

Treatment of Kitechen Waste Water by Phytoremediation Method Using Canna Indica Plant

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Abstract: *The treatment of wastewater is a critical environmental issue, and phytoremediation is a promising method for addressing this challenge. This project examines the effectiveness of phytoremediation as a method for the treatment of wastewater. The paper provides an overview of the principles of phytoremediation and its various applications in wastewater treatment. The study also evaluates the performance of phytoremediation in treating different types of wastewater, including industrial, agricultural, and domestic effluents. The paper explores the factors that influence the performance of phytoremediation, such as plant selection, nutrient availability, and the presence of pollutants. Furthermore, the study highlights the advantages and limitations of phytoremediation and discusses potential strategies for improving its effectiveness. The thesis concludes by highlighting the potential of phytoremediation as a sustainable and cost-effective method for the treatment of wastewater, and it proposes directions for future research and development in this field. Overall, phytoremediation offers a promising approach for the treatment of wastewater, and its continued development and refinement could have significant environmental and economic benefit.*

Keywords: *Kitchen wastewater, Canna Indica, p^H, TDS, BOD, COD, Turbidity, Phytoremediation.*

1. INTRODUCTION

The situation is getting worse day by day with rapid urbanization where adequate Sanitation and wastewater treatment facilities are lacking. Due to availability of less wastewater treatment plants, large portion of the sewage remains untreated and left as it is to water bodies. In order to clean this water bodies, it is necessary to clean these waste i.e., mainly domestic sewage. Therefore, it is very essential to treat and reuse this wastewater for various purposes by using some advanced technologies such as phytoremediation Technology.

Phytoremediation technology is one of the suitable techniques for treatment of wastewater used in various parts of the world.

Phytoremediation: - Phytoremediation is a process that uses plants to remove, detoxify or immobilize pollutants and contaminants from soil, water or air.

Phyto = plant
Remediation = restoring balance

2. AIM

1. To study the effectiveness of phytoremediation plants in controlling water pollution.
2. To reduce the pollutant load of wastewater.

3. OBJECTIVES

1. To convert the wastewater into usable water with the help of green plant.
2. To monitor changes in water quality parameters, including pH, BOD, COD, TDS, and turbidity, during the phytoremediation process.
3. To investigate the growth and adaptability of *Canna indica* plants in a wastewater treatment setting.

4. MATERIALS

Materials used for phytoremediation set up

The various materials used in the wastewater treatment by phytoremediation process are as follows:

- 1) Plastic collection tank
- 2) Plastic tank(inlet, outlet)
- 3) Drainage pipe
- 4) Flow controller
- 5) Plastic pipe
- 6) Glass tank
- 7) Sand
- 8) Black Soil
- 9) Gravels
- 10) *Canna Indica* plant

Factors of suitable experimental setup

Determine the specific phytoremediation system you will employ. This could include constructed wetlands, floating treatment wetlands, or other types of plant-based treatment systems.

Consider factors such as plant selection, planting media, hydraulic flow rate, and configuration. Choose appropriate plant species based on their tolerance to the contaminants in the wastewater and their ability to uptake and remove pollutants. Consider factors such as plant growth characteristics, nutrient requirements, and availability of the selected plant species.

Implement a monitoring plan to regularly assess the performance of the phytoremediation system. This may include sampling and analyzing the influent and effluent water for contaminants, as well as monitoring plant growth, nutrient levels, and other relevant parameters.

Collect data on various parameters, including contaminant concentrations, plant biomass, nutrient levels, and any other relevant measurements. Analyse the data to evaluate the effectiveness of the phytoremediation system and draw conclusions.



Fig 1: Tank showing filing of material

By reviewing the above data mentioned and several factors, we have installed the above experimental model to treat the kitchen waste water. A horizontal rectangular tank made of glass with a capacity of at least 160 litres was used to set up the phytoremediation system. The tank was designed with one inlet end from where the wastewater sample will enter to the horizontal tank and one outlet end to collect the treated waste water. The tank was divided into three compartments with which each compartment was filled with sand, gravel, black soil & basic soil up to the thickness of 28 cm which were laid from bottom of the tank. The gravels were laid at the bottom layer of the tank followed by sand, basic soil and the black soil up to the height of 28cm. The plant species canna Indica was planted in each compartment due to its high tolerance to polluted water and its ability to absorb nutrients and heavy metals. The materials and the canna indica plant have been selected for the treatment process depending on their characteristic in the waste water treatment as mentioned earlier. A total of 12 plants in which each compartment having 4 plants were used and planted in substrate.

