

A
Minor Project Report
On

**Sustainability Analysis of Ion Exchange Inspired by CO₂
Mineralization and Desalination Processes**

Submitted in partial fulfilment of the requirement for the award of
BACHELOR OF TECHNOLOGY
IN
CHEMICAL ENGINEERING

SUBMITTED BY:

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UNDER THE GUIDANCE OF:

Dr. Raghwendra Singh Thakur
(HoD & Associate Professor, Chemical Engineering)

DEPARTMENT OF CHEMICAL ENGINEERING



SCHOOL OF STUDIES IN ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA,
(CENTRAL UNIVERSITY)
BILASPUR, CHATTISGARH, INDIA

July-December 2024

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DEPARTMENT OF CHEMICAL ENGINEERING



SCHOOL OF STUDIES IN ENGINEERING & TECHNOLOGY GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY) BILASPUR, CHHATTISGARH, INDIA

CERTIFICATE

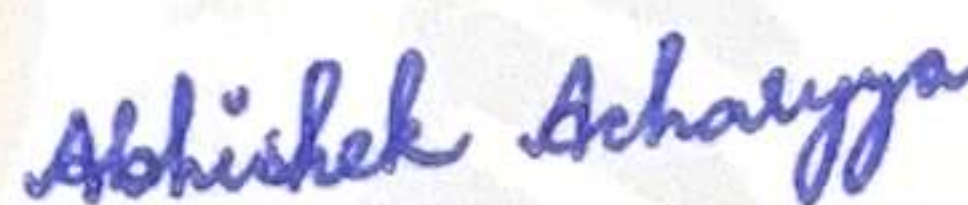
We hereby certify that the work which is being presented in the B.Tech. Minor Project Report on "Sustainability Analysis of Ion Exchange Inspired by CO₂ Mineralization and Desalination Processes", in partial fulfilment of the requirements for the award of the Bachelor of Technology in Chemical Engineering submitted to the Department of Chemical School of Studies of Engineering & Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh, India is an authentic record of our work carried out during a period from July 2024 to December 2024 (7th semester) under the supervision of Dr. Raghwendra Singh Thakur, Head of the Department, Chemical Engineering Department. The matter presented in this Project Report has not been submitted by us or by anyone else for the award of any other degree elsewhere.

Signature of Student

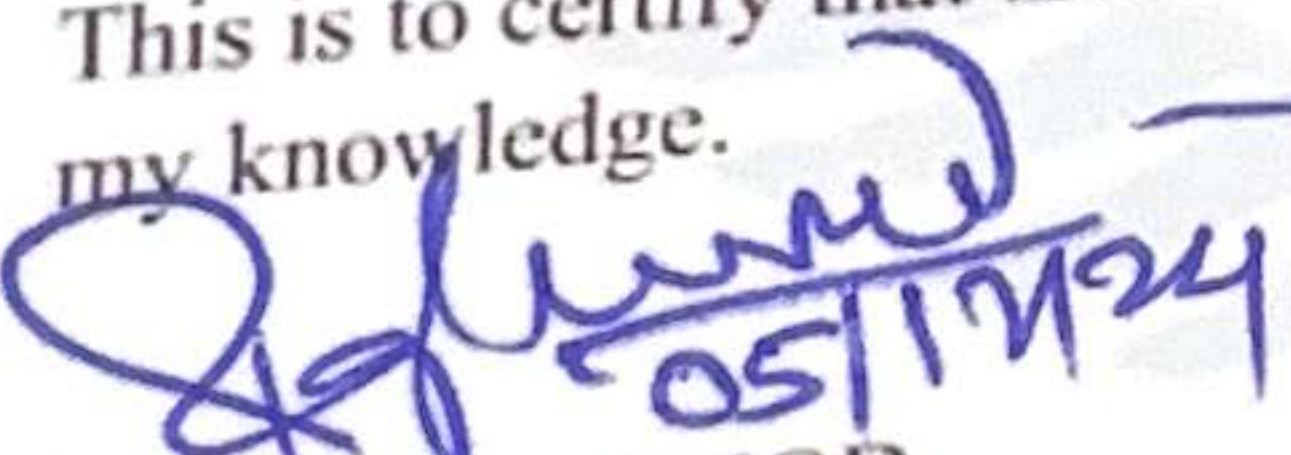

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Signature of HOD

Dr. Raghwendra Singh Thakur
Department of Chemical Engineering

Date:

A MINOR PROJECT REPORT

On

" REMOVAL OF HEAVY METALS FROM WASTE WATER "

Submitted in partial fulfilment of the requirement for the award of

**BACHELOR OF TECHNOLOGY
IN
CHEMICAL ENGINEERING**

SUBMITTED BY:

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NASIM AHMAD (21021130)

Under Guidance of :

**Dr. Anil Kumar Chandrakar
(Professor)**



DEPARTMENT OF CHEMICAL ENGINEERING

**SoS ENGINEERING & TECHNOLOGY GURU GHASIDAS
VISHWAVIDYALAYA, BILASPUR, INDIA**

December 2024

CERTIFICATE

I hereby certify that the work which is being presented in the B.Tech. Minor Project Report entitled “ **REMOVAL OF HEAVY METALS FROM WASTE WATER**” in partial fulfilment of the requirements for the award of the Bachelor of Technology in Chemical Engineering and submitted to the Department of Chemical Engineering , Institute of Technology, Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur, Chhattisgarh, India is an authentic record of our own work carried out during a period from July 2024 – December 2024 (7th semester) under the supervision of **Dr. Anil Kumar Chandrakar** Professor of **CHEMICAL ENGINEERING DEPARTMENT.**

The matter presented in this Project Report has not been submitted by us or by anyone else for the award of any other degree elsewhere.

