

Formulation and Evaluation of Eco-Friendly Dish Washing Liquids

A Minor Project Report

In Partial Fulfillment of the Requirement for Award of Degree of
Bachelor of Technology of the 3rd Year in Chemical Engineering

Submitted By

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Under the Guidance of

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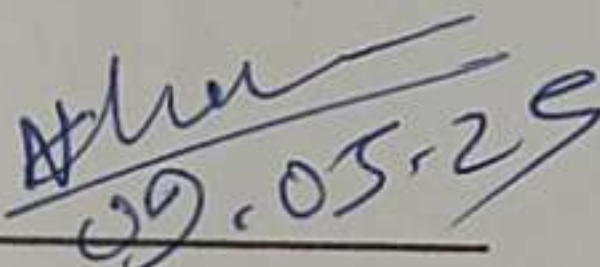


**DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
May 2025**

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Certified that the Minor Project Report entitled "**Formulation and Evaluation Eco-Friendly Dish washing Liquids**" submitted by Aryan Singh of B.Tech. 6th 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 of Engineering & Technology, GGV, during the session 2024-25.

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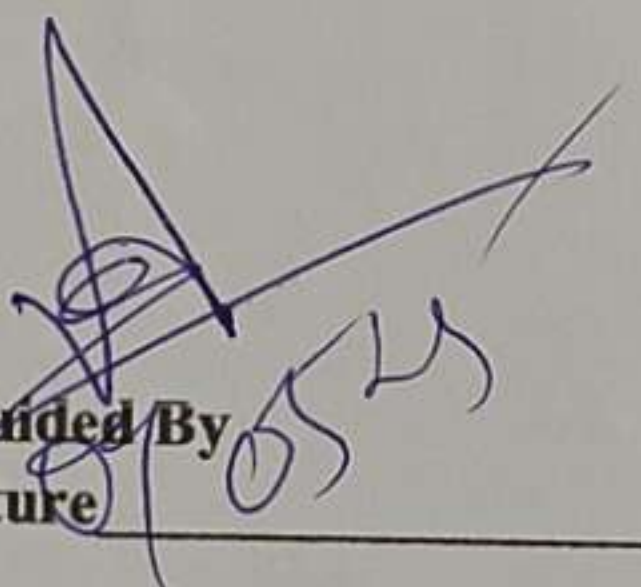

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SMART AGRICULTURAL MONITORING SYSTEM

A Project Report

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Bachelor of Technology of the 3rd Year in Chemical Engineering

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May 2025

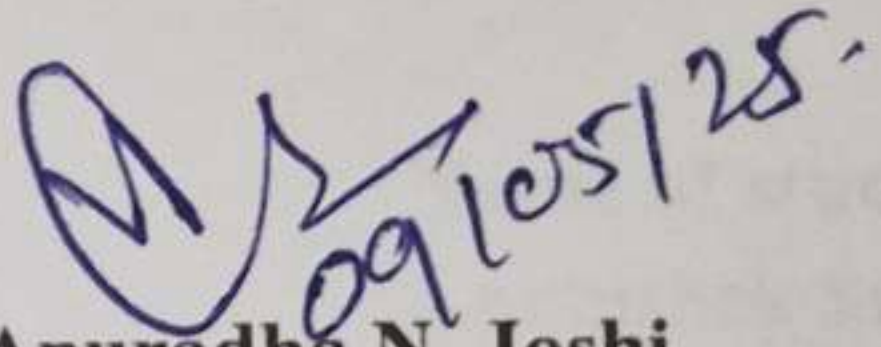
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**ANN-Based Prediction of Extraction Efficiency for
Propionic Acid Recovery Using TOA in Edible Oils**

A Project Report

In Partial Fulfilment of the Requirement for Award of Degree of
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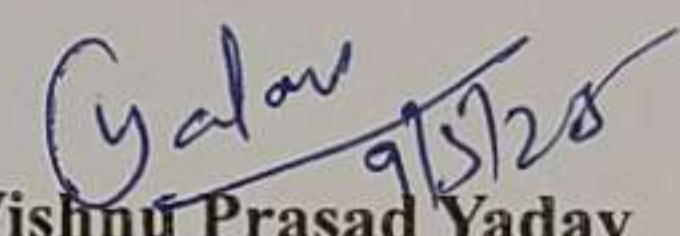
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Menthol-Acetic Acid DES for Propionic Acid Separation