Kitchen waste water was collected from college canteen and stored in a separate tank(inlet). It has been observed that the water was pumped into the horizontal rectangular tank at a flow rate of 40 ml per minute.



Fig 2: Experimental Model

Design of Tank

Following is the diagrammatic representation of the tank designed for the wastewater treatment process including its dimensions

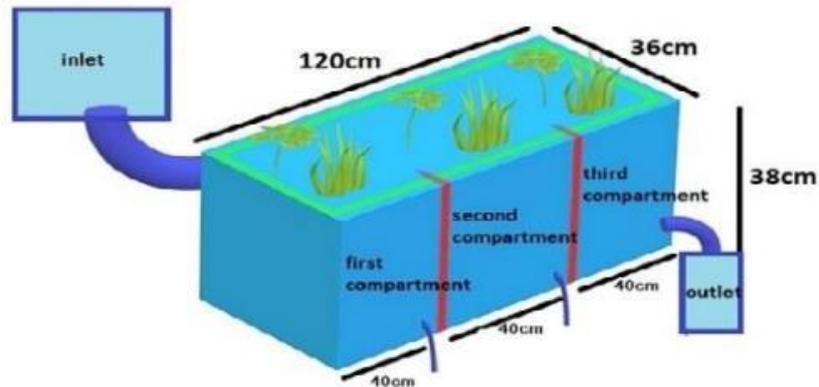


Fig 3: Design of Tank

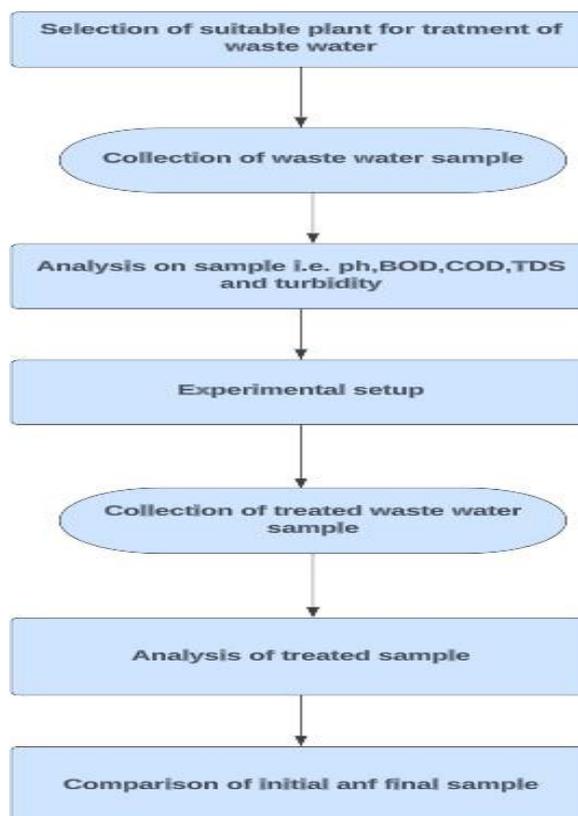
5. METHODOLOGY

The experimental setup for phytoremediation of wastewater treatment using *Canna Indica* has been installed in open air with horizontal flow system the study was conducted in glass tank filled with contaminated soil, sand and gravel and wastewater.

Following is the procedure adopted for treatment of kitchen waste water by phytoremediation method: -

- Collection of kitchen waste water sample from KIT'S College Canteen.
- Determining the initial characteristics of waste water sample by performing various tests on it like BOD, COD, PH, TDS and turbidity test.
- Installation of horizontal tank and designing of tank for treatment of waste water.
- Addition of sand, gravels, black soil in the sufficient amount layer by layer for filtration of Water.
- Placing of sufficient number of plants (*Canna Indica* Plant) in the different compartments of the tank so that it will help in absorption and purification of kitchen waste water effectively.
- Maintaining the flow and velocity of water with adjusting the flow of water.
- Observing and monitoring the growth of the plants in the tank by daily basis
- Collecting the treated water at the outlet end of the tank.
- Determining the final characteristics of treated water by as the initial one.
- To compare both the initial and final results.