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Date : 05-12-2024

ACKNOWLEDGEMENT

We would like to place on record my deep sense of gratitude to **Dr. Anil Kumar Chandrakar** Professor and Dept. of Chemical Engineering, Institute of Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh, India, for his stimulating guidance, continuous encouragement and supervision throughout the course of present work.

We express my sincere gratitude to **Dr. R.S. Thakur** Professor and HOD of Chemical Engineering, Institute of Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh, India for his generous guidance, help and useful suggestions

Date: 05-12-2024

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**A
Minor project report**

on

**Study of Removal of heavy metals from water using
activated charcoal using adsorption**

**Submitted in partial fulfillment for
The requirement of the degree of**

**Bachelor of Technology
in
Chemical Engineering**

**Submitted by
Anjali Sindram(21021108)
Pranjali Srivastava(21021136)**

*Under the Guidance of
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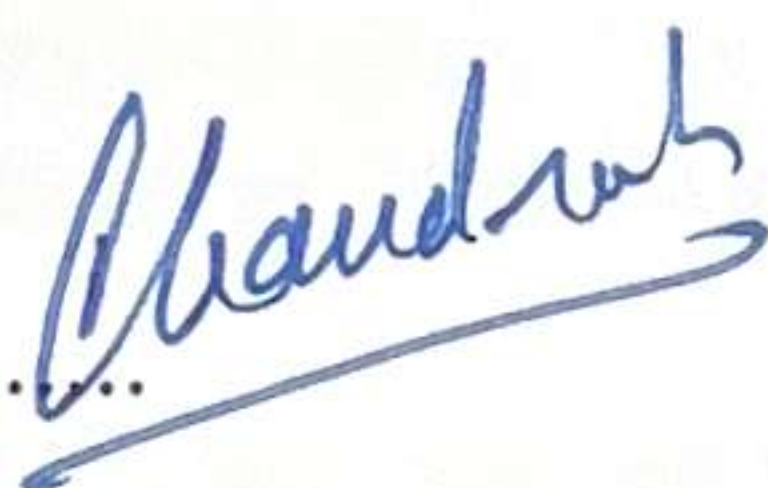
**Department of Chemical Engineering
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Guru Ghasidas Vishwavidyalaya
July-December 2024**

CERTIFICATE

This is to certify that the project report on **“Study of removal of heavy metals using coconut based activated charcoal”** submitted by **Anjali Sindram**, Roll no. **21021108** and **Pranjali Srivastava (21021136)** in partial fulfillment of the requirements for the prescribed curriculum of Bachelor of Technology in Chemical Engineering at School of Studies of Engineering and Technology Guru Ghasidas Vishwavidyalaya, Bilaspur for the session 2024-2025 in an authentic work to the best of my Knowledge a belief.

Guided By

Signature.....



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Professor

Department of Chemical Engineering

School of Studies Engineering and Technology

GGV, Bilaspur

Approved By

Signature.....

Dr. Raghwendra Singh Thakur

Head of Department

Department of Chemical Engineering

School of Studies Engineering and Technology

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A
Minor Project Report

On

**Production of Biodiesel from Neem Oil
Using Acidic Catalyst**

Submitted for the partial fulfilment of award of degree of
Bachelor of Technology
in
Chemical Engineering



Submitted by

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Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)
December 2024



Department of Chemical Engineering
School of Studies of Engineering and Technology
Guru Ghasidas Vishwavidyalaya, Bilaspur

Certificate

This is to certify that the minor project entitled **Production of Bio-Diesel From Neem Oil Using Acidic Catalyst** submitted by **Anupama** (Roll No:21021111), **Ishan Jha** (Roll No:21021122), **Pratik Kumar** (Roll No:21021138), **Ram Manish Kumar** (Roll No:21021140) and **Rishav Raj** (Roll No:21021141) partial fulfilments for the requirements for the award of Bachelor of Technology degree in Chemical Engineering is a bonafide record of the work carried out by them under my supervision and guidance.

Guided By

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Dr. Raghwendra Singh Thakur

Head

Department of Chemical Engineering
School of Studies of Engg. and Tech.
Guru Ghasidas Vishwavidyalaya
Bilaspur, Chhattisgarh

ABSTRACT

The increasing demand for sustainable energy sources has motivated research into biodiesel as a renewable and environmentally friendly alternative to conventional fossil fuels. This study focuses on the production of biodiesel from neem oil using methanol and ethanol as alcohols and sulphuric acid as a catalyst through the transesterification process. Neem oil, a non-edible feedstock with abundant availability, was chosen to avoid competition with food sources.

