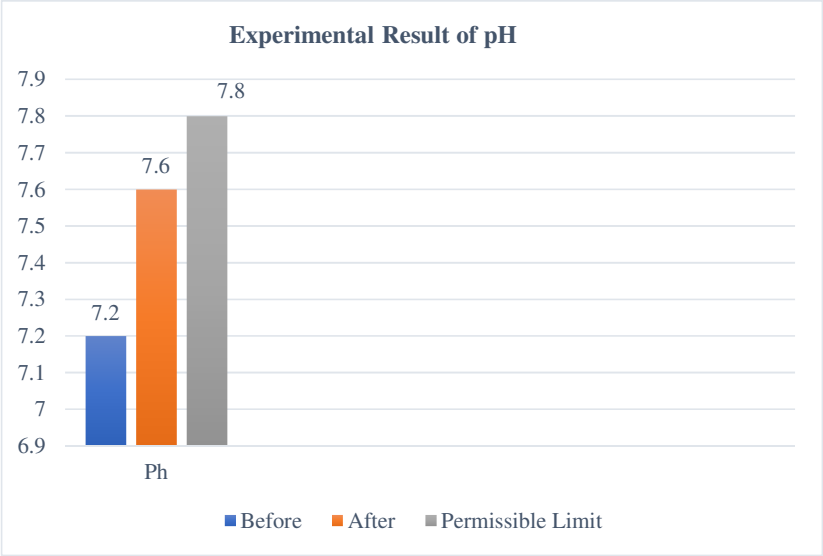
NITRATE:-(Nitrate) is the wastewater parameter. The removal efficiency of the CW reactor is before passing the reactor wastewater reading is 5.76 mg / l, after passing through the reactor wastewater reading is 2.1 mg/l. Hence the increasing the result of nitrate after wastewater passes through the reactor.

5. Graph for BOD Result :-



BOD:-(Biochemical Oxygen Demand) is the wastewater parameter. The removal efficiency of the CW reactor is before passing the reactor wastewater reading is 60 mg / l, after passing through the reactor wastewater reading is 6.4 mg/l. Hence the increasing the result of biochemical oxygen demand after wastewater passes through the reactor.

6. Graph for pH Result :-



pH:-(pH) is the wastewater parameter. The removal efficiency of the CW reactor is before passing the reactor wastewater reading is 7.2, after passing through the reactor wastewater reading is 7.6. Hence the increasing the result of pH after wastewater passes through the reactor.

Future Scope

Phytoremediation is encouraging economical, effective and ecofriendly technology that uses plants root for the remediation of heavy metals contaminated by pollutants affected water.

Now we use organic material for the phytoremediation process for treatment of wastewater. In the future, we will use advanced materials that should increase removal efficiency of treatment of wastewater. At that time, we had only one method used for treating waste water, for society's benefits.

This research has used a few parameters of water treatment. In the future, used in advanced materials and nanoparticles, increases more removal efficiency. In the future, this method will be only one method to treat water in an economical way.

Conclusion

The removal efficiency of the CW reactor is before passing the reactor wastewater reading is 0.3, 460, 0.38 mg / l, after passing through the reactor wastewater reading is 5.4, 380, 0.38 mg/l. Hence the increasing the result as per the project parameters of Dissolved Oxygen, Total Solid, Total Phosphate after wastewater passes through the reactor.

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