

An Experimental Investigation on Recycling of Grey Water Naturally by Using Canna Plants

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ABSTRACT: Water resources are the sources of water that are potentially useful. And now a days this resource is steadily decreasing. In Residential houses grey water started playing its major role due to the increasing population. In this experimental investigation, instead of allowing this daily used grey water into the drainage as waste, it can be recycled naturally by using the roots of the Canna plants and soil bacteria for domestic re-usage such as for Gardening, Flushing of toilets. The main aim of this study was treatment of untreated wastewater from campus and to compare the efficiency of two different plants- Canna indica and Canna flaccida. The grey water sample is collected from AERI campus (Cauvery hostel) and was analysed for various parameters such as BOD, COD, TSS. Then the collected grey water is allowed for its treatment by flowing it over the Canna plant bed. The results of grey water before and after treatment using Canna indica which is effective than Canna flaccida having COD - 100 & 28 mg/l, BOD - 22 & 5 mg/l and TSS -12 & 5 mg/l respectively.

KEYWORDS: Canna plant, grey water, recycling, soil bacterias, re-usage.

I. INTRODUCTION

The issue of grey water management is gaining more and more importance, especially in developing countries where improper wastewater management is one of the most important causes for environmental pollution and fatal diseases. Usually the treatment of grey water is carried out by setting up small treatment plants or by using chemicals or by developing micro-organisms. This method of treating the grey water by using treatment plant requires more space and the cost will also be high. In this experiment, the grey water is collected and arrangement is made such that the collected water flows over the Canna plant bed for its treatment process. As the roots of canna plant supplies abundant amount of oxygen the bacterias present in the soil becomes active and due to this abundant amount of oxygen available the sludge digestion takes place for long period. As a result, the organic and inorganic compounds in the grey water are taken as a food by the Aerobic bacterias and renders the grey water clean. At the lower level of soil layer Anaerobic bacterias are present which digests the remaining waste or sludge in the grey water which is left over from the Aerobic bacteria. As the Anaerobic bacteria digests the waste left over by the Aerobic bacteria and consumes this waste as food and renders the grey water.

OBJECTIVES

1. To offer more economical and ecologically acceptable solution to water pollution management problems.
2. To treat the grey water naturally by using canna plant at low cost without any usage of chemicals.

II. MATERIALS AND METHODOLOGY

II.1 MATERIALS

1. Plastic container
2. Plastic buckets with lids

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3. PVC pipe
4. Nuts and closets
5. Taps

II.II EXPERIMENTAL SETUP

The experimental setup consists of two units and this pilot scale model has been built in open air at a site of “Adhiyamaan College of Engineering, Hosur”. The size of each tub was 0.6mx0.4mx0.3m and vertical bucket were used to hold the wastewater that has been collected from Cauvery hostel, AERI campus. The capacity of each vertical bucket was 20 litres. To enable the flow of wastewater gravitationally from inlet to outlet, a longitudinal slope was provided. A vertical pipe was placed above the tub in the inverted ‘T’ shape for equal flow of wastewater, which was connected with flexible pipe to the inlet of holding tank for each set. The length of PVC pipe was 0.4m and the holes were provided on the plastic pipe at equal interval of 5cm for equal flow and the taps were adjusted by manually. The two pilot units were “filled (from bottom to top) first layer of 0.1m consisted of coarse aggregate gravel, second layer of 0.1m consisted of fine aggregate sand”. First unit was planted with *Canna flaccida* and second unit was planted with *Canna indica*, both units were planted the plants in 3x3 rows.

II.II EXPERIMENTAL PROCEDURE

The experiment was carried out from July 2016 to September 2016 and two pilot scale units were fed with fresh water for a period of one month. The untreated wastewater from campus were collected and analysed for various parameters. Then the greywater is allowed to flow over the canna plant bed for its treatment. The greywater is fed over the plant and the water collected after treatment is taken for tests such BOD,COD and TSS.



Figure 1- Experimental Setup

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II.IV ANALYSIS OF UNTREATED GREY WATER

| S.NO | PARAMETERS | QUANTITY |
|------|---|-----------------|
| 1 | Appearance | Brown in colour |
| 2 | Biological Oxygen Demand(3 days @ 27°C) | 22.0 mg/l |
| 3 | Chemical Oxygen Demand | 100.0 mg/l |
| 4 | Total Suspended Solids | 12.0 mg/l |

Table-1

III. RESULTS AND DISCUSSION

III.I RESULTS AND DISCUSSION

Comparison of properties of grey water before and after treatment and from the parameter removal efficiency study, it is found that the Canna plant is the best for treatment of all parameters. There is a remarkable reduction in BOD, COD, TSS from 1st to 7th day by root zone treatment mainly by Cannas and it has been evaluated that the treated water is fit enough to be let out directly into a receiving water body as the concentrations are below the allowable limits.