The transesterification process was carried out by optimizing key parameters such as alcohol-to-oil molar ratio, catalyst concentration, reaction temperature, and time. Methanol and ethanol were evaluated individually, and their performance in biodiesel production was compared. The biodiesel yield, physical properties (specific gravity, viscosity), and compliance with ASTM standards were analysed.

The results indicate that neem oil biodiesel produced with methanol achieved a higher yield (70.4%) compared to ethanol (58.72%), with optimal reaction conditions being 60–65°C and a molar ratio of 1:9. The fuel properties demonstrated close similarity to conventional diesel, suggesting its compatibility with existing combustion engines.

This study highlights neem oil's potential as a viable feedstock for biodiesel, offering a renewable, cost-effective, and environmentally sustainable alternative. Further exploration into large-scale production and economic feasibility is recommended for transitioning toward greener energy solutions.

Minor Project on
“Study of Reactive Extraction of Gallic acid using Deep Eutectic Solvent”

Submitted in partial fulfilment of the requirement for the award of
BACHELOR OF TECHNOLOGY
in
CHEMICAL ENGINEERING

Submitted by
Priya (21021139)
Swapnil Tiwari (21021149)
Abhishek Patel (21021104)
Rupali Mishra (21021142)

Under the guidance of-
Dr. Anuradha N Joshi
(Associate Professor)



Department of Chemical Engineering
School of Studies of Engineering & Technology
Guru Ghasidas Vishwavidyalaya
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DECLARATION

We hereby declare that the project entitled – **Study of Reactive Extraction of Gallic acid using Deep Eutectic Solvent**, which is being submitted as Minor Project of 7th Semester in Chemical Engineering to Guru Ghasidas Vishwavidyalaya, Bilaspur (C. G) is an authentic record of our genuine work done under the guidance of **Dr. Anuradha N Joshi**, Associate Professor, Dept. Of Chemical Engineering, SOS of Engineering and Technology, Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur, Chhattisgarh. We also declare that if any information provided by us is found false, our candidature may be rejected at any point of time.

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CERTIFICATE

I hereby certify that the work which is being presented in the B.Tech. Minor Project Report entitled "Study of Reactive Extraction of Gallic acid using Deep Eutectic Solvent " in partial fulfilment of the requirements for the award of the Bachelor of Technology in Chemical Engineering and submitted to the Department of Chemical Engineering , Institute of Technology, Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur, Chhattisgarh, India is an authentic record of my own work carried out during a period from July 2024 – Dec 2024 (7th semester) under the supervision of **Dr. Anuradha N Joshi**, Associate Professor, Department of Chemical Engineering.

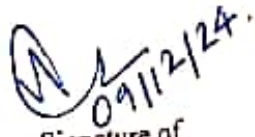
The matter presented in this Project Report has not been submitted by me or by anyone else for the award of any other degree elsewhere.

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This is to certify that the above statement made by the student is correct to the best of my knowledge.

Date: 05-12-2024


Signature of
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Associate Professor
Department of Chemical Engineering

ACKNOWLEDGEMENT

We would like to place on record my deep sense of gratitude to **Dr. Anuradha N Joshi**, Associate Professor, Dept. of Chemical Engineering, Institute of Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh, India, for her stimulating guidance, continuous encouragement and supervision throughout the course of present work.

We express my sincere gratitude to **Dr. R.S. Thakur**, Head, Department of Chemical Engineering, Institute of Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh, India for his generous guidance, help and useful suggestions

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Minor Project Report

On

Adsorption of Methylene Blue by using Tea Waste as Adsorbent

For the partial fulfilment of the Degree of

Bachelor of Technology

in

Chemical Engineering

Submitted by

SHIVANI SURYAVANSHI

AMIT CHAUDHARY

Guided by

Dr. Saurabh Meshram

Associate Professor



Department Of Chemical Engineering
School of Studies of Engineering and Technology

गुरु घासीदास विश्वविद्यालय, बिलासपुर

Guru Ghasidas Vishwavidyalaya, Bilaspur

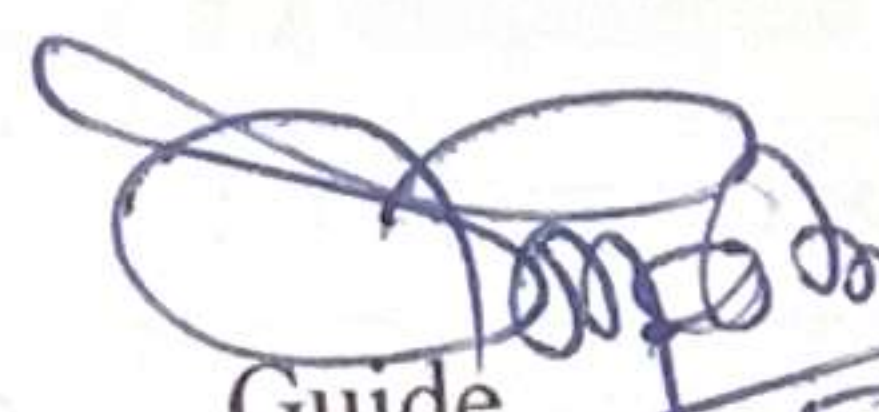
2024-25



Department Of Chemical Engineering
School of Studies of Engineering and Technology
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Certificate