Working Flow Chart



The above parameters have been used for the treatment of kitchen wastewater depending on their role, relevance and characteristics in waste water treatment and phytoremediation process which are discussed below:

The parameters P^H, BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand), TDS (Total Dissolved Solids), and Turbidity are commonly used to assess the quality of wastewater and evaluate its suitability for treatment by phytoremediation.

6. RESULT AND DISCUSSION

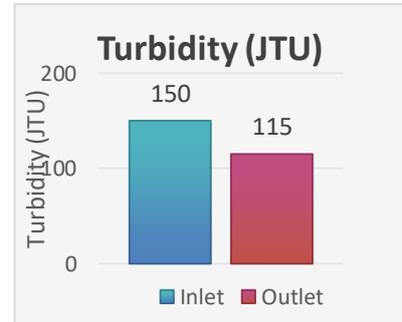
Initial testing & final testing on waste water sample

Sr. No.	Parameters	Standard Values	Kits Canteen Kitchen Waste Water Reading	Kits Canteen Kitchen Purified Water Reading
1	P ^H	6.5 to 9.5	8	7
2	TURBIDITY	0-10 JTU	150 JTU	115 JTU
3	COD	5 to 20 mg/l	1240 mg/l	58 mg/l
4	BOD	20 to 30 mg/l	433 mg/l	21.5 mg/l
5	TDS	300 to 500 PPM	519 PPM	417 PPM

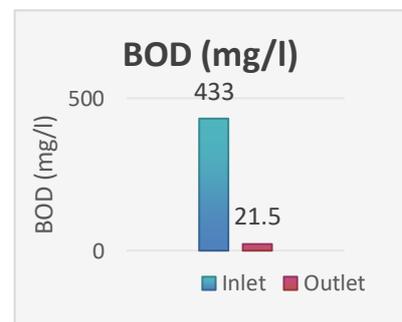
Table 1: results of kitchen waste water & kitchen purified water sample

Reduction in Kitchen Wastewater

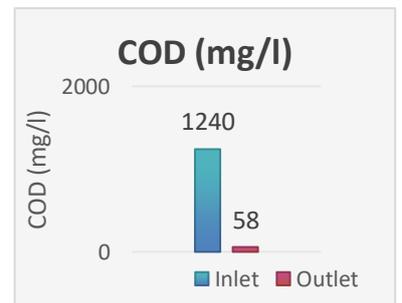
- The average removal efficiency of TDS obtained is 23.33%. The following graph shows the removal rate of turbidity obtained during the process.



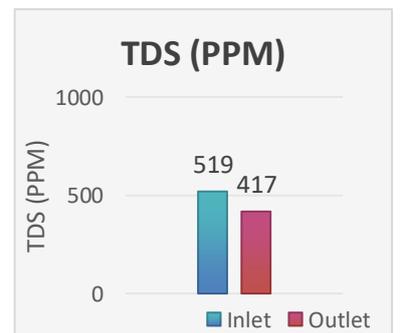
- The average removal efficiency of BOD obtained is 95.03%. The following graph shows the removal rate of BOD obtained during the process.



- As plants absorb the pollutants from the water, they can reduce the overall COD level. The average removal efficiency of COD obtained is 95.32%. The following graph shows the removal rate of COD obtained during the process.



- The average removal efficiency of TDS obtained is 19.65%. The following graph shows the removal rate of TDS obtained during the process.



7. CONCLUSIONS

- The treatment of wastewater using *Canna indica* plants resulted in notable improvements in water quality parameters. After initial and final treatment process, parameters like pH, Turbidity, TDS, COD, and BOD, it is founded that water comes under the permissible limit.
- The pH of the water remained within the optimal range for plant growth and nutrient

uptake throughout the experiment, indicating that the plants were able to thrive and effectively remove contaminants from the water..

- This process does not require high energy inputs and maintenance cost. The results of this study suggest that phytoremediation using *Canna Indica* plants has the potential to be a cost-effective and environmentally friendly method for treating kitchen waste water.
- Treated wastewater can be reused for irrigation, washing, flushing tanks, plantation and other purposes. Further studies will focus on removal of impurities, and utilization of plants to treat waste water naturally.

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