A Project Report

In Partial Fulfilment of the Requirement for Award of Degree of
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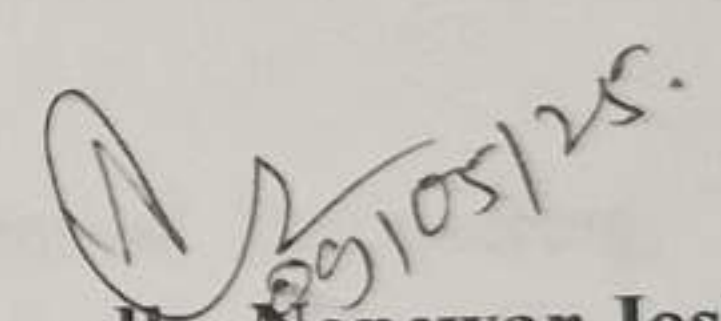
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Menthol-Acetic Acid DES for Propionic Acid Separation

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A Minor Project Report

On

**Theoretical analysis and Numerical modelling of
Gasification Process**

**In Partial Fulfilment of the Requirement for Award of Degree of
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A
PROJECT REPORT

on

"Process Simulation of Lignin-Derived Aromatics from Biomass and
Syngas Using Aspen Plus"

Submitted in partial fulfilment of the requirement for the award of

BACHELOR OF TECHNOLOGY

IN

CHEMICAL ENGINEERING

SUBMITTED BY :

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DEPARTMENT OF CHEMICAL ENGINEERING



SCHOOL OF STUDIES IN ENGINEERING & TECHNOLOGY

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BILASPUR , CHHATTISGARH, INDIA

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We hereby certify that the work which is being presented in the B.Tech. Project Report on ""Process Simulation of Lignin-Derived Aromatics from Biomass and Syngas Using Aspen Plus"" 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 January 2025 to May 2025 (6th Semester) under the Guidance of Dr. Pankaj Kumar, Assistant Professor 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.'

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

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ABSTRACT

The escalating global demand for sustainable energy and chemicals has intensified interest in biomass valorization, particularly the conversion of lignin—a highly abundant yet underutilized biopolymer—into valuable aromatic compounds. This study investigates the process simulation of lignin-derived aromatics from biomass and syngas using Aspen Plus, aiming to model an integrated biorefinery capable of producing high-value chemicals like benzene, toluene, and xylene (BTX). The research adopts a systematic approach involving lignin extraction via Organosolv and Deep Eutectic Solvents (DES), catalytic depolymerization under hydrogen-rich syngas atmospheres, and product recovery.

The simulation incorporates key process blocks, including lignin isolation, syngas production from biomass gasification, and catalytic conversion pathways such as hydrogenolysis and fast pyrolysis. Various catalysts (e.g., Ru/C, Ni/Al₂O₃, HZSM-5) and reaction conditions were analyzed for their efficacy in breaking down β -O-4 ether linkages and enhancing aromatic yields. Organosolv and DES-extracted lignins were found to be more amenable to depolymerization due to their preserved functional structures and sulfur-free profiles.

The results highlight the critical role of syngas, not only as a hydrogen source but also in enabling a circular energy model within the biorefinery. The simulation demonstrated monomeric aromatic yields of up to 35 wt% under optimized conditions. Furthermore, integration of all biomass fractions, including carbohydrates for ethanol production and syngas recycling, significantly improved the system's economic and environmental metrics.

This project establishes a robust framework for simulating lignin valorization into aromatics, underscoring the feasibility and sustainability of such biorefinery configurations. It also lays the groundwork for future experimental validation and process intensification strategies, such as continuous flow reactors, advanced solvent systems, and decentralized feedstock logistics, crucial for commercial-scale deployment.

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GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)**

May 2025



**UASB Reactor and It's Mathematical Approach to
Treatment of POME**

A Project Report

**In Partial Fulfilment of the Requirement for Award of Degree of
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A Project Report
on
PLANT BASED BODY LOTION

Submitted in Partial Fulfilment of the Requirement for Award of Degree of
Bachelor of Technology of the 3rd Year in Chemical Engineering

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“ From Flowers Waste to Organic Dhoop Sticks ”