This is to certify that the project entitled, "Adsorption Of Methylene Blue By Using Tea Waste As Adsorbent" submitted by **SHIVANI SURYAVANSHI** (Roll No:21021147) and **AMIT CHAUDHARY** (Roll No:21021106) in partial fulfilments for the requirements for the award of Bachelor of Technology Degree in Chemical Engineering is a bonafide record of the work carried out by them under my supervision and guidance.


Guide **5/12/24**
Dr. Saurabh Meshram
Associate Professor

Head, Chemical Engineering
Dr. Raghwendra Singh Thakur

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A Minor Project Report

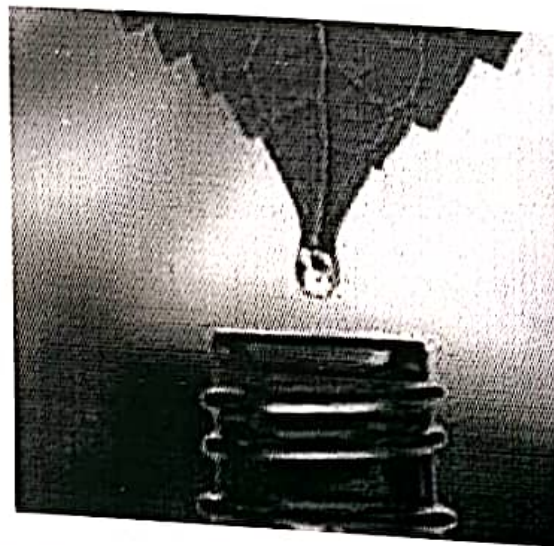
On Hydrodistillation for essential oil extraction

Submitted in partial fulfilment of the requirement

**for the award of BACHELOR OF TECHNOLOGY in CHEMICAL
ENGINEERING**

SUBMITTED BY Shashwat Tiwari (21021146) Dhanjit Rajbongshi(21021116)

SUBMITTED TO Dr Saurabh Meshram (Assistant Professor)



**DEPARTMENT OF CHEMICAL ENGINEERING & ENVIRONMENTAL
GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)**

DECLARATION

We hereby declare that this submission is our own work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person or material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.



Shashwat Tiwari



Dhanjit Rajbongshi

CERTIFICATE

*This is to certify that the thesis entitled: **HYDRO-DISTILLATION FOR ESSENTIAL OIL SEPARATION** submitted by students **SHASHWAT TIWARI, DHANJIT RAJBONGSHI** to the Guru Ghasidas Vishwavidyalaya towards partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in Chemical Engineering is a bona fide record of the work carried out by him/her/them under my/our supervision and guidance.*

ACKNOWLEDGEMENT

/

This thesis report is prepared under the guidance and supervision of **Dr. Saurabh Meshram** Guru Ghasidas Vishwavidyalaya. We were able to talk through technical issues with them for hours before reaching a final draft of the report. We are extremely grateful to sir.

In this context, we are grateful to **Dr. Saurabh Meshram** for the opportunity he provided to work on the topic of our interests. His encouragement and motivation allowed us to complete this work on time and to a high degree of quality. We would also like to thank **Dr. Raghwendra Singh Thakur**, Head, Department of Chemical Engineering for his guidance and moral support.

We extend our sincere appreciation to all faculty and staff members of the Chemical Engineering Department at Guru Ghasidas Vishwavidyalaya in Bilaspur, Chhattisgarh, for their continuing support and encouragement.

ABSTRACT

Through this study, several parameters concerned with extraction of essential oil, including Moisture content, Particle size, pH levels, Condensation rate, solvent choice atmospheric conditions, and concentrations of different oils were analysed. Oil extracted, are used in different domains with applications in food, pharmaceuticals, perfumes, medical field etc, fostering interest in its extraction to enhance economic feasibility.

In our work on the recovery of oil from hydro distillation, three methods are employed: the conventional method, physical extraction, and reactive extraction. However, the importance is placed on physical and reactive extraction due to the absence of prior research in these areas, aiming to identify gaps between conventional methods and physical and reactive extraction techniques

.Efficiency of hydrodistillation depends on factors such as plant type, temperature, and duration of distillation.This paper examines the principles, methodology and variables influencing essential oil yield and quality, highlighting the role of hydro distillation as key technique in essential oil extraction.

