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Treatment of leachate using Horizontal flow Constructed Wetland

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Abstract – The study was carried out for treatment of leachate by using horizontal flow constructed wetland. For this lab scale model was prepared of size 1.65m*0.91m*0.30m. In this model different filtration medias has used. The layer of media chosen were gravel, blast furnace slag and natural sand. The treatment was carried out by using two methods to know the comparison between them. First the treatment of leachate without recirculation of treated leachate and second the treatment of leachate with recirculation of treated leachate. The treatment was carried out by mixing leachate and domestic wastewater for dilution of leachate. As the leachate is acidic in nature so it cannot be used directly for the treatment by using constructed wetland. Results shown that 85% of BOD removal and 50% of COD removal by using recirculation method. The vegetation used for study wetland model is colocasia.

***KeyWords*: horizontal flow constructed wetland, colocasia, leachate, blast furnace slag.**

1. INTRODUCTION

After degradation of solid waste, the liquid generates is known as leachate. The black colored liquid contains organic and inorganic chemicals, heavy metals as well as pathogens. Leachate can pollute groundwater, soil around and will cause health risk.

Constructed wetland is used for treatment of leachate, domestic wastewater, and industrial wastewater. Constructed wetland is low cost treatment having low construction cost and low maintenance cost. Generally there are two types of constructed wetlands, vertical flow constructed wetlands and horizontal flow constructed wetlands. Both wetlands have same working but they are design different. Horizonatl flow wetlands are on subsurface and utilizes by rising aquatic vegetation. Horizontal flow constructed wetland is subsurface flow wetland, where the water flows horizontal through the basin. While designing constructed wetland, the quantity of influent and quality has considered. The model was designed according to it Size of model designed is 1.65m *0.91*0.30m.The model has designed into three compartment where the first compartment is filtration, then root zoning and third is outlet. The plants in constructed wetland absorbs and accumulate heavy metals, nutrients and poisonous substance by the plant in wetland. The process of removal of these pollutants take place in second compartment where wetland is constructed The third compartment only for outlet. The plant used for horizontal flow wetland is colocasia.

1.1 Material and method

Gravel – It is used at the bottom layer. The size of gravel is 40mm-60mm.

Blast furnace slag- Blast furnace slag is waste product of foundary and size used in between 20mm-40mm and it was filled upto 12cm above gravel layer.

Fig-1: Blast furnace slag

Sand layer – The natural sand was used in dry form. The selected size of sand was in between 2mm-4.75mm and sand was filled upto 10cm at top layer of filter media.

Plant used – Colocasia is selected for treatment of leachate.

Fig -2: colocasia plant

1.2 Pilot scale horizontal constructed wetland

Fig-3: On site model of horizontal flow constructed wetland

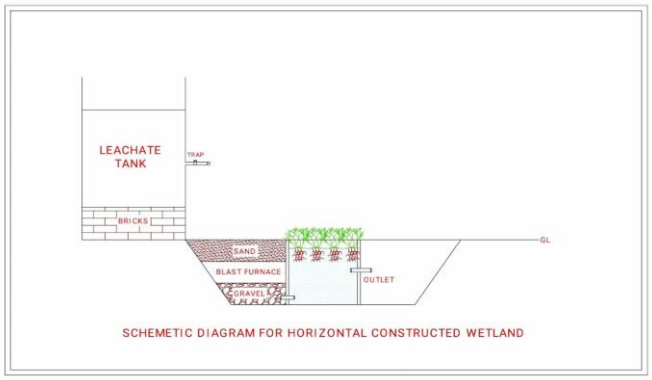

Fig-4: Diagram of horizontal flow constructed wetland

The pilot scale constructed wetland consist of horizontal flow constructed wetland. The dimension of the model is 1.65 m *0.91m *0.30m in which there are three compartments. First compartment is filtration zone, second compartment is of wetland where the plants are used for removal of heavy metals, nutrients and the third compartment is of outlet of the system. The tank is provided where the leachate is loaded. It is first part of experimental set up. Influent is allowed to pass in filtration media where the influent gets filtered and it goes to constructed wetland. The influent is allowed to stay for 2 days in wetland compartment. The retention time considered here is 2 days. The HLR is 0.040 m3/m2/day. After that the effluent was collected at outlet . After passing two samples the outlet was again allowed to pass through inlet for same process recycling of outlet was done. Both the results were compared. The dilution of leachate was done with domestic waste water first dilution was 30% leachate and 70% of domestic wastewater. The second dilution was of 20% leachate and 80%of domestic waste water. The domestic waste water was collected from shastri nagar nalla.

