EXPERIMENTAL STUDY ON WASTE WATER
TREATMENT USING LAB SCALE REED BED SYSTEM
USING PHRAGMITIS AUSTRALIS

PROJECT REFERENCE NO.: 40S_BE_0469

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Keywords: Waste water, Reed bed, Root zone, Phragmitis australis

Abstract:
As global water resources decline, reuse of domestic grey water for the irrigation of home gardens is quickly becoming widespread in many parts of the world. To find an alternative for fresh water resource in the places where drinking water standards are not required, grey water recycling can be adopted. Wastewater is an immense resource which could have significant application in the regions of water scarcity. This experiment deals with eco-friendly treatment of grey water by adopting Reed Bed Technology. This is done by using wet land plant, reeds that has extensive root system. The characteristics of grey water before and after treatment are analyzed and compared.

Introduction:
Water resources have become scarce and also the demand for food is increasing. Under this situation, the agricultural productivity has to be increased with minimum water. Therefore the need of an alternate for fresh water source is necessary. Grey water is abundantly available waste water resource. Hence recycling grey water can be used as an alternative irrigation source. The treatment adopted in an eco-friendly manner where special equipments and electricity are not required. This method is done using wetland plants adopting the principle of natural wetland and applying reed bed technology. Reeds are rough coarse grasses having extensive root system that grows in wet areas. They can be treated as a natural and inexpensive method for domestic, agricultural, industrial waste water. This is done through phytoremediation which is the direct use of living green plants for in situ, or in place, removal, degradation, or containment of contaminants in soils, sludge, sediments, surface water and groundwater. Using this reed, the domestic sewage is treated and let out for reuse.

Objective:
- Reuse of sewage water for irrigation purposes.
- The wastewater parameters namely BOD, COD, TDS, TSS, DO, chlorides, Hardness Turbidity and pH were analyzed.
The characteristics of treated sample include DO, pH, TSS, TDS, BOD, COD, Hardness, and Turbidity is analyzed.

- Evaluate technical information on the use of reed bed.
- Compare the waste water and treated water and find out the efficiency.
- High level of bacterial and viral removal.
- Decreased biological oxygen demand and reduction of suspended solids.

**Literature review**

- Ramprasad.C (2012), study on waste water treatment and using lab scale reed bed system through the application Root Zone Treatment. To analyze the quality of treated and untreated wastewater is compared and it prove the remarkable reduction in pH, COD, BOD and the treated water is fit to let out directly to water bodies.
- Geetha G, study the Eco–Friendly treatment and reuse of grey water and compare with the water before and after treatment. Its proves effectiveness of reed bed system and it is suitable for use of water in agricultural activity.

**Methodology:**

**MATERIAL COLLECTION:**

- **Reed plant selection:**
  Plant used for this eco-friendly treatment is Aquatic Plant (Phragmitis australis) that is collected from an agricultural land near Halekote. These plants are easily available in agricultural land, thrown as a waste from crops. Especially, this plant has pores in root system hence transports oxygen through it.

- **Other materials:**
  Other materials like coarse aggregate, stone dust and sand are collected from local construction place. Filter paper, tubs with pipe and tap connection are used.

**Construction of reed bed system:**

The unit was constructed by placing separate layers of coarse aggregate (10 to 20cm), stone dust(10 to 15cm) and sand(20 to 30cm), after arranging the layers the plants were planted in the unit. Further the growth of plants was monitored. During the growth period of one month, only plain water was sprinkled. Then sewage water was let into the root zone system and the samples were collected.
Collection of waste/grey water:

Grey water collected from nearer HASSAN

ANALYSE THE WASTE WATER/GRAY WATER CHARACTERISTICS:
Waste water characteristic like hardness, COD, BOD, chlorides, turbidity, TDS, TSS and pH were analyzed.