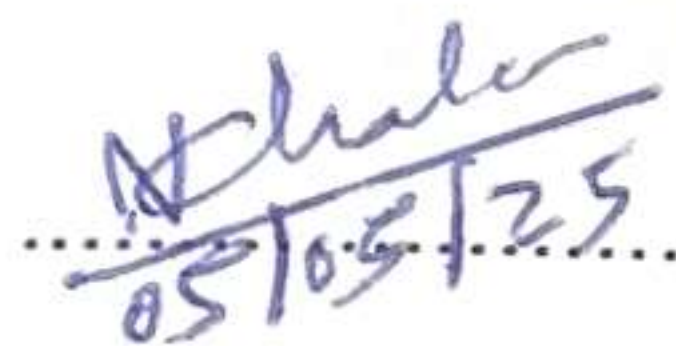
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DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A Central University established by the Central Universities Act No. 25 of 2009)

CERTIFICATE

Certified that the Minor Project Report entitled "*Extraction of Essential Oil from night jasmine and wood apple leaves*" submitted by Lokendra Singh Chandel, Niranjana Roy & Vinit Mishra of B.Tech. 8th Semester, in partial fulfillment of the requirements for the award of degree in Bachelor of Technology (B. Tech) in Chemical Engineering, is according to the students their own investigation carried out by them in the Department of Chemical Engineering, School of Studies in Engineering & Technology, GGV, during the session 2024-25


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Dr. Neeraj Chandraker

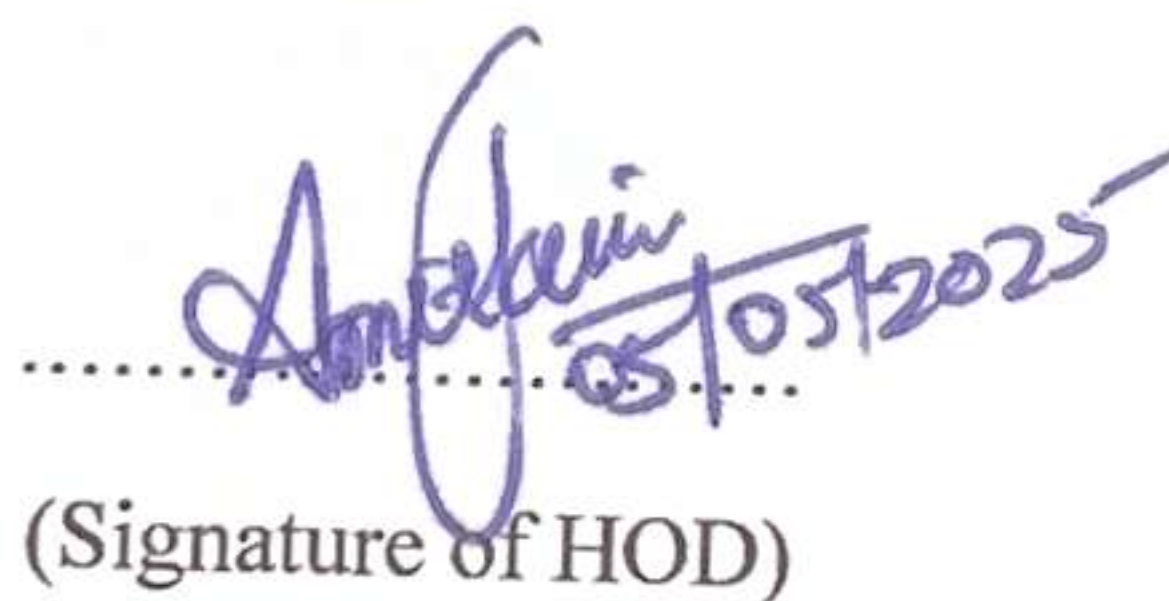
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Mr. Satyajit Bhattacharjee

Department of Chemical Engineering


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05/05/2025

(Signature of HOD)

Prof. Amit Jain

Department Of Chemical Engineering

A
Minor project report
On
Study on Characterization of Fuel Pellets Preparation from
Biomass using Binder

Submitted in partial fulfillment for
the requirement of the degree of

Bachelor of Technology
In Chemical Engineering

Submitted by

Ankit Jaiswal (21021109)

Swati Priya (21021150)

Under the Guidance of

Dr. Gautam Prasad Dewangan

(Associate Professor)



Department of Chemical Engineering
School of Studies Engineering and Technology
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)
Bilaspur-495009
December-2024

CERTIFICATE

This is to certify that the project report on "**Study on Characterization of Fuel Pellets Preparation from Biomass using Binder**" submitted by **Ankit Jaiswal (21021109)** and **Swati Priya (21021150)** in partial fulfillment of the requirements for the prescribed curriculum of Bachelor of Technology in Chemical Engineering at School of Studies of Engineering and Technology Guru Ghasidas Vishwavidyalaya, Bilaspur for the session 2024-2025 in an authentic work to the best of my Knowledge a belief.

Guided By

Signature.....

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Associate Professor

Department of Chemical Engineering

School of Studies Engineering and Technology

GGV, Bilaspur

Approved By

Signature.....

