IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 4, April 2026

DOI: 10.17148/IARJSET.2026.13458

Treatment of kitchen wastewater by Phytoremediation method by canna indica plant

Girishkumar.B.Marathe[1], Kalpesh.V.Amale[2], Pranav.P.Patil[3], Aniket .N.Patil[4], Harshal.V.Ghuge[5], Dr F I Chavan[6]

UG Scholar, Department Of Civil Engineering, SSBT's College Of Engineering And Technology Bambhori, Affiliated Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon - 425001 (Ms)[1-5]

Professor, Department Of Civil Engineering, SSBT's College Of Engineering And Technology Bambhori, Affiliated Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon - 425001 (Ms)[6]

Abstract: This report details a project focused on developing a sustainable, low-cost, and eco-friendly method for treating domestic kitchen wastewater using the principles of phytoremediation. Kitchen wastewater, a major component of household greywater, poses an environmental challenge due to its high concentration of organic matter, nutrients, and suspended solids, indicated by elevated Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Total Suspended Solids (TSS). Conventional treatment systems are often energy-intensive and cost-prohibitive for decentralized application.The core objective of this study was to evaluate the efficiency and suitability of the wetland plant, Canna indica (Indian Shot), as the primary phytoremediation agent. The project sought to analyze changes in key water quality parameters (PH, BOD, COD, and TSS) before and after treatment, and to develop a functional, low-cost treatment system.

1.INTRODUCTION

Background With rapid urbanization and population growth, wastewater management has become one of the major challenges in both urban and rural areas. Most households, commercial kitchens, restaurants, and small food-processing units generate large amounts of wastewater every day. This wastewater contains high levels of organic matter, oils, grease, detergents, suspended solids and sometimes even heavy metals. When it is discharged into natural water bodies without proper treatment, it leads to pollution, foul odor, eutrophication, and serious health concerns.Kitchen wastewater plays a significant role in degrading water quality because of its high organic load. Oil and grease from washing vessels and food preparation stick to the inner walls of pipelines, causing blockages and odour issues. When such wastewater reaches rivers, lakes, or groundwater systems, it dissolves easily and contributes to the deterioration of aquatic ecosystems. Excess organic matter promotes algal growth, reduces oxygen levels, and affects the survival of fish and other aquatic organisms.

Due to insufficient wastewater treatment systems in many developing regions, most of the domestic sewage remains untreated. Traditional treatment methods such as chemical precipitation, activated sludge process, and coagulation are effective but require high installation cost, skilled labour, electricity, and regular maintenance. These systems are generally designed for large urban communities and cannot be easily implemented in small towns or households.

To address these limitations, eco-friendly, low-cost and decentralized wastewater treatment methods are gaining popularity. Among them, phytoremediation—the use of plants to clean contaminated water—has emerged as a sustainable and natural alternative.

•Phytoremediation as a Sustainable SolutionPhytoremediation is a green technology that uses plants to remove, degrade, or stabilize contaminants from wastewater or polluted soil. It is based on natural processes where plant roots absorb pollutants and microorganisms around the roots help in breaking them down.This method is widely appreciated because it requires:

1. No heavy machinery
2. No chemicals
3. Low construction and maintenance cost
4. Minimum technical skill for operation

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 4, April 2026

DOI: 10.17148/IARJSET.2026.13458

Phytoremediation improves water quality through different mechanisms such as phytodegradation, rhizofiltration, phytoextraction, and phytostabilization. It also creates green spaces, enhances biodiversity, and provides aesthetic value to the surroundings.

2. LITERATURE REVIEW

2.1 Rutuji Rodge, Abhishek Kumar, Atharva Bondare, Vaishali P. Kesalkar (2023)

This study explains that wastewater contains many impurities and must be treated before reuse. Kitchen and canteen wastewater carries oil, grease, organic matter and other pollutants. Traditional methods are costly and need large land and skilled operation. The authors highlight phytoremediation as safe, natural and low-cost method to remove pollutants.They studied the potential of Canna indica for treating wastewater and analyzed parameters like BOD, COD, TDS, turbidity and pH. The results showed that Canna indica can absorb and reduce both organic and inorganic pollutants. The study recommends wider use of this plant due to its low cost, easy maintenance and good pollutant-removal efficiency

2.2 Asst. Prof. Kavita S. Kene, Chetana D. Dhore, Madhulika D. Dhore (2024)

The authors describe phytoremediation as a promising method for wastewater treatment. This work explains the basic principles of phytoremediation and how plants can clean different types of wastewater, including industrial, agricultural and domestic.The review discusses the factors affecting phytoremediation such as plant health, nutrient availability, retention time and type of pollutant. The study also explains the advantages like low cost, environmental friendliness and simple operation. Limitations such as slow treatment rate and plant-specific performance are also mentioned.

2.3 Priya D. Patil (2022)

This paper focuses on the increasing contamination of land and water systems due to human activities. It explains that phytoremediation is becoming widely used because it is inexpensive and requires less equipment compared to conventional treatment.The study tested the phytoremediation capacity of Canna indica for kitchen wastewater. The wastewater was treated for 10 days and analyzed for physical and chemical properties. The results showed improvements in pH, turbidity, solid content and other parameters. The plant performed well and reduced pollutants effectively.The study concludes that Canna indica is suitable for cleaning kitchen wastewater at household

3. MATERIALS USED IN THE 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) Soil
9) Gravels
10) Canna Indica plant

4 .METHODOLOGY

The methodology describes the step-by-step procedure used to carry out the project. It explains how the wastewater sample was collected, how the plant system was prepared, how tests were conducted.