III.II CHARACTERISTICS VALUES OF GREY WATER SAMPLE AFTER TREATMENT USING CANNA INDICA

| CHARACTERISTICS / DAYS | DAY 1 | DAY 2 | DAY 3 | DAY 4 |
|---------------------------|-------|-------|-------|-------|
| BOD, 3 days @ 27° C(mg/l) | 20 | 7 | 6 | 5 |
| COD (mg/l) | 80 | 36 | 32 | 28 |
| TSS (mg/l) | 8 | 6 | 5 | 5 |

Table-2

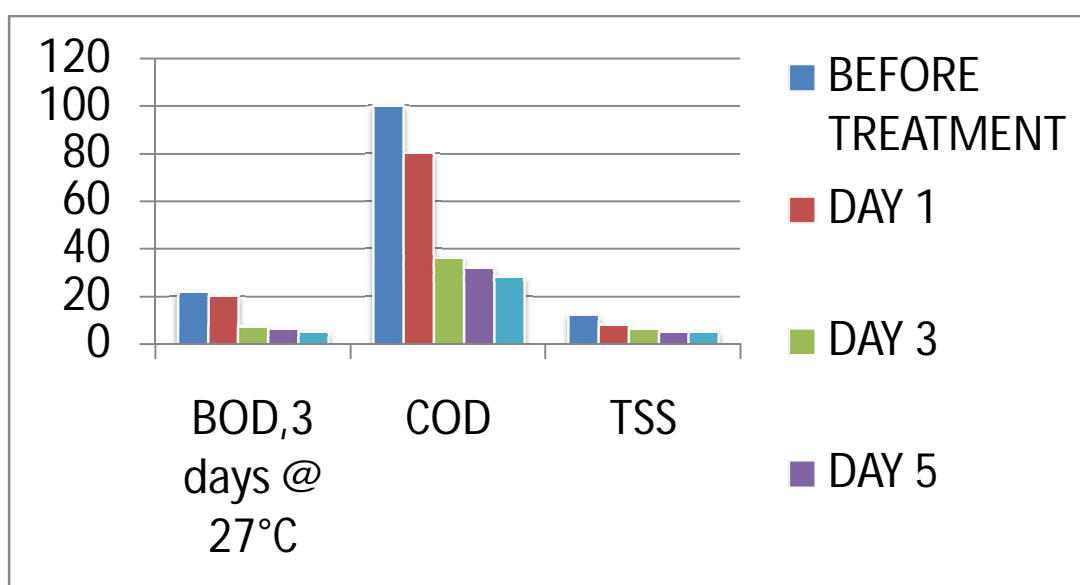


Figure 2- Comparison graph

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III.III CHARACTERISTICS VALUES OF GREY WATER SAMPLE AFTER TREATMENT USING CANNA FLACCIDA

| CHARACTERISTICS / DAYS | DAY 1 | DAY 2 | DAY 3 | DAY 4 |
|----------------------------|-------|-------|-------|-------|
| BOD, 3 days @ 27° C (mg/l) | 22 | 11 | 6 | 6 |
| COD (mg/l) | 90 | 55 | 48 | 47 |
| TSS (mg/l) | 10 | 7 | 5 | 5 |