Dr. Raghwendra Singh Thakur

Head of Department

Department of Chemical Engineering

School of Studies Engineering and Technology

GGV, Bilaspur

ABSTRACT

There is a growing need to find alternatives to conventional fossil fuel like coal. Extensive research has been conducting every day to find such alternatives in the form of sustainable and environmentally friendly energy sources. Biomass pellets from organic materials are found as a potential solution for reduction of greenhouse gas emissions. It is also likely to be used for renewable energy and purposes. In this project, the feasibility of biomass pellets is investigated based on physical, chemical and thermal properties of them. Also studying their efficiency is done in generation of energy as an alternative to coal.

The study starts with picking suitable biomass material, i.e. agricultural residues, wood waste and energy crops. These materials undergo preprocessing steps like drying, grinding and palletization. Consistency and optimization of combustion efficiency with respect to key parameters including pellet density, durability, and moisture content are assessed. Properties such as fixed carbon content, volatile matter, ash content are determined. These metrics help understand fuel quality and the environmental impact of biomass pellets.

Finally, the project compares biomass pellets and coal with respect to their energy efficiency, environmental impact, and economic viability. Advancements in palletization techniques, other biomass sources, and combustion systems are all recommended to improve consistency in pellet quality.

The results demonstrate the biomass pellet's potential as a green and economical substitute for coal while highlighting environmental and economic benefits. This study provides a comprehensive characterization and comparison, in order to support the transition to cleaner energy solutions and contribute to global efforts to mitigate climate change.

A
MINOR PROJECT REPORT
on
Extraction of Phenolic Compounds from Spent Tea using
Deep Eutectic Solvent
Submitted in partial fulfilment of the requirement for the award
of
BACHELOR OF TECHNOLOGY
in
CHEMICAL ENGINEERING

Submitted by
Madhav Kumar Jha
Aryan Yadav
Shivendu Bhaskar
Ravi Kumar

Under the Supervision of
Mr. Vishnu Prasad Yadav
(Assistant Professor)



Department of Chemical Engineering
School of Studies of Engineering and Technology
Guru Ghasidas Vishwavidyalaya
Bilaspur
05 December 2024



Department Of Chemical Engineering
School of Studies of Engineering and Technology
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

DECLARATION

We hereby declare that the project entitled – “**Extraction of phenolic compound from spent tea using deep eutectic solvent**”, which is being submitted as Minor Project of 7th Semester in Chemical Engineering School of Studies of Engineering And Technology Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G) is an authentic record of our genuine work done under the guidance **Mr. Vishnu Prasad Yadav** Assistant Professor, Dept. of Chemical Engineering, Institute of Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh . We also declare that if any information provided by us is found false, our candidature may be rejected at any point of time.

Signature of

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Department Of Chemical Engineering
School of Studies of Engineering and Technology
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Certificate

This is to certify that the project entitled, “**Extraction of phenolic compound from spent tea using deep eutectic solvent**” submitted by **MADHAV JHA (RollNo:21021126)**, **ARYAN YADAV (RollNo:21021112)**, **SHIVENDU BHASKAR (RollNo:21021148)** and **RAVI KUMAR (RollNo:21021160)** in partial fulfilments for the requirements for the award of Bachelor of Technology Degree in Chemical Engineering is a Bonafide record of the work carried out by them under my supervision and guidance.

This is to certify that the above statement made by the student is correct to the best of my knowledge.

Signature of

Mr. Vishnu Prasad Yadav

(Assistant Professor)

Place: Bilaspur

Date: 5 December 2024



Acknowledgement

We would like to express our sincere gratitude to the following individuals and organizations for their support and assistance in the completion of this report. We would like to Thank our Department of Chemical Engineering of School of Engineering and Technology, Guru Ghasidas Vishwavidyalaya Bilaspur (C.G.) for being the internal support. We would like to acknowledge our profound and sincere gratitude to **MR. VISHNU PRASAD YADAV** Assistant Professor, Dept. of Chemical Engineering, School of Studies of Engineering And Technology Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G), India, for his careful and precious guidance which were extremely valuable for my study both theoretically and practically. I offer thanks and gratitude to him for the responds who extended so honestly his cooperation answering the queries on time and helping us.

We express our sincere gratitude to **Dr. R.S. Thakur** Professor and HoD, Department of Chemical Engineering, School of Studies of Engineering & Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh, India for his generous guidance, help and useful suggestions.

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A
Minor Project Report
On
Solar-Powered Pyramid Desalination for Remote and
Arid Regions

Submitted in partial fulfilment of the requirement for the award
of Bachelor of Technology in Chemical Engineering

SUBMITTED BY-

AVINASH DIWAN (21021113)

KARAN SINGH UIKEY (21021123)

KOMAL MISHRA (21021124)

Under the Supervision of
Dr. Sandeep Dharmadhikari
(Assistant Professor)

