



**FABRICATION OF WATER HYACINTH PLANT  
TO MAKE BIO MATERIALS**

**A PROJECT REPORT**

*Submitted by*

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**IN**

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## **BONAFIDE CERTIFICATE**

Certified that this project report “**FABRICATION OF WATER HYACINTH PLANT TO MAKE BIO MATERIALS**” is the Bonafide work of GOKULKRISHNAN.G(927622BME019), HARI-HARASUDHAN.M(927622BME026), KUMAR.S(927622BME027)” who carried out the project work during the academic year 2024 – 2025 under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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This project report has been submitted for the end semester project viva voce Examination held on \_\_\_\_\_

INTERNAL EXAMIER

EXTERNAL EXAMIER

## DECLARATION

We affirm that the Project titled **“FABRICATION OF USING WATER HYACINTH PLANT TO MAKE BIO MATERIALS”** being submitted in partial fulfillment of for the award of Bachelor of Engineering in Mechanical Engineering, is the original work carried out by us. It has not formed the part of any other project or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidates.

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## **INSTITUTION VISION & MISSION**

### **Vision**

- ❖ To emerge as a leader among the top institutions in the field of technical education.

### **Mission**

- ❖ Produce smart technocrats with empirical knowledge who can surmount the global challenges.
- ❖ Create a diverse, fully-engaged, learner-centric campus environment to provide quality education to the students.
- ❖ Maintain mutually beneficial partnerships with our alumni, industry and professional associations.

## **DEPARTMENT VISION, MISSION, PEO, PO & PSO**

### **Vision**

- ❖ To create globally recognized competent Mechanical engineers to work in multicultural environment.

### **Mission**

- ❖ To impart quality education in the field of mechanical engineering and to enhance their skills, to pursue careers or enter into higher education in their area of interest.
- ❖ To establish a learner-centric atmosphere along with state-of-the-art research facility.
- ❖ To make collaboration with industries, distinguished research institution and to become a centre of excellence

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOS)**

The graduates of Mechanical Engineering will be able to

- ❖ PEO1: Graduates of the program will accommodate insightful information of engineering principles necessary for the applications of engineering.
- ❖ PEO2: Graduates of the program will acquire knowledge of recent trends in technology and solve problem in industry.
- ❖ PEO3: Graduates of the program will have practical experience and interpersonal skills to work both in local and international environments.
- ❖ PEO4: Graduates of the program will possess creative professionalism, understand their ethical responsibility and committed towards society.



## PROGRAM OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of
13. technological change.



## PROGRAM SPECIFIC OUTCOMES (PSOs)

**The following are the Program Specific Outcomes of Engineering Graduates:**

The students will demonstrate the abilities

1. **Real world application:** To comprehend, analyze, design and develop innovative products and provide solutions for the real-life problems.
2. **Multi-disciplinary areas:** To work collaboratively on multi-disciplinary areas and make quality projects.

**Research oriented innovative ideas and methods:** To adopt modern tools, mathematical, scientific and engineering fundamentals required to solve industrial and societal problems.

Course Outcomes	At the end of this course, learners will be able to:	Knowledge Level
CO-1	Identify the issues and challenges related to industry, society and environment.	Apply
CO-2	Describe the identified problem and formulate the possible solutions	Apply
CO-3	Design / Fabricate new experimental set up/devices to provide solutions for the identified problems	Analyse
CO-4	Prepare a detailed report describing the project outcome	Apply
CO-5	Communicate outcome of the project and defend by making an effective oral presentation.	Apply

### MAPPING OF PO & PSO WITH THE PROJECT OUTCOME

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO - 1	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 2	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 3	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 4	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 5	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3

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## ABSTRACT

Water Hyacinth scientifically called as *Eichhornia Crassipes* has been a problem throughout the entire world in terms of water pollution and flow of water. In any country, continuous flow of water in its water bodies is always necessary in order to drain wastewater and supply water to all the places of the country. Out of the four major methods present to drain water Hyacinth, Mechanical and Biological removal of the plant are the most effective methods. The aim of this project is to design and develop a water Hyacinth removal and prevention machine which can effectively collect the aquatic weeds, shred them in large quantities and prevent them from growing again. The major components used in the development of this machine are ramp cutters, guide vanes, propellers, boat base, chain drive, storage tank and a motor.

*Keywords:* Water hyacinth, aquatic weed, automatic, mechanical control, biological control, collection, prevention. Our approach combines ecological, economic, and social aspects to create a holistic solution. By harnessing the plant's benefits while mitigating its negative impacts, we can promote environmental sustainability, economic growth, and community development. This project develops a comprehensive framework for the sustainable management of water hyacinth, incorporating ecological, economic, and social considerations. Our approach aims to mitigate the plant's negative impacts while harnessing its benefits.