<table>
<thead>
<tr>
<th>TESTS</th>
<th>pH</th>
<th>HARDNESS (mg/l)</th>
<th>TURBIDITY (NTU)</th>
<th>TSS (mg/l)</th>
<th>TDS (mg/l)</th>
<th>DO (mg/l)</th>
<th>CHLORIDES (mg/l)</th>
<th>BOD (mg/l)</th>
<th>COD (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE</td>
<td>8.2</td>
<td>335</td>
<td>58</td>
<td>272</td>
<td>323</td>
<td>0.4</td>
<td>435</td>
<td>138</td>
<td>108</td>
</tr>
</tbody>
</table>

TREATMENT PROCESS:

A. Preliminary treatment:
Preliminary treatment is done by screening

B. Root zone treatment:
Root zone treatment is done by waste water pass through the reed bed system by horizontal and vertical flow.

ANALYSE THE TREATED WATER CHARACTERISTICS:
Treated water characteristic like hardness, COD, BOD, chlorides, turbidity, TDS, TSS and pH were analyzed
### COMPARISON OF WASTE WATER AND TREATED WATER CHARACTERISTICS:

Comparing the waste water and treated water characteristics and finding the efficiency.

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>UNTREATED EFFLUENT</th>
<th>TREATED EFFLUENT</th>
<th>FAO-PERMISSIBLE VALUE FOR IRRIGATION</th>
<th>EFFICIENCY IN REMOVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>8.2</td>
<td>7.8</td>
<td>6.5-8.5</td>
<td>-</td>
</tr>
<tr>
<td>HARDNESS</td>
<td>335</td>
<td>129</td>
<td></td>
<td>61.49</td>
</tr>
<tr>
<td>COD</td>
<td>368</td>
<td>74.4</td>
<td>&lt;150</td>
<td>79.78</td>
</tr>
<tr>
<td>DO</td>
<td>0.4</td>
<td>4.2</td>
<td>&gt;4</td>
<td>-</td>
</tr>
<tr>
<td>BOD</td>
<td>138</td>
<td>32</td>
<td>&lt;100</td>
<td>76.81</td>
</tr>
<tr>
<td>CHLORIDES</td>
<td>435</td>
<td>194</td>
<td>&lt;250</td>
<td>55.4</td>
</tr>
<tr>
<td>TSS</td>
<td>272</td>
<td>32.8</td>
<td>&lt;100</td>
<td>87.94</td>
</tr>
<tr>
<td>TDS</td>
<td>323</td>
<td>51</td>
<td>&lt;120</td>
<td>84.21</td>
</tr>
<tr>
<td>TURBIDITY</td>
<td>58</td>
<td>20</td>
<td></td>
<td>65.51</td>
</tr>
</tbody>
</table>

**Result and conclusion:**

The greywater sample discharged in the domestic sewage was analysed to determine their characteristics. Reed bed system with root zone treatment was employed on a lab scale to treat wastewater. The characteristics of untreated greywater samples were analysed. After treating with the rootzone treatment using Aquatic plant, the characteristics of treated sample includes pH, TSS, TDS, BOD, COD, Hardness, Turbidity, DO is analyzed and compared with untreated sample shows a temporal variation.

Results shows that the concentration of BOD before treatment is 138 mg/l whereas after treatment, the removal efficiency is 76.81% which indicates the use of greywater can be put to use in agricultural practices. The use of reed bed to remove nutrients and micro pollutants from domestic sewage is more cost effective than conventional sewage treatment system. It is also more effective in the places where there is a land constraint.

There are, of course, still many instances where farmers either have no other option but to use marginal-quality water resources (such as in regions where reliable water supplies are lacking and discharge of municipal wastewater into the environment pollutes water bodies), or where farmers are unaware that they are directly using wastewater. Planned wastewater use for irrigation, however, is an increasingly important resource in recognition of its potential benefits, especially in urban and peri-urban agriculture. This is driving
wastewater use in both developing and industrialized countries – especially in water-scarce areas where alternative supplies are lacking.

The treated water has a wide range of application in the place of fresh water source where drinking water standards are not to be maintained. It is very helpful for farmers to use this resource since it is economical, no land constraint and simple in construction. It has to be noted that growing reeds do not even require cultivatable land. Hence, waste uncultivatable land can be used for this whole process.

Apart from these, it can be used for terrace gardening, toilet flushing, power plant as a coolant, laundries etc. Hence the process with the obtained removal efficiency can be replaced with conventional sewage treatment plant, is eco-friendly without use of chemicals, special equipments, electricity and also with zero operational and less maintenance cost.

References: