MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

VIDYAVARDHINI'S BHAUSAHEB VARTAK POLYTECHNIC

MICRO PROJECT

Academic year: 2024-2025

Title of Micro Project:

Bioenergy from Agricultural Waste

Program/Code: Computer Engineering (CO-2) **Semester:** FIFTH

Course/Code: Environmental Studies(22447)

Name: **Roll No:**

Enrollment No.:

Name of Faculty: Mr. Anuraag Rathod

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

Certificate

This is to certify that Mr./Ms.………………………………………………………

Roll No…………… of **Fifth** Semester of Diploma in **Computer Engineering- I (CO-II)** of Institute, B.V. POLYTECHNIC (Code: **0093**) has completed the **Micro-Project** satisfactorily in **Subject– Environmental Studies (22447)** for the academic year 2024- 2025 as prescribed in the curriculum.

Place: Vasai **Enrollment No: ……………………………………**

Date: ……………………… **Exam. Seat No: …………………………………….**

Subject Teacher **Head of the Department** **Principal**

Seal Of
Institution

Annexure - I

Part A: Micro Project Proposal

1.0 Aim/Benefits of the Micro-Project:

The aim of **environmental studies** is to understand the interactions between human activities and the natural environment, promoting sustainable practices. It seeks to raise awareness and develop solutions to environmental challenges for future generations.

2.0 Course Outcomes integrated:

1. Develop critical thinking to analyze and address environmental issues effectively.
2. Gain interdisciplinary knowledge of ecology, social sciences, and policy-making.
3. Acquire practical skills for implementing sustainable practices in diverse contexts.
4. Foster awareness and advocacy for environmental protection and stewardship.

3.0 Proposed Methodology:

1. Literature survey.
2. Collect information through different sources.
3. Analysis of data.
4. Compilation of collected data.

4.0 Action Plan

Sr. No.	Details of the activity	Planned Start date	Planned Finish date	Name of Members
1	Formation of Group & Topic Selection			All members
2	Submission of Proposed Plan			All members
3	Preparation of Report			All members
4	Final valuation of a working Report			All members
5	Presentation of Report			All members
6	Submission of Final Report			All members

5.0 Resource Required:

Sr. No.	Name of resources/Material	Specifications	Qty	Remarks
1.	Computer	Processor: i3 RAM : 4.00 GB	**1**	
2.	Microsoft Word	Word -2016	**1**	
3.	Printer	Hp Laser Jet	**1**	
4.	Book/ website name	https://www.academia.edu	**1**	

6.0 Name of Team Members with Roll No:

Sr. No.	Roll No	Name of Students	Process and Product assessment (06)	Individual Presentation (04)	Total (10)
01	1932	Bethan R. D'mello			
02	1933	Cian K. Fonseca			
03	1942	Neelay K. Joshi			

Name & Signature of Faculty: Mr. Anuraag Rathod

Annexure- II
Final Micro Project Report

Title: Bioenergy from Agricultural Waste

1.0 Rationale The Evironmental studies is essential for understanding and addressing the complex challenges posed by human impact on ecosystems, promoting sustainability and responsible resource management. It equips individuals with the knowledge and skills needed to advocate for and implement solutions to protect the environment for future generations.

2.0 Course Outcomes Integrated:

1.Develop critical thinking to analyze and address environmental issues effectively.
2.Gain interdisciplinary knowledge of ecology, social sciences, and policy-making.
3.Acquire practical skills for implementing sustainable practices in diverse contexts.
4.Foster awareness and advocacy for environmental protection and stewardship.

3.0 Actual Procedure Followed.

1 Discussion about topic with guide and among group members.
2 Literature survey.
3 Information collection.
4 Compilation of content.
5 Editing and revising content.
6 Report Preparation.

4.0 Actual Resources Required:

Sr. No.	Name of resources/Material	Specifications	Qty	Remarks
1.	Computer	Processor: i3 RAM : 4.00 GB	1	
2.	Microsoft Word	Word -2016	1	
3.	Printer	Hp Laser Jet	1	
4.	Book/Site name	https://www.academia.edu	1	

5.0 Skill Developed/Learning outcomes of this Micro-Project

The following skills were developed:

1. **Teamwork:** Learned to work in a team and boost individual confidence.
2. **Problem-Solving:** Developed good problem solving habits.
3. **Technical Writing:** Preparing the report of proposed plan and the final report.

Annexure - III
Rubrics for Assessment of Micro-Project

Title: Bioenergy from Agricultural Waste.

Institute Code: 0093

Academic year: 2024-25

Program: CO-5-I

Course & Code: EST (22447)

Name of Candidate:

Roll No:

Semester: Fifth

Name of Faculty: Mr. Anuraag Rathod

Sr. No.	Characteristic to be Assessed	Poor (Marks 1-3)	Average (Marks 4-5)	Good (Marks 6-8)	Excellent (Marks 9-10)
1.	Relevance to the Course				
2.	Literature Survey/Information Collection				
3.	Project Proposal				
4.	Completion of the Target as per Project Proposal				
5.	Analysis of Data and Representation				
6.	Quality of Prototype/Model				
7.	Report Preparation				
8.	Presentation				
9.	Viva				

Annexure IV
Micro-Project Evaluation Sheet

Title: Bioenergy from Agricultural Waste.

Institute Code: 0093
Academic year: 2024-25
Program: CO-5-I
Course & Code: EST (22447)
Name of Candidate:
Roll No:
Semester: Fifth
Name of Faculty: Mr. Anuraag Rathod

Course Outcomes Achieved:

1. Enhanced ability to analyze and propose solutions to complex environmental issues.
2. Improved skills in advocacy and collaboration for environmental protection initiatives..

Evaluation as per Suggested Rubric for Assessment of Micro Project:

Sr. No.	Characteristic to be assessed	Poor Marks 1-3	Average Marks 4-5	Good Marks 6-8	Excellent Marks 9-10	Sub Total
(A) Process and product assessment Out Of 6						
1	Relevance to the course					
2	Literature Survey Information Collection					
3	Completion of the Target as per project proposal					
4	Analysis of Data and representation					
5	Quality of Prototype/ Model/Content					
6	Report Preparation					
(B) Individual Presentation/Viva Out of 4						
7	Presentation					
8	Viva					

Name and designation of the Faculty Member: Mr.Anuraag Rathod.

Weekly Activity Sheet

Topic: Bioenergy from Agricultural Waste.

Institute Code: 0093

Academic year: 2024-2025

Program: CO-II

Course & Code: EST (22447)

Name of Candidate:

Roll No:

Semester: Fifth

Name of Faculty: Mr. Anuraag Rathod

SR. NO	WEEK	ACTIVITY PERFORMED
1.	1st Week	Discussion and Finalization of Topic
2.	2nd Week	Literature Review
3.	3rd Week	Submission of Proposed Plan
4	4th Week	Information Collection
5.	5th Week	Analysis of Data
6.	6th Week	Compilation of content
7.	7th Week	Editing and Revising the Content
8.	8th Week	Report Preparation
9.	9th Week	Report Preparation
10.	10th- 12th Week	Presentation

Signature of Student

Dated Signature of Faculty

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ACKNOWLEDGEMENT

We would like to express our special thanks or gratitude to our professor Mr. Anuraag Rathod for guiding and supporting us in completing the microproject. His advices helped us tremendously all the time. We are deeply indebted to him as without his constructive feedback this project would not have been a success.

Also, profound gratitude towards all the group members, as without their kind support it would not have been possible for completion of this microproject. We could learn a lot of things through this microproject. Once again, we thank all those who have encouraged and helped us in preparing this microproject.

TITLE: BIOENERGY FROM AGRICULTURAL WASTE

This document explores the potential of bioenergy derived from agricultural waste, emphasizing its significance in sustainable energy solutions. The focus is on innovative methods to convert agricultural residues into biofuels, highlighting the environmental and economic benefits. Through this exploration, we aim to contribute to the ongoing discourse on renewable energy resources and their application in addressing global energy challenges.

Key Points:

1. **Types of Agricultural Waste**: Overview of common agricultural residues such as straw, husks, and animal manure.
2. **Conversion Technologies**: Examination of methods to convert waste into bioenergy, including anaerobic digestion, combustion, and gasification.
3. **Environmental Benefits**: Discussion on the reduction of greenhouse gas emissions and enhancement of soil health through waste recycling.
4. **Economic Viability**: Analysis of the economic benefits, including job creation and energy cost savings for farmers and communities.
5. **Case Studies**: Examples of successful bioenergy projects utilizing agricultural waste across different regions.

ABSTRACT

This document presents a comprehensive analysis of bioenergy generation from agricultural waste, aiming to underscore its role in promoting sustainable energy solutions. The primary purpose of the study is to evaluate various methodologies for converting agricultural residues into viable biofuels, thereby contributing to the discourse on renewable energy resources. The research employs a mixed-methods approach, incorporating both qualitative and quantitative analyses to assess the efficiency and viability of different conversion techniques, such as anaerobic digestion, gasification, and fermentation.

Key findings reveal that agricultural waste, which includes materials such as crop residues, livestock manure, and agro-industrial by-products, possesses significant potential as a feedstock for bioenergy production. The study identifies that anaerobic digestion is particularly effective in converting organic waste into biogas, while gasification offers a promising route for producing synthetic fuels. Furthermore, the research highlights the economic advantages of utilizing agricultural waste, including the generation of additional revenue streams for farmers.

The document concludes that harnessing bioenergy from agricultural waste not only addresses waste management challenges but also contributes to reducing greenhouse gas emissions and enhancing energy security. It emphasizes the need for policy support and investment in technological advancements to optimize bioenergy production processes. Overall, the findings advocate for a shift towards integrating agricultural waste into the energy sector as a sustainable pathway to mitigate climate change and promote economic resilience in rural communities

INTRODUCTION

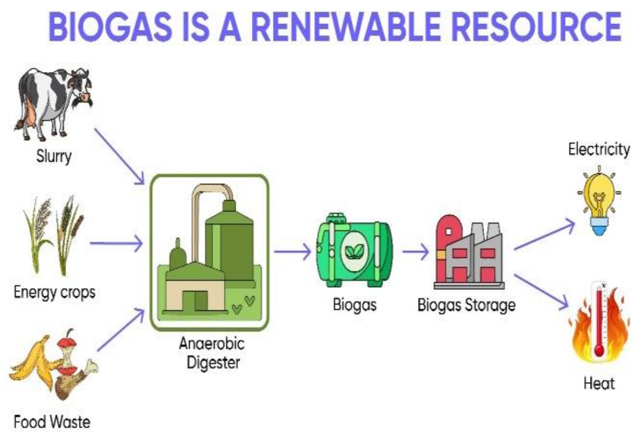
The worldwide trend in energy production is moving toward circular economy systems and sustainable availability of sources. As a result of rapid innovation in the utilization of agro waste for biomass-derived bioenergy, a comprehensive overview of the thrilling highlights and necessary advancements, in addition to a detailed analysis of feedstock, characterization, bioconversion, and contemporary pre-treatment procedures, appear to be vital. To this end, the current status in the generation of bioenergy from agro biomass through various pre-treatment procedures was examined in this study, along with presenting relevant challenges and a perspective for future investigations.

The socio-economic importance of utilizing agricultural waste for bioenergy production is multi-faceted. This approach can enhance the economic viability of rural communities, as farmers can generate additional income by converting waste into biofuels or biogas. This dual benefit of waste reduction and income generation contributes to the overall resilience and sustainability of agricultural systems. Moreover, bioenergy production can create jobs in rural areas, ranging from feedstock collection and processing to transportation and technology development.

The primary objectives of this study are to evaluate the potential of various agricultural waste materials for bioenergy production. This research is significant as it not only aims to fill the existing knowledge gap regarding agricultural waste utilization but also seeks to inform policymakers and stakeholders about the benefits and challenges associated with bioenergy production. By highlighting the relevance of agricultural waste in the bioenergy sector, this study aspires to contribute to the transition towards a more sustainable and economically viable energy future.

METHODOLOGY

1] Input Materials:



Slurry

- Waste from livestock (manure, for example) is collected.

Energy Crops

- Crops specifically grown to be used as biomass for energy production, such as grass, maize, or other organic plant material.