2. Results

The influent and effluent was tested for different parameters like pH, BOD and COD.

2.1 For the dilution 1:2:3

2.1.1 pH results without recirculation.

As the pH of inlet is more before treatment and after treatment pH is reduced as shown in graph.

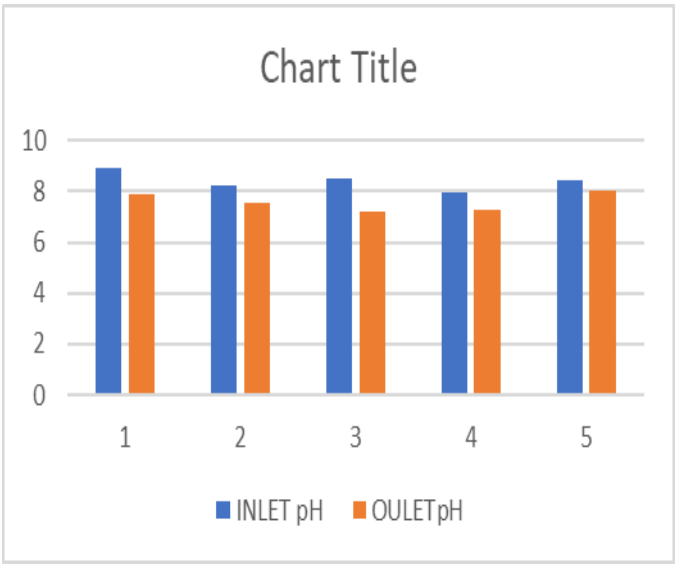

Chart-1 pH results without recirculation

2.1.2 BOD results without recirculation.

The BOD of influent found higher before treatment and after the treatment of HFCW the outlet values reduced upto 80% as shown in graph.

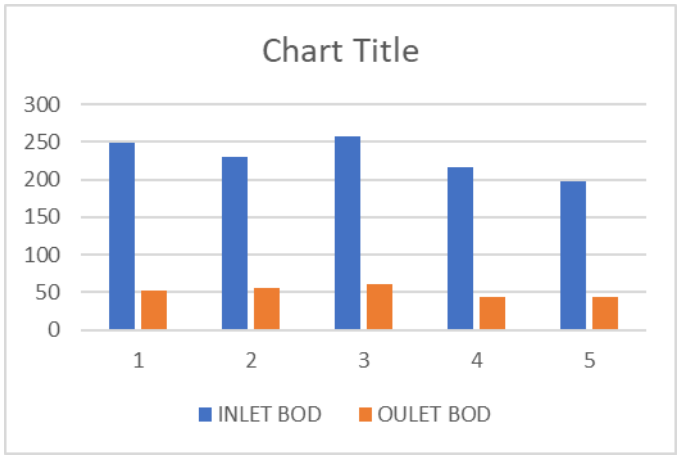

Chart -2: BOD results without recirculation

2.1.3 COD results without recirculation.

The COD of inlet was found higher before treatment and after treatment of wetland the COD reduced upto 45 %.

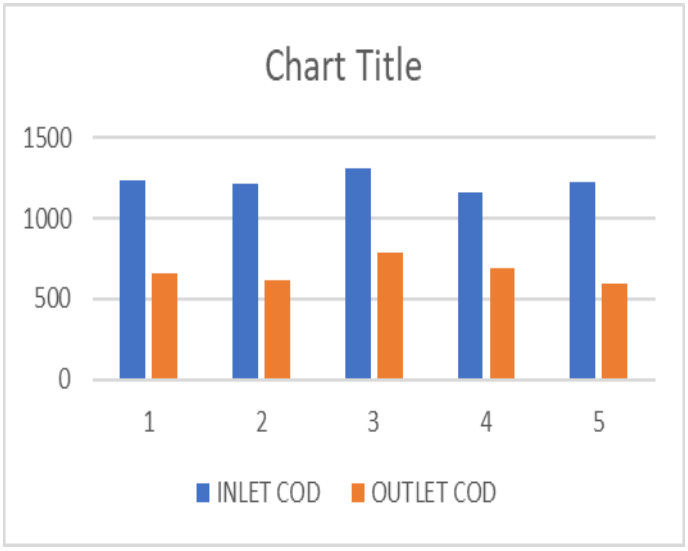

Chart -3: COD results without recirculation

2.1.4 COD results with recirculation

COD reduced upto 27% after recirculation of treated leachate.