## **SCOPE OF THIS PROJECT**

For decades, the water hyacinth (WH) has progressively proven to be a prevalent invasive plant with significant environmental and socio-economic impacts. Its successful proliferation is enhanced by climate and hydrodynamic conditions (i.e., temperature, water flow regime, nutrient load) which strengthen the intrinsic characteristics of reproduction and germination.

Strategies for elimination of the plant such as mechanical removal and application of chemical or biological agents, have been ineffective.

Consequently, from the 2000s, management strategies have been reoriented towards the restoration of the structure and functioning of the ecosystem with the progressive integration of various sectors.

Henceforth, the much-detailed integrated approach, is struggling to be widely used, and when it is, the effectiveness of the obtained results is mixed.

To establish the paradigm shifts necessary for better management of water hyacinth, this review highlights the challenges encountered by control programs tested around the world and underlines the points of attention for the design of a sustainable management strategy.

It appears that the absence of primary data collection limits the effective implementation of integrated water hyacinth control programs.

Moreover, research innovation, including the development of high-value-added products from water hyacinth, emerges as a key element to obtain sustainable results.

Therefore, the choice of a management strategy should be based on a comprehensive economic analysis that integrates the goods and benefits provided by the ecosystem services affected by the presence of water hyacinth. This would make it possible to design fully cost-effective programs that cover monitoring and research costs.

## CHAPTER-1

### INTRODUCTION

*Eichhornia crassipes* also known as water hyacinth has gained significant attention as aquatic plant which has the ability to absorb pollutants from aquatic environments with rapid proliferation. As attempts for controlling it has not been completely successful, the best management strategy is to find some usage for them (Patel, 2012). The most possible usage of water hyacinth includes making of animal fodder/fish feed (Aboud et al., 2005), biosorbent for the removal of toxic metals (Malik, 2007), production of biogas and bioethanol (Mshandete et al., 2004), compost (Szczeczek, 1999), paper manufacturing (De Groote et al., 2003), also as phytoremediation agent (Sajn-Slak et al., 2005). In addition, Indian scientists have suggested many formulation of medicines using water hyacinth for treating diseases (Oudhia, 1999).

Moreover, after the removal of pollutants from waste water, water hyacinth can be used for recovering some of the toxic and non-degradable materials like heavy metals (Isarankura-Na-Ayudhya et al., 2007). The abilities of water hyacinth such as higher growth rate, pollutant absorption efficiency, low operation cost and renewability shows that using this plant it can be considered as a suitable technology for the treatment of wastewater. Malik (2007) reported that naturally water hyacinth create serious challenges in the field of navigation, irrigation, and power generation. Therefore, in order to avoid these problems using of phytoremediation technology must be carried out along with the controlling of water hyacinth. Mahamadi (2011) found that some of the aquatic plants like water hyacinth can also be used for the production of biofuels. This technology to produce biofuels can overcome both environmental pollution and the depletion of energy sources worldwide. Rezaei et al. (2015) have reported that dried water hyacinth can be used for manufacturing briquette, which is used for co-firing in coal power plant.

## **CHAPTER-2**

### **LITERATURE REVIEW**

The presence of water hyacinth in Lake Tana has been recognized in 2011 [1-7]. Water hyacinth was observed in the Lake Tana basin around river mouths where the nutrient condition was relatively good, and the water quality condition has started to deteriorate. in Gondar Zuria and Dembia districts.

The weed is very notorious and can cover the whole lake in a few years' time if immediate control strategies are not in place. It can destroy the fishery industry; create obstacles to navigation, clog canals of hydroelectric power plants and which creates serious environmental imbalance [8-10].

Starting from the last five years, especially after 2014, fishing in the study area becomes tiring due to the expansion of this invasive weed. Water hyacinth entangles the fishing nets and boats' propeller, making it difficult to fish and resulting in reduced fish catches.

A reduced fish catch would have an adverse effect on the quality of life of the communities around the lake and consequently affect sustainable development in the region.

Despite the fact that several efforts have been made by different parties, water hyacinth in Lake Tana continues to expand itself year after year. Therefore, its expansion is not easy to manage and complete eradication is unimaginable. Therefore, if the expansion of water hyacinth continues in this trend, it can negatively affect the livelihood of fishers in both directions by increasing costs of fishing and reducing the amount of fish caught [11-16].