A Project Report

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May 2025

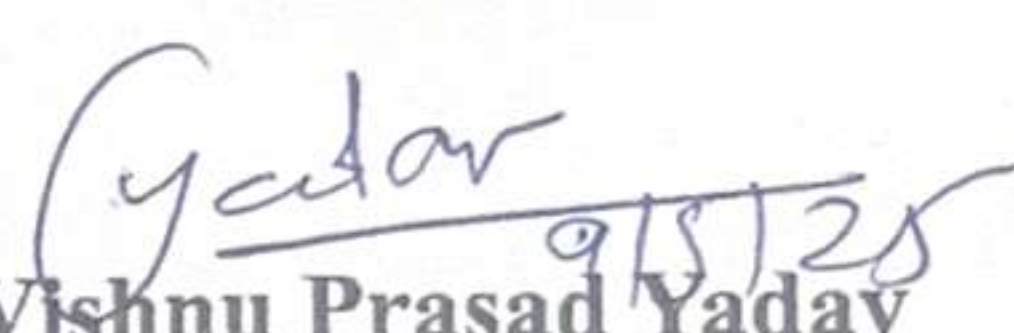
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**A
Project Report
on**

**“Removal of Indigo Carmine dye from waste
water using CaO nano Adsorbent”**

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

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(A Central University Established by the Central University Act 2009 No. 25 of 2009)

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Abstract

The discharge of synthetic dyes from textile industries is a major environmental issue due to their intense color and resistance to degradation. Indigo carmine, a widely used blue synthetic dye, is especially difficult to remove from industrial wastewater. In this project, calcium oxide (CaO) nanoparticles were synthesized from waste chicken eggshells using the sol-gel method and tested as an effective and low-cost adsorbent for dye removal. Eggshells, mainly composed of calcium carbonate, were first dissolved in dilute hydrochloric acid to form calcium chloride. Sodium hydroxide was then added to form calcium hydroxide gel, which was dried and calcined at high temperature to produce CaO nanoparticles. The synthesized adsorbent was characterized using FTIR to confirm the presence of functional groups. Batch adsorption experiments were conducted using two different amounts of CaO- 0.5g and 0.25g in 100 mL of indigo carmine dye solution (50 mg/L). The results showed significant dye removal within 5 minutes, with over nearly 100% efficiency achieved using 0.5 g of CaO. This study presents a simple, economical, and environmentally friendly approach to treat dye-containing industrial wastewater using biowaste-derived CaO nano adsorbent.

Extraction of Citric Acid by Distillation

A Project Report

In Partial Fulfilment of the Requirement for Award of Degree of
Bachelor of Technology of the 3rd Year in Chemical Engineering

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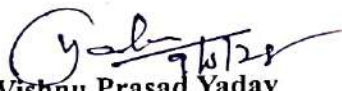
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ABSTRACT

Citric acid is one of the most widely used organic acids in the food, pharmaceutical, cosmetic, and chemical industries due to its versatile properties as an acidulant, antioxidant, and chelating agent. Traditionally, citric acid is recovered from fermentation broth using lime precipitation followed by sulfuric acid treatment, ion exchange, and crystallization. However, these methods are associated with high chemical consumption, significant waste generation (e.g., gypsum), and multi-step processing. This study explores an alternative approach—the extraction of citric acid by distillation, focusing on vacuum distillation, molecular distillation, and reactive distillation techniques.

The research involved experimental investigations using both synthetic citric acid solutions and real fermentation broth samples. Vacuum distillation was performed under reduced pressure (10–50 mbar) and controlled temperatures (60–80°C), achieving water removal efficiencies of 70–85% while maintaining citric acid purity above 95%. Molecular distillation, operating under ultra-high vacuum (<0.01 mbar) and temperatures up to 100°C, demonstrated structural preservation of citric acid but with lower recovery rates (65–75%) due to equipment limitations and low throughput. Reactive distillation involving esterification of citric acid with ethanol significantly enhanced volatility, enabling efficient separation of ethyl citrate esters via standard distillation, with subsequent hydrolysis regenerating citric acid at yields of 70–78%.

Solvent-assisted distillation using tri-n-octylamine (TOA) and tributyl phosphate (TBP) in kerosene showed potential for improving extractability into an organic phase before distillation. Process optimization using Response Surface Methodology (RSM) identified key operational parameters such as temperature, pressure, and feed concentration that significantly affect yield and purity. Thermal degradation studies confirmed that citric acid remains stable under optimized conditions, although decomposition products like aconitic acid were observed at higher temperatures.

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ADHESIVE MAKING PROCESS FROM CASSAVA STARCH

A Minor Project Report

In Partial Fulfillment of the Requirement for Award of Degree of
Bachelor of Technology of the 3rd Year in Chemical Engineering

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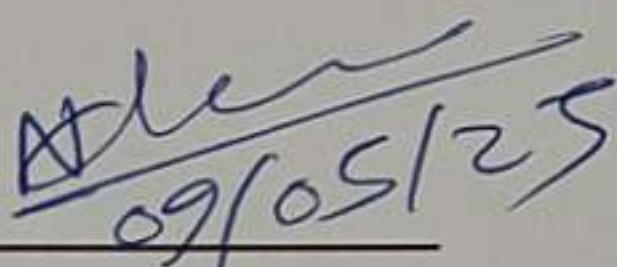


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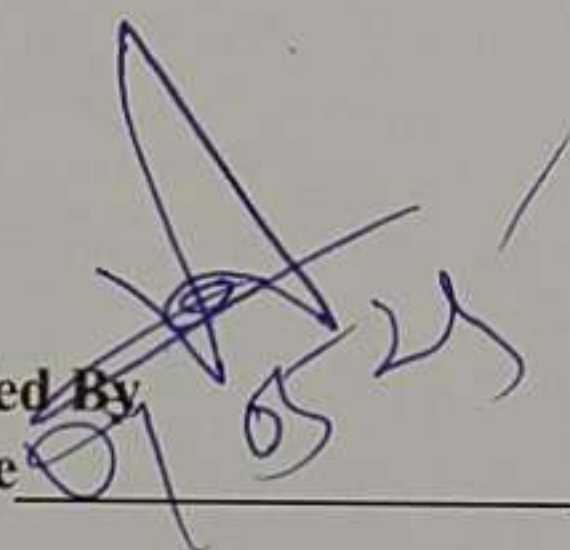

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A Mini Project Report
on
**Energy Consumption Analysis and Planning for a Remote Village
Ecosystem with Windmill**

Submitted in partial fulfilment of the requirement of the degree of
Bachelor of Technology in Chemical Engineering

Submitted by
Prathamesh Prashant Nagapure

Session 2024-25

Guided by
Dr Gautam Prasad Dewangan
Associate Professor



**Department of Chemical Engineering
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(A central university established by the central university Act, 2009)**

2024-25

CERTIFICATE OF APPROVAL

This is to certify that the project entitled "**Energy Consumption Analysis and Planning for a Remote Village Ecosystem with Windmill**" submitted by **Prathamesh P Nagapure** (Roll No: 21021137) in fulfilment of the requirements for the degree of **Bachelor of Technology in Chemical Engineering** is a record of bonafide and original research work carried out by them under our guidance and this project does not include any work which has previously been submitted for the award of other degree, diploma, associate-ship, fellowship, or other similar titles to them. I further certify that the work reported in this project was carried out independently by the candidate.

Approved by

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A Minor Project Report

On

Preparation of Herbal Handwash

**In Partial Fulfilment of the Requirement for Award of Degree of
Bachelor of Technology of the 3rd Year in Chemical Engineering**

Submitted By

Priyanka Kumari

Under the Guidance of

Mr. Satyajit Bhattacharjee

Assistant Professor



**DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)**

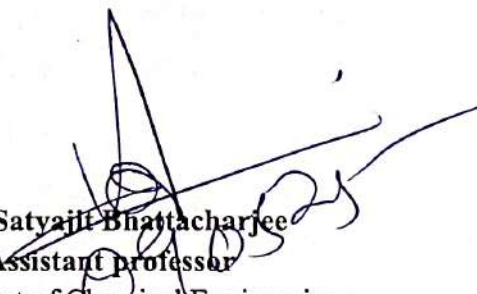
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Certified that the Minor Project Report entitled "*Preparation of Herbal Handwash*" submitted by Priyanka Kumari of B.Tech. 6th Semester, in partial fulfillment of the requirements for the award of degree in Bachelor of Technology (B. Tech) in Chemical Engineering, is according to the students their own investigation carried out by them in the Department of Chemical Engineering, School of Studies of Engineering & Technology, GGV, during the session 2024-25.

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Department of Chemical Engineering
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A Project Report
on
FORMATION OF HERBAL LIPSTICK
USING MAHUA OIL

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

Submitted by

Mahi Srivastava

22021123

Ramesh Kumar

22021142



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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 University Act 2009 No. 25 of 2009)

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Department of Chemical Engineering

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Satyajit Bhattacharjee
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Assistant Professor

Department of Chemical Engineering

School of Studies of Engineering and Technology

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Bilaspur, Chhattisgarh

Synthesis of Air-Freshener Gel Using Apple Peels

A Project Report

In Partial Fulfilment of the Requirement for Award of Degree of
Bachelor of Technology in Chemical Engineering