Collection of Kitchen Wastewater Kitchen wastewater was collected from a household kitchen where daily activities such as washing utensils, cleaning vegetables, and cooking took place. This wastewater generally contained soap, oil, food particles, suspended solids and organic matter.The water was collected in a clean container to avoid outside contamination. The sample was stored for a short time to keep its natural properties unchanged. Initial Testing of Wastewater (Before Treatment)

Before starting the treatment, the raw wastewater was tested to understand its pollution level. Basic water-quality parameters such as pH, turbidity, total dissolved solids (TDS), biological oxygen demand (BOD), chemical oxygen demand (COD) and oil-grease content were measured.This helped in understanding how acidic or alkaline the water was, how cloudy it appeared, and how much organic load it contained. These initial values acted as the baseline for the whole experiment. Later, after treatment, these results were compared to evaluate the improvement.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 4, April 2026

DOI: 10.17148/IARJSET.2026.13458

Selection of Canna indica Plant –

Canna indica was selected because it is widely available, grows quickly, and has a strong root system suitable for wastewater treatment. The plant can absorb nutrients like nitrogen and phosphorus, and its roots allow microorganisms to grow around them, which helps break down pollutants

Preparation of the Phytoremediation Setup -

A simple container-based setup was prepared to mimic a small wetland system. The container was filled with layers of gravel, sand and soil. These layers helped in supporting the plant and provided additional filtration during treatment Canna indica plants were placed in the middle of the container in such a way that the roots remained fully submerged. The setup was kept in a well-lit area because sunlight supports plant growth and also helps microorganisms become active.

Introduction of Wastewater into the Setup –

Raw kitchen wastewater was carefully poured into the planted container The wastewater covered the root region completely so that maximum contact occurred between pollutants and the plant root zone. The wastewater remained inside the container for a specified period known as "retention time." This is the time required for the water to interact with plant roots and microorganisms so that pollutants start breaking down. A longer retention time usually results in better treatment.

Monitoring During Treatment –

During the treatment period, the condition of the plant, water level, color and smell of wastewater were observed regularly. The health of the plant was important because a healthy plant absorbs more pollutants. The growth of microorganisms in the root zone was monitored indirectly through changes inwater clarity and smell. If the plant remained stable and continued growing, it indicated thatthe phytoremediation process was working properly. Observations were noted daily to understand how the plant reacted to the wastewater.

5. RESULTS

Parameter	Raw Kitchen Wastewater	Cannindica Treated Water
Ph @25°C	8.56	8.14
Turbidity	5	3
Dissolved Oxygen	2.2	4.1
Chemical Oxygen Demand	165	95
Bio-Chemical Oxygen Demand	26	14

Observations:

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 4, April 2026

DOI: 10.17148/IARJSET.2026.13458

- pH slightly reduced, staying within safe limits.
- Turbidity dropped by 50%, indicating improved water clarity.
- Dissolved Oxygen (DO) doubled from 2.0 to 4.0 mg/l, a positive sign of oxygenation.
- COD was reduced by over 42%, showcasing efficient organic load reduction.
- BOD halved, further validating the treatment's efficacy in removing biodegradable waste.

6. CONCLUSIONS

This project demonstrated that phytoremediation using Canna indica is an effective and eco-friendly method for treating kitchen wastewater. The initial testing of raw wastewater showed the presence of pollutants such as suspended solids, organic matter, oil and grease, and variations in pH, turbidity, BOD, COD, and TDS levels.
After treatment through the container-based wetland setup, noticeable improvements were observed in water quality. The reduction in turbidity, odor, and organic load indicated that the plant roots and associated microorganisms played a significant role in filtering and breaking down contaminants. The retention time allowed sufficient interaction between wastewater, plant roots, and microbial activity, leading to better purification results. Canna indica proved to be a suitable plant for phytoremediation due to its strong root system, adaptability to wet conditions, and ability to absorb nutrients like nitrogen and phosphorus. The experiment confirmed that a simple, low-cost setup can effectively treat household wastewater at a small scale.

REFERENCES

[1]. Chandra, R., Yadav, S., Mohan, D., & Samadder, S. R. (2016). Phytoremediation of wastewater: a review. Journal of environmental management, 182, 351-366.Dhivya Balamoorthy1

[2]. Prabu Velusamy2, Badrinarayan Rath3, Praveenkumar

[3]. Julla Kabeto1(2022)," Removal of heavy metals from waste water by using phytoremediation technology", Journal of Civil Engineering, Science and Technology Volume 13, Issue 1, April 2022, 23-32, DOI: 10.33736/jcest.4473.2022.

[4]. Huang, J. Y., & Zhang, J. (2018). Phytoremediation of domestic wastewater by water hyacinth in floating bed system. Journal of Cleaner Production, 196, 1565-1572.

[5]. Kaul, S., & Khanna, M. (2019). Kitchen wastewater treatment through phytoremediation using Canna indica. Journal of Environmental Chemical Engineering, 7(1), 102837.

[6]. K. Sri Lakshmi, V. Hema Sailaja and M. Anji Reddy (2017)," Phytoremediation –

[7]. Promising Technique in Waste Water Treatment", International Journal of Scientific Research and Management (IJSRM).

[8]. Neharika S. Chandekar and Buddharatna J. Godboley, "Use of Phytoremediation for the Treatment of Kitchen Wastewater", International Journal of Science and Research (IJSR) January 2015, ISSN (Online): 2319-7064.