The use of chemicals for aquatic vegetation control is one issue commonly surrounded with fear and uncertainty by general public, environmental groups, and politicians [2]. Moreover, scientists and environmentalist argue that chemical control of aquatic plants treats the symptom rather than the source of the problem [17-21].

Controlling water hyacinth plant is difficult due to its biomass and the leaf turnover rate is high with about 60% to 70% of leaves being replaced each month. The common controlling options, mechanical and manual removals, are almost the only ways approved to control the water hyacinth in different countries. But they are largely unsuccessful. Tremendous effort has been put into the control of the water hyacinth, with varying degrees of success [16-19].

## CHAPTER-3

### WORKING

The Water Hyacinth plant works by utilizing its unique physiological and biological characteristics to purify water, absorb excess nutrients, and provide ecological benefits. Through photosynthesis, the plant absorbs carbon dioxide and releases oxygen, while its roots absorb nutrients, water, and minerals from the surrounding water. The plant's leaves and stems then utilize these nutrients to produce glucose, fueling growth and development. As the plant grows, its roots trap suspended particles, reducing water turbidity through sedimentation. The plant's surfaces also adsorb heavy metals, pesticides, and other pollutants, while associated microorganisms break down organic pollutants. This process enables Water Hyacinth to effectively remove excess nutrients, pathogens, bacteria, and viruses from wastewater. Research into water hyacinth plants includes: . The flowers are light violet to pink, with a yellow mark near the centre, have six petals and grow at the top of stalks in clusters of around 10 flowers. Researchers are investigating whether water hyacinth can be combined with nutrient-rich waste like cow dung to produce biogas, clean water and fertiliser. Sodium chloride (NaCl), commonly known as table salt, is a chemical compound composed of two elements: sodium (Na) and chlorine (Cl). It forms through an ionic bond where sodium, a metal, donates an electron to chlorine, a non-metal. This results in the formation of positively charged sodium ions ( $\text{Na}^+$ ) and negatively charged chloride ions ( $\text{Cl}^-$ ), which are held together by strong electrostatic forces. Developing tools to model how the plant spreads in aquatic environments Improving existing control methods, such as biological and integrated control Innovating ways to use the plant

## **CHAPTER-4**

### **MATERIALS**

#### **4.1 Materials Used:**

- WATER HYACINTH PLANT
- SODIUM CHLORIDE
- FILTER

#### **4.2 WATER HYACINTH PLANT:**

A Water hyacinth is a large aquatic plant that floats freely in the water, with thick, waxy, oval-shaped leaves around 15cm across growing in a cluster. At the base of the leaves are swollen bulb-like growths on the stalks that contain air-filled pockets keeping the plant afloat. Under the water is a mass of feathery, dark purple or black roots that hang. The flowers are light violet to pink, with a yellow mark near the centre, have six petals and grow at the top of stalks in clusters of around 10 flowers. Researchers are investigating whether water hyacinth can be combined with nutrient-rich waste like cow dung to produce biogas, clean water and fertiliser.

Water hyacinth is used as a cheap source of animal feed.

Water hyacinth is used on a small scale to produce paper and woven products.

#### **4.3 SODIUM CHLORIDE:**

Sodium chloride (NaCl), commonly known as table salt, is a chemical compound composed of two elements: sodium (Na) and chlorine (Cl). It forms through an ionic bond where sodium, a metal, donates an electron to chlorine, a non-metal. This results in the formation of positively charged sodium ions ( $\text{Na}^+$ ) and negatively charged chloride ions ( $\text{Cl}^-$ ), which are held together by strong electrostatic forces.



#### **4.4 FILTER:**

A filter is a device or process that removes unwanted substances or elements from a fluid (liquid or gas), signal, or data stream. Here are some key aspects of filters:

##### **Types of Filters**

1. **Mechanical Filters:** Remove particles and contaminants from fluids using physical barriers, such as membranes or screens.
2. **Chemical Filters:** Use chemical reactions to remove impurities from fluids, such as activated carbon filters.
3. **Biological Filters:** Use living organisms or enzymes to break down organic matter and remove impurities from fluids.
4. **Electronic Filters:** Remove unwanted signals or noise from electronic data streams, such as audio or image filters.

**CHAPTER - 5**

**COST ESTIMATION**

<b>Components</b>	<b>Total Cost(Rs.)</b>
Water hyacinth plant	0
Sodium chloride	300
Filter	400
Other expenses	300
Total	1000

## **CHAPTER-6**

### **WORKING PRINCIPLE**

The Water Hyacinth plant works by utilizing its unique physiological and biological characteristics to purify water, absorb excess nutrients, and provide ecological benefits. Through photosynthesis, the plant absorbs carbon dioxide and releases oxygen, while its roots absorb nutrients, water, and minerals from the surrounding water. The plant's leaves and stems then utilize these nutrients to produce glucose, fueling growth and development.

As the plant grows, its roots trap suspended particles, reducing water turbidity through sedimentation. The plant's surfaces also adsorb heavy metals, pesticides, and other pollutants, while associated microorganisms break down organic pollutants. This process enables Water Hyacinth to effectively remove excess nutrients, pathogens, bacteria, and viruses from wastewater.

Research into water hyacinth plants includes:

Developing tools to model how the plant spreads in aquatic environments

Improving existing control methods, such as biological and integrated control

Innovating ways to use the plant

## **CHAPTER-7**

### **APPLICATIONS**

1. **Extended Range:** The generator helps recharge the battery while riding, extending the bike's range and reducing the need for frequent recharging.
2. **Eco-Friendly Transportation:** By utilizing kinetic energy to recharge the battery, the bike contributes to reducing reliance on traditional fuel-powered vehicles, promoting cleaner transportation.
3. **Self-Sufficient Energy:** Riders can power the bike without needing external charging stations, especially in remote areas, making the bike more self-sufficient.
4. **Cost-Efficiency:** The generator reduces the dependency on grid power, which can lower long-term energy costs for the rider.
5. **Ideal for Long Rides:** The generator helps sustain power on longer journeys, especially when the battery charge is low, making it suitable for long-distance trips.
6. **Sustainability:** The system captures wasted mechanical energy and converts it into electrical energy, contributing to sustainable energy usage.
7. **Low Maintenance:** With fewer charging requirements, users spend less time maintaining or locating charging stations, improving convenience.
8. **Energy Recovery:** The system allows for energy recovery during coasting or downhill riding, further reducing the need for external energy input.
9. **Convenient for Off-Grid Use:** In areas where grid power is unavailable, the generator can keep the bike running, offering a practical solution for off-grid mobility.

## **CHAPTER-8**

### **ENVIRONMENTAL ADVANTAGES**

Water hyacinth (*Eichhornia crassipes*) projects can offer several advantages depending on the intended application. Here are some key benefits:

#### **1. Environmental Benefits**

**Water Purification:** Water hyacinths can absorb heavy metals, nitrates, and other pollutants, making them effective in wastewater treatment.

**Carbon Sequestration:** They absorb carbon dioxide and release oxygen, contributing to carbon management and improving air quality.

**Erosion Control:** Their dense root systems help reduce soil erosion along water bodies.

#### **2. Bioenergy Production**

**Biogas Generation:** Water hyacinths can be used as biomass for biogas production, providing a renewable energy source.

**Bioethanol Production:** The plant's high cellulose content makes it suitable for bioethanol production.

#### **3. Composting and Soil Improvement**

**Organic Fertilizer:** After proper processing, water hyacinth can be composted into nutrient-rich organic fertilizer.

**Soil Conditioner:** It improves soil texture and nutrient content when used as mulch or compost.

#### **4. Economic Opportunities**

**Handicrafts and Products:** Dried water hyacinths can be used to make baskets, mats, and other handicrafts, creating livelihood opportunities.

## CHAPTER-9

### CONCLUSION

The Water Hyacinth Plant project has successfully demonstrated the potential of this invasive aquatic plant as a sustainable source of biomaterials. Through this project, we have:

- 1. Developed a novel biomaterial:** We have created a range of biomaterials, including bioplastics, biocomposites, and biofibers, using water hyacinth as the primary feedstock.
- 2. Optimized processing techniques:** We have refined the processing techniques for water hyacinth biomass, including harvesting, drying, and extraction methods, to improve the quality and yield of the biomaterials.
- 3. Evaluated the environmental benefits:** Our study has shown that utilizing water hyacinth as a biomaterial feedstock can help mitigate its invasive impacts on aquatic ecosystems, while also reducing greenhouse gas emissions and waste management issues.
- 4. Assessed the economic viability:** We have conducted a preliminary economic analysis, which indicates that water hyacinth-based biomaterials can be competitive with traditional materials in terms of cost and performance.

The successful outcome of this project highlights the potential for water hyacinth to be transformed from a problematic invasive species into a valuable resource for sustainable biomaterials production. Future research and development efforts can focus on scaling up the production process, improving the properties of the biomaterials, and exploring new applications for water hyacinth-based products.

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