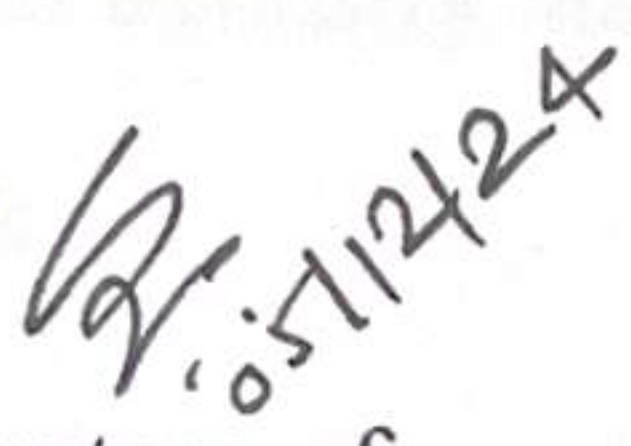


DEPARTMENT OF CHEMICAL ENGINEERING
SoS ENGINEERING & TECHNOLOGY GURU GHASIDAS
VISHWAVIDYALAYA, BILASPUR, INDIA

CERTIFICATE

This is to certify that the project entitled, "**Solar-Powered Pyramid Desalination for Remote and Arid Regions**" submitted by **AVINASH DIWAN** (21021113), **KARAN SINGH UIKEY** (21021123) and **KOMAL MISHRA** (21021124) in partial fulfilments for the requirements for the award of Bachelor of Technology Degree in Chemical Engineering is a Bonafide record of the work carried out by them under my supervision and guidance.

This is to certify that the above statement made by the student is correct to the best of my knowledge.


Signature of

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Place: Bilaspur

Date: 5 December 2024

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**A
PROJECT REPORT
ON
DESIGN AND MODELLING OF
THREE- EFFECT EVAPORATOR FOR
DIFFERENT CONFIGURATIONS**

Submitted in partial fulfilment of the requirements of the degree

**BACHELOR of TECHNOLOGY
IN
CHEMICAL ENGINEERING
SESSION 2024-25**

SUBMITTED

by

Abhinav Kumar

Boda Suresh

Akhilesh Kumar Patel

Bhima Raju

UNDER THE SUPERVISION

of

Dr. Ghoshna Jyoti

(Assistant Professor)



**Department of Chemical Engineering
School of Studies of Engineering & Technology
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)**

May 2025

CERTIFICATE OF APPROVAL

This is to certify that the thesis entitled “**Design and Modelling of Three-effects Evaporator for Different Configurations using MATLAB**” submitted by **Abhinav Kumar** (Roll No. – 21021103), **Akhilesh Kumar Patel** (Roll No. – 21021154), **Boda Suresh** (Roll No. -21021115), **Bhima Raju** (Roll No. 20101023) in partial fulfilment of the requirements for Degree of **Bachelor of Technology in Department of Chemical Engineering** is a record of Bonafide and original research work carried out by them under our guidance and the thesis does not include any work which has previously been submitted for the award of other degree, diploma, associate-ship, fellowship, or other similar title to them. We further certify that the work reported in this thesis was carried out independently by the candidates.

APPROVED BY

Professor Amit Jain

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Signature 05/05/2025

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ABSTRACT

Evaporators play a crucial role in minimizing the production of regulated waste residues while enhancing the recovery of valuable materials from waste streams. Multiple-effect evaporators (MEEs) are widely used in industries for concentrating products, regenerating solvents, and separating solid-liquid mixtures. Through process integration, the optimal configuration of MEEs can be determined to maximize energy efficiency. This work focuses on modelling and analyzing various configurations of a three-effect evaporator system, typical of an Indian sugar industry, while considering factors such as vapor bleeding, variable physical properties, and boiling point rise. The system is described by a set of nonlinear algebraic equations incorporating mass and energy balances, heat transfer equations, and temperature- and composition-dependent thermodynamic properties like vapor pressure and enthalpy. MATLAB is used to solve these models through a system of nonlinear equations.

An economic evaluation of the three-effect evaporator system is carried out by comparing different feed flow configurations, including forward feed and forward feed with vapor bleeding. The study concludes that the forward feed configuration with vapor bleeding is the most cost-effective among the evaluated options. This technique significantly enhances steam economy by 24.53% and reduces steam consumption by 24.62% compared to the simple forward feed system. These improvements demonstrate the effectiveness of vapor bleeding in optimizing evaporator performance and overall energy efficiency in industrial applications.

A Minor Project Report

On

Solgel Auto Combustion

**Submitted in partial fulfilment of the requirement for the
award of**

BACHELOR OF TECHNOLOGY

in

CHEMICAL ENGINEERING

SUBMITTED BY-

Sachin Kumar(21021143)

Nimish Asawa (21021158)

Dushyant Singh (21021117)

SUBMITTED TO-

Dr. Pankaj kumar (Assistant Professor)

Department of Chemical Engineering,

And

Dr. Samarjit Singh (Assistant Professor)

Department of Mechanical Engineering,

SoS Engineering & Technology,

Guru Ghasidas Vishwavidyalaya

DEPARTMENT OF CHEMICAL ENGINEERING



**SoS ENGINEERING & TECHNOLOGY GURU GHASIDAS
VISHWAVIDYALAYA, BILASPUR, INDIA**

November, 2023

CERTIFICATE

I hereby certify that the work which is being presented in the B.Tech. Minor Project Report entitled **"Solgel Auto Combustion "** in partial fulfilment of the requirements for the award of the Bachelor of Technology in Chemical Engineering and submitted to the Department of Chemical Engineering , Institute of Technology, Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur, Chhattisgarh, India is an authentic record of my own work carried out during a period from July 2024 – Nov 2024 (7th semester) under the supervision of **Dr. Pankaj Kumar Assistant Professor of CHEMICAL ENGINEERING Department and Dr. Samarjit Singh Assistant Professor of Mechanical Engineering.**

The matter presented in this Project Report has not been submitted by me or by anyone else for the award of any other degree elsewhere. Signature of Student

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Nimish Asawa
Dushyant Singh

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This is to certify that the above statement made by the student is correct to the best of my knowledge.