Food Waste

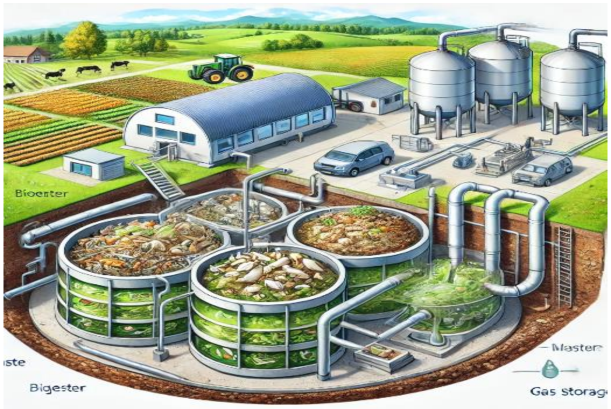
- Organic waste from kitchens, restaurants, and other food industries is also used as feedstock.

2] Anaerobic Digester:

- All the organic waste materials (slurry, energy crops, and food waste) are fed into an anaerobic digester. This is a closed container where anaerobic bacteria (which live without oxygen) break down the organic material.

- The digestion process produces biogas, a mixture mainly consisting of methane (CH4) and carbon dioxide (CO2), along with other gases.

3] Biogas Collection:

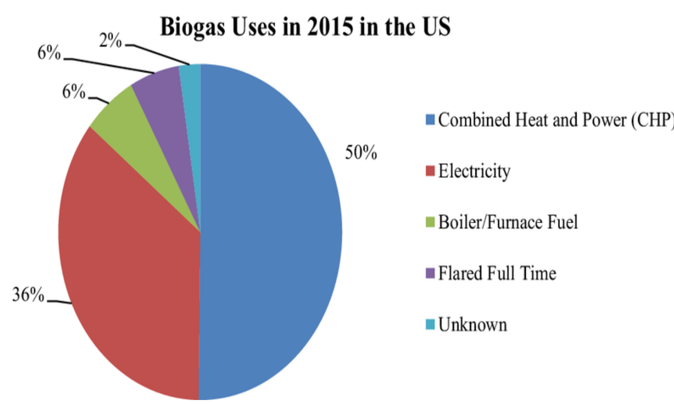


- The biogas produced in the digester is collected and can be stored for later use. This storage unit helps in regulating the supply of biogas based on demand.

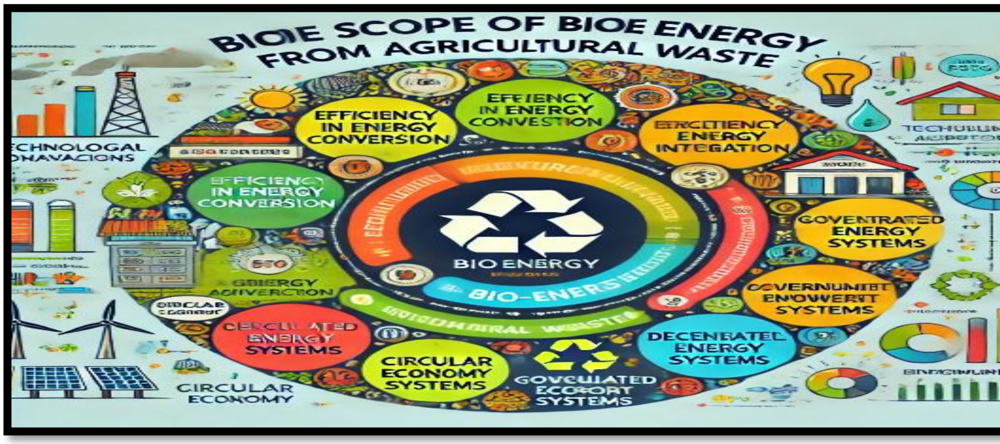
- This process not only helps manage waste effectively but also promotes energy self-sufficiency and supports environmental conservation efforts.

4] Biogas Utilization:

- The stored biogas is used to generate energy in two main forms:
    - **Electricity:** Biogas can be burned to power generators that produce electricity.
    -
    - **Heat:** Biogas can also be directly used for heating purposes in industries, homes, or agriculture.



RESULTS/FINDINGS



The results of this study provide a comprehensive overview of the bioenergy potential from various types of agricultural waste, highlighting the efficiency and viability of different conversion methods. The data which summarize the quantities of bioenergy produced and the specific yields associated with each type of waste.

Bioenergy Yields

The analysis revealed that anaerobic digestion of livestock manure yielded the highest biogas production, averaging approximately 600 m^3 of biogas per ton of manure processed. In contrast, crop residues such as wheat straw and corn stover produced significantly lower biogas yields, around 250 m^3 per ton. Graph 1 below illustrates the comparative biogas production from different agricultural wastes.

Conversion Efficiency

Gasification proved to be another effective method, particularly for woody biomass and agro-industrial by-products. The experiments indicated that sugarcane bagasse resulted in a syngas yield of about 200 Nm^3 per ton, showcasing its potential as a feedstock for synthetic fuel production. Table 1 presents a summary of the energy yields from various conversion techniques, emphasizing the differences in efficiency based on the type of agricultural waste used.

Conversion Method	Feedstock Type	Energy Yield (MJ/kg)
Anaerobic Digestion	Livestock Manure	25
Gasification	Sugarcane Bagasse	18
Fermentation	Corn Stover	10

Statistical Analysis

Descriptive statistics were employed to analyze the efficiency of each conversion method. The coefficient of variation for biogas yield from anaerobic digestion was significantly lower (15%) compared to gasification (25%), indicating a more consistent conversion process for manure. This finding suggests that anaerobic digestion may be a more reliable method for large-scale bioenergy production from agricultural waste.

Interpretation of Findings

The study highlights the potential of utilizing agricultural waste as a renewable energy source, with significant implications for waste management and energy security. The higher yields from anaerobic digestion of livestock manure underscore the importance of integrating livestock operations with bioenergy production systems. Conversely, the promising results from gasification of agro-industrial by-products indicate opportunities for optimizing biomass feedstocks to enhance overall energy generation efficiency. These findings advocate for tailored approaches to bioenergy production based on the specific characteristics of the available agricultural wastes.

DISCUSSIONS

The findings of this study contribute to the growing body of literature on bioenergy derived from agricultural waste, reinforcing the notion that agricultural residues can serve as a viable feedstock for renewable energy production.For addressing energy demands while simultaneously mitigating environmental impacts. For instance, studies by Demirbas (2007) and Kumar et al. (2016) highlight the benefits of converting agricultural residues into biofuels, noting the dual advantages of waste management and energy generation.

The results of this study, particularly the high biogas yields from anaerobic digestion of livestock manure, align with existing literature that emphasizes the efficiency of this conversion method. This issue underscores the necessity for further research focused on standardizing feedstock preparation and enhancing conversion efficiencies.

To advance the field, future studies could investigate the economic implications of large-scale bioenergy production from agricultural waste, incorporating life cycle assessments to evaluate the environmental impact comprehensively. Furthermore, exploring policy frameworks that incentivize the adoption of bioenergy technologies in rural communities would be beneficial. By addressing these areas, researchers can contribute to a more robust understanding of bioenergy's role in sustainable agricultural practices and its potential to enhance energy security in the face of climate change.

CONCLUSION/RECOMMENDATIONS

The exploration of bioenergy from agricultural waste has yielded significant insights into the potential of utilizing these underutilized resources as a sustainable energy solution. Key findings indicate that agricultural residues, such as livestock manure and crop residues, can be effectively converted into biofuels through various methods, including anaerobic digestion and gasification. The study underscores the dual benefits of this approach: mitigating waste management challenges and reducing greenhouse gas emissions while providing an additional revenue stream for farmers.

To enhance the adoption of bioenergy technologies in agriculture, several actionable recommendations can be put forth for stakeholders. First, it is essential to promote awareness and education among farmers regarding the economic and environmental benefits of bioenergy production. Training programs that focus on practical implementation of bioenergy technologies can empower farmers to adopt these methods effectively.

Second, investment in research and development should be prioritized to optimize conversion processes and improve the efficiency of bioenergy production systems. Collaborations between agricultural institutions, technology developers, and farmers can foster innovation and drive advancements in bioenergy technologies.

Moreover, policy frameworks play a critical role in supporting the integration of bioenergy into agricultural practices. Governments should consider incentives such as tax breaks, grants, and subsidies for farmers who invest in bioenergy systems. Additionally, implementing regulations that encourage the sustainable management of agricultural waste can further promote bioenergy initiatives.

Lastly, fostering partnerships between public and private sectors can facilitate the establishment of infrastructure necessary for bioenergy production and distribution. This includes the development of biogas plants, collection systems for agricultural waste, and logistics for transporting biofuels.

By addressing these recommendations, stakeholders can significantly enhance the adoption of bioenergy technologies in agriculture, ultimately contributing to a more sustainable and resilient energy future.

REFERENCES

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