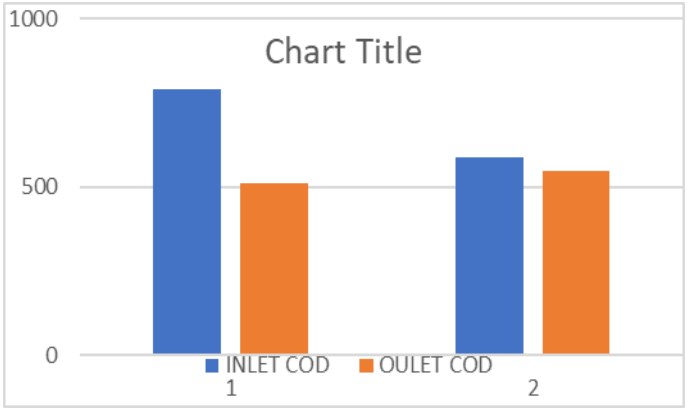

Chart- 4: COD results with recirculation

2.1.5 BOD results with recirculation

BOD values are reduced upto 88%after recirculation of treated leachate.

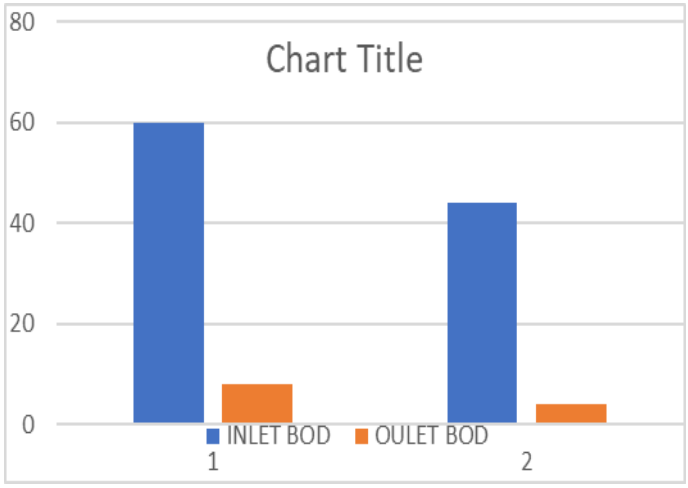

Chart-5: BOD results with recirculation

2.1.6 pH results with recirculation

As pH values were high before treatment of wetland after treatment the values are reduced as shown in graph.

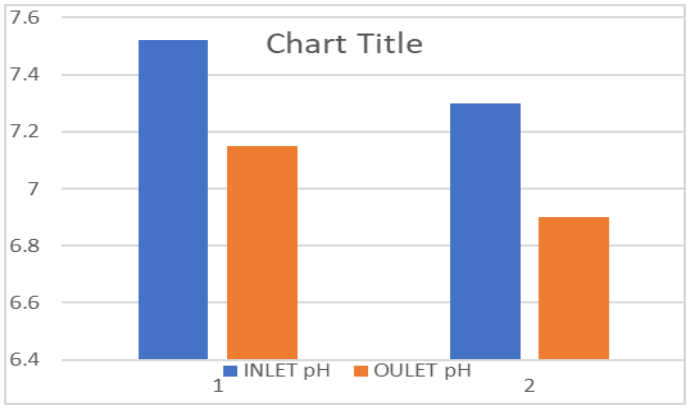

Chart-6: pH results with recirculation

2.2 For the dilution 1:4

2.2.1 pH results without recirculation.

As the inlet values are higher before treatment of wetland and after treatment slighlty the values are reduced.