Table-3

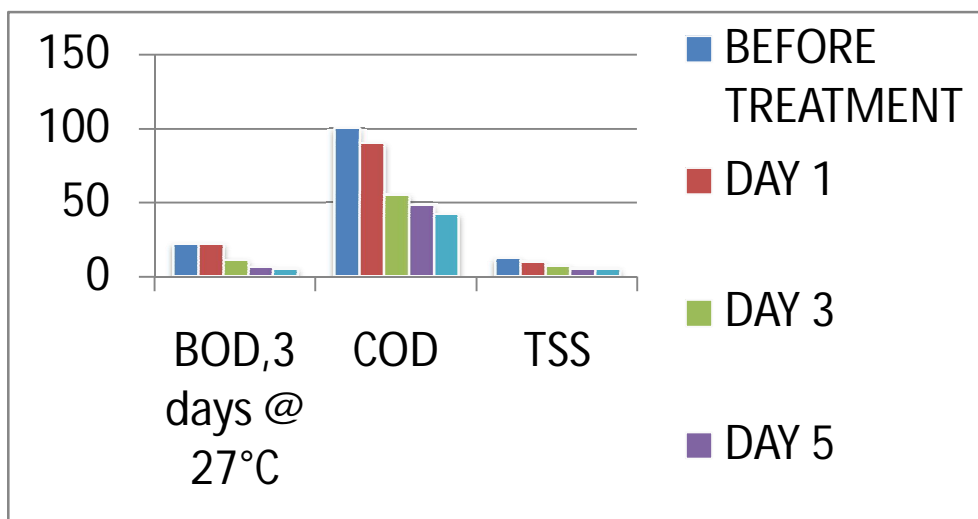


Figure 3- Comparison graph

III.III DISCUSSION

From the tests conducted [Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Suspended Solids (TSS)] it is found that all the organic and inorganic composition in the treated grey water using Canna plants are in the minimum specific limit and safe for re-usage of water for domestic use. Among the both plants (Canna indica and Canna flaccida) it is found that Canna indica is more effective and the BOD (3 days @ 27°C) content consecutively decreases from 22 mg/l to 5 mg/l and COD removal was from 100 mg/l to 28 mg/l and TSS was from 12 mg/l to 5 mg/l which is safe composition for domestic re-usage. Grey water treated naturally by using Canna plants and natural soil can be used for treating the residential grey water instead of treating the grey water by using treatment plants, as it shows decreased composition of organic and inorganic compounds which is completely safe for the domestic re-usage such as gardening, flushing of toilets as per the water quality standards for domestic usage. This type of treatment which is done at low cost will be very economical and safe for re-usage for domestic purpose and this process can reduce 50 to 60% of fresh water usage and maintains good water level in the ground water table around the surrounding and reduces water scarcity problems.

IV. CONCLUSION

From this experimental investigation it is seen that the treatment of grey water using Cannas is very efficient in reducing the concentrations of all parameters. As this is a simple method, it can be adopted in each household to suit the amount of wastewater generated to save water.

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In this experiment it has been evaluated that the maximum removal of pollutants such as BOD, COD & TSS using *Canna flaccida* and *Canna indica* is 72% & 77%, 56% & 72% and 58.3% & 58.3% respectively. The removal efficiency using *Canna indica* plant is more higher compared to *Canna flaccida* and therefore *Canna indica* is more efficient in treating grey water.

REFERENCES

- [1]. American Public Health Association.(1992). Standard Methods for the Examination of Water and wastewater, 18th Edition, American Public Health Association, Washington, D.C.
- [2]. Babbit, H.,E., & Baumann, E.R.(1960). Sewage and sewage Treatment, 8th Edition, Asia Publishing House, Bombay,(p. 389)
- [3]. Baskar, G., Deeptha, V.T., & Abdul Rahaman, (2009). A root zone technology for campus waste water treatment. Journal of Environmental Research and Development, 3 (3), 695-705.
- [4]. Central Pollution Control Board Guidelines on construction, operation and application of root zone treatment system for treatment of municipal and industrial wastewater.(2003). Central Pollution Control Board, Ministry of Environment and Forests, Government of India, (pp.1-17).
- [5]. Crites,R.W.(1994). Design Criteria and practices for constructed wetlands, Water Science & Technology., 29(4),1-16.
- [6]. Devendra Kumar Patel & Kanungo, V.K.(2012).Treatment of domestic waste water by potential application of a submerged aquatic plant *Hydrilla verticillata* Cas. Recent Research Science and Technology 4(10), 56-61.
- [7].Gerald,R.S.,James,T.W.(1993).General Design,Construction,and Operation Guidelines: Constructed Wetlands Wastewater treatment Systems for Small Users Including Individual Residences, Design manual technical report series,Tennessee Valley Authority, Resource Group,Water Management, University of Virigenia, 65(2), 1-84.
- [8]. Hammer DA. Constructed wetlands for treatment of agricultural waste and urban stormwater. Chelsea, MI: Lewis Publishers, 1989
- [9]. Jan Vymazal, Lenka Kropfelova. (2011). A three-stage experimental constructed wetland for treatment of domestic sewage: First 2 years of operation, Elsevier Journal of Ecological Engineering 37 (1), 90-98.
- [10].Pendleton,C.H., Morris, J.W.F., Goldmund, H., Rozema L.R., Mallamo, M.S. &Agricola,L.(2005). Leachate treatment using vertical subsurface flow wetland systems – findings from two pilot studies, proceedings of Int. Waste Management & Landfill Symposium., (pp 1-10).
- [11]. Ram Prasad, C. (2012). Experimental study on waste water treatment using lab scale reed bed system using *Phragmites australis*, International journal of environment sciences 3(1), 297- 304.
- [12]. Reed SC, Middlebrooks EJ, Crites RW. Natural systems for waste management and treatment. New York, NY: McGraw-Hill, 1988.
- [13]. Standard Methods for the Examination of Water and Wastewater APHA, AWWA, and WPCF. 16th ed., 1992.
- [14]. Water Pollution Control Regulations. Turkish Official Newspaper, 4th September 1984.