Signature of

Dr. Pankaj Kumar

Signature of

Dr. Samarjit Singh

Date : 08-11-2023

Head Dept. of Chemical Engineering Department

DECLARATION

We hereby declare that the project entitled – “**Solgel Auto Combustion**”, which is being submitted as Major Project of 7th Semester in Chemical Engineering to Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G) is an authentic record of our genuine work done under the guidance of **Dr.Pankaj kumar** Dept. of Chemical and **Dr. Samarjit Singh**, Dept. Of Mechanical Engineering, SOS Engineering and Technology, Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur, Chhattisgarh. We also declare that if any information provided by us is found false, our candidature may be rejected at any point of time.

Sachin Kumar
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ACKNOWLEDGEMENT

We would like to place on record my deep sense of gratitude to, **Dr. Pankaj Kumar** Dept. of Chemical and **Dr. Samarjit Singh**, Dept. of Mechanical Institute of Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh, India, for his stimulating guidance, continuous encouragement and supervision throughout the course of present work.

We express my sincere gratitude to **Dr. R.S. Thakur** Professor and Hod of Chemical Engineering, Institute of Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh, India for his generous guidance, help and useful suggestions

Date:05/12/2024

Sachin Kumar
Nimish Asawa
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A Minor Project Report

On

Biomass waste derived activated carbon

Submitted in partial fulfilment of the requirement for the award

of

BACHELOR OF TECHNOLOGY

in

CHEMICAL ENGINEERING

SUBMITTED BY-

Anubhav Jangde (21021110)

SUBMITTED TO-

Mr. Satyajit Bhattacharjee

(Assistant Professor)

Department of Chemical

Engineering, SOS Engineering &

Technology, Guru Ghasidas

Vishwavidyalaya



**SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR, INDIA**

December, 2024

DECLARATION

I hereby declare that the project entitled – “**Biomass waste derived activated carbon**”, which is being submitted as Minor Project of 7th Semester in Chemical Engineering to Guru Ghasidas Vishwavidyalaya , Bilaspur (C.G) is an authentic record of our genuine work done under the guidance of **Mr. Satyajit Bhattarcharjee**, Dept. of Chemical Engineering , SOS Engineering and Technology, Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur, Chhattisgarh. We also declare that if any information provided by us is found false, our candidature maybe rejected at any point of time.

Anubhav Jangde

(21021110)

DECLARATION

I hereby declare that the project entitled – “**Biomass waste derived activated carbon**”, which is being submitted as Minor Project of 7th Semester in Chemical Engineering to Guru Ghasidas Vishwavidyalaya , Bilaspur (C.G) is an authentic record of our genuine work done under the guidance of **Mr. Satyajit Bhattarcharjee**, Dept. of Chemical Engineering , SOS Engineering and Technology, Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur, Chhattisgarh. We also declare that if any information provided by us is found false, our candidature maybe rejected at any point of time.

Anubhav Jangde

(21021110)

ACKNOWLEDGEMENT

I would like to place on record my deep sense of gratitude to **Mr. Satyajit Bhattacharjee** , Assistant Professor , Dept. of Chemical Engineering, Institute of Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh, India, for his stimulating guidance, continuous encouragement and supervision throughout the course of present work.

I express my sincere gratitude to **Dr. R. S. Thakur** Professor and Head of department of Chemical Engineering, Institute of Technology, Guru Ghasidas Vishwavidyalaya, Central University, Bilaspur, Chhattisgarh, India for his generous guidance, help and useful suggestions.

Date: 05-12-2024

Anubhav Jangde

(21021110)

CERTIFICATE

I hereby certify that the work which is being presented in the B.Tech. Minor Project Report entitled "**Biomass waste derived activated carbon**" in partial fulfilment of the requirements for the award of the Bachelor of Technology in Chemical Engineering and submitted to the Department of Chemical Engineering, Institute of Technology, Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur, Chhattisgarh, India is an authentic record of my own work carried out during a period from August 2024

– November 2024 (7th semester) under the supervision of **Mr. Satyajit Bhattacharjee, Assistant Professor of CHEMICAL ENGINEERING Department.**

The matter presented in this Project Report has not been submitted by me or by anyone else for the award of any other degree elsewhere.

Signature of Student

This is to certify that the above statement made by the student is correct to the best of my knowledge.

Signature

Mr. Satyajit Bhattacharjee

Date : 04-12-2024

Head Dept. of Chemical Engineering Department

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