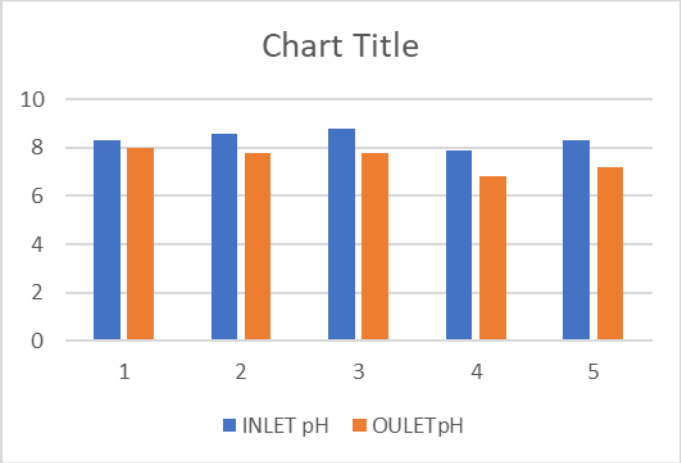

Chart-7: pH results without recirculation

2.2.2 BOD results without recirculation

BOD values are reduced upto 82% after treatment of leacahte.

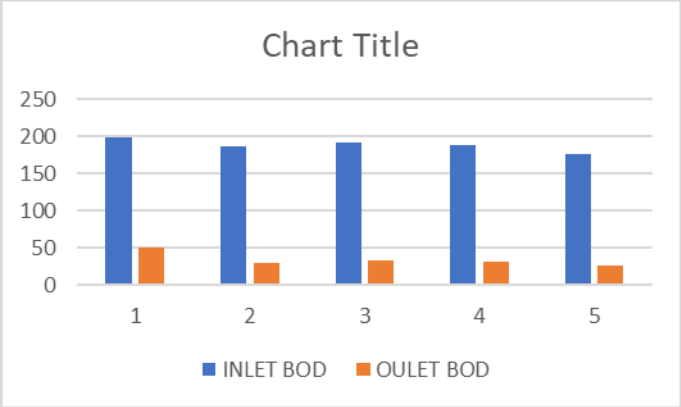

Chart-8: BOD results without recirculation

2.2.3 COD results without recirculation.

COD values are reduced upto 46% after wetland treatment.

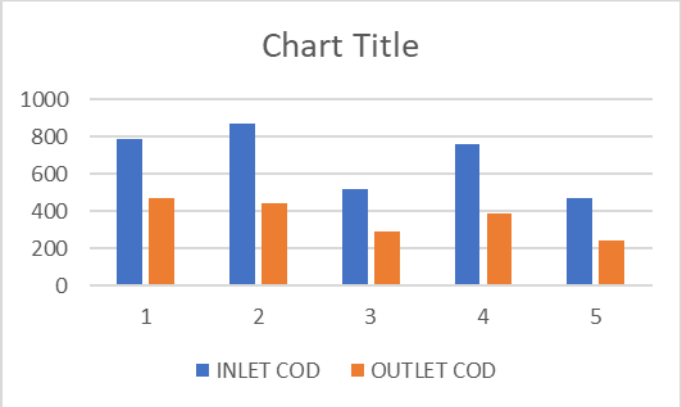

Chart-9: COD results without recirculation

2.2.5 pH results with recirculation

As pH values are reduced after treatment of wetland as shown in graph below.

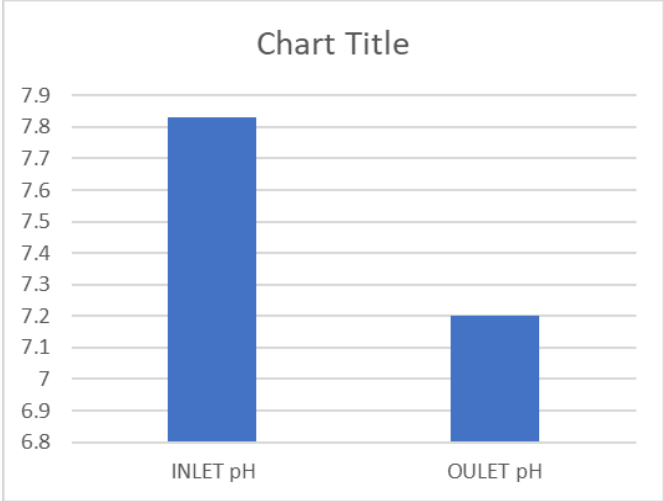

Chart-10: pH results with recirculation

2.2.6 BOD results with recirculation

BOD values are reduced upto 65% after recirculation of treated leacahte.

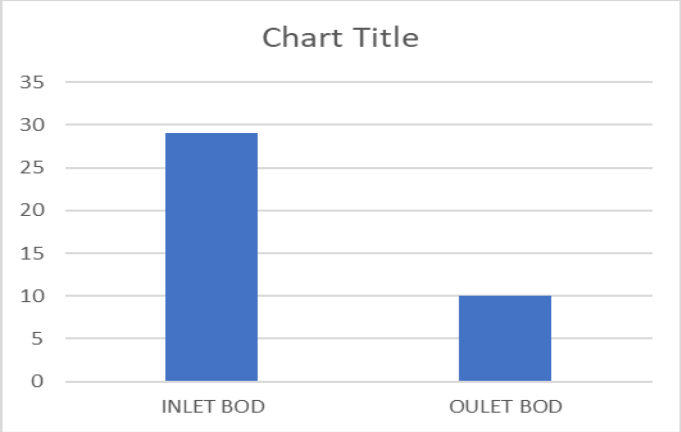

Chart-10: results with recirculation

2.2.7 COD results with recirculation

COD values are reduced upto 38% after recirculation of treated leacahte.

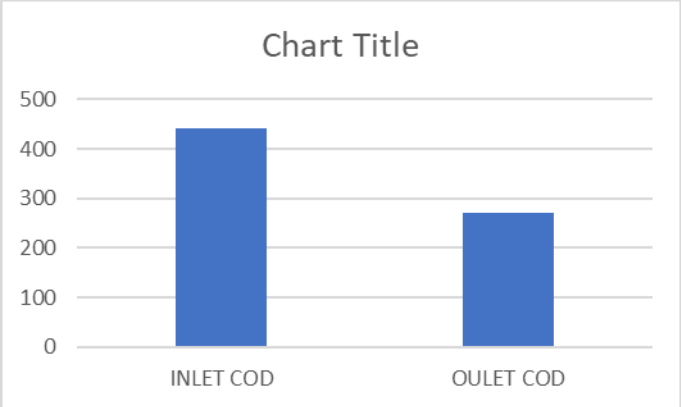

Chart-12: COD results with recirculation

2.2.8 Leachates analysis

Leachate COD is quite high due its toxic nature as compare to BOD.

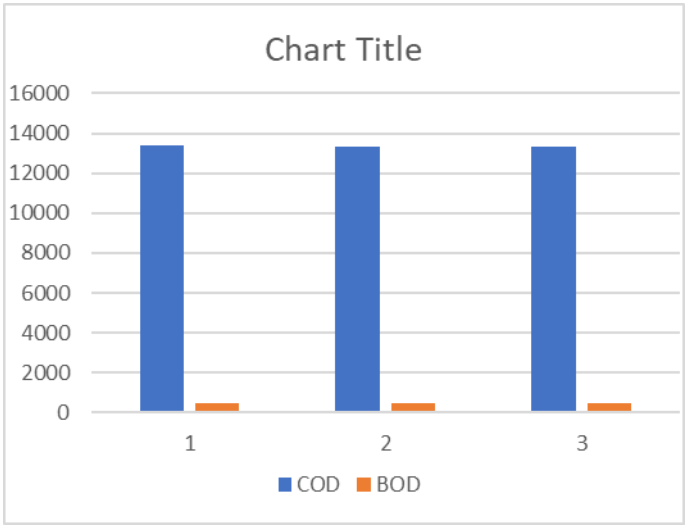

Chart-13: Results of leacahte analysis

3. CONCLUSIONS

1) Using blast furnace slag for filter media and recirculation method good results are found.

2) Without recirculation average COD reduction and BOD reduction found for dilution 1:2:3 are 45% and 80%.

3) With recirculation average COD reduction and BOD reduction for dilution 1:2:3 are 27% and 88%.

4) Without recirculation average COD reduction and BOD reduction found for dilution 1:4 are 46% and 82%.

5) With recirculation average COD reduction and BOD reduction found for dilution 1:4 are 38% and 65%.

6)1:4 dilution has got better results as compare to the other dilution for leachate treatment without recirculation.

7)1:2:3 dilution has got better results for BOD after recirculation.

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