Submitted by

Ravi Ranjan Kumar

Aayush Kumar

Anwar Sahil Ali

Dimpal Gautam

Jitesh Meher

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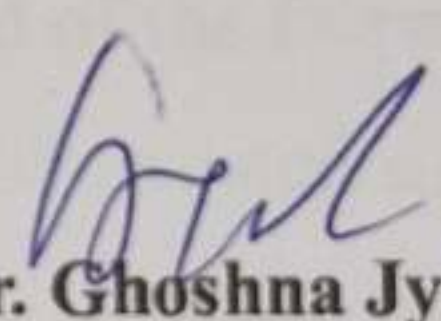
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Department of Chemical Engineering
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Department of Chemical Engineering
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A Project Report

On

“Preparation of Herbal Soap Using Neem Leaves”

**In Partial Fulfilment of the Requirement for Award of Degree of
Bachelor of Technology of the 3rd Year in Chemical Engineering**

Submitted By

RavindraKumar Meena(22021146)

Under the Guidance of

Dr. NeerajChandrakar

Associate Professor



DEPARTMENT OF CHEMICAL ENGINEERING

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)

May 2024-25

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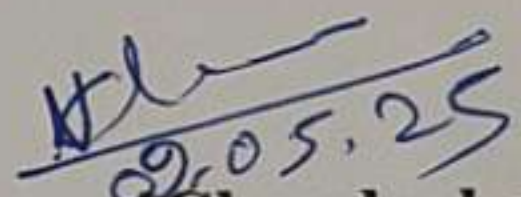
Certified that the Project Report entitled "*Preparation of Herbal Soap Using Neem Leaves*" submitted by RavindraKumar Meena of B.Tech. 6th Semester, in partial fulfillment of the requirements for the award of degree in Bachelor of Technology (B. Tech) in Chemical Engineering, is according to the student their own investigation carried out by them in the Department of Chemical Engineering, School of Studies of Engineering & Technology, GGV, during the session 2024-25.

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SoS of Engineering & Technology, GGV

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A
Minor project report
on
Preparation of cellulose and CMC from southern cattail
(*Typha domingensis*)

Submitted in partial fulfillment for
the requirement of the degree of
Bachelor of Technology
in

Chemical Engineering

Submitted by

Sadhana Mall(22021147)

Under the guidance of

Mr. Satyajit Bhattacharjee(Assistant Professor)



Department of Chemical Engineering
School of Studies in Engineering and Technology,
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May 2025

CERTIFICATE OF APPROVAL

This is to certify that the Minor Project Report entitled "Preparation of cellulose and CMC from Southern cattail: A review report" submitted by Sadhana Mall (Roll No. : 22021147) in fulfilment of the requirements for the degree of **Bachelor of technology in Chemical Engineering** is a record of bonafide and original research work carried out by them under our guidance and this project does not include any work which has previously been submitted for the award of other degree, diploma, associate-ship, fellowship, or other similar titles to them. We, further certify that the work reported in this project was carried out independently by the candidate.

Approved by

Prof. Amit Jain

Head of Department

Department of Chemical Engineering
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Mr. Sayant Bhattacharjee

Assistant Professor

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Carbon Purification For Industries/Factories

A Minor Project Report

In Partial Fulfillment of the Requirement for Award of Degree of
Bachelor of Technology of the 3rd Year in Chemical Engineering

Submitted By

Sagar Kumar (22021171)

Under the Guidance of

Dr. Neeraj Chandrakar (Associate Professor)

And

Mr. Satyajit Bhattacharjee (Assistant Professor)



**DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
May 2025**

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Certified that the Minor Project Report entitled "*Carbon Purification For Industries/Factories*" submitted by Sagar Kumar of B.Tech. 6th 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 of Engineering & Technology, GGV, during the session 2024-25.

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A Project Report
On
Production of Biodiesel from Coconut Oil
Using Acidic Catalyst
Submitted for the partial fulfilment of award of degree of
Bachelor of Technology of the 3rd Year
in
Chemical Engineering



Submitted by

Sagar Raj (22021148)

Guided by

Satyajit Bhattacharjee

Assistant Professor

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May 2025

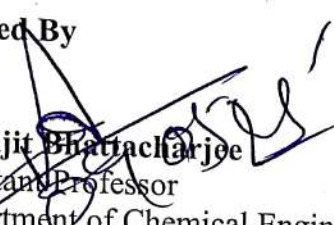


Department of Chemical Engineering
School of Studies of Engineering and Technology
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This is to certify that the minor project entitled **Production of Biodiesel from Coconut Oil Using Acidic Catalyst** submitted by **Sagar Raj** (Roll No:22021148), 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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Head
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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 coconut oil using methanol as alcohol and zinc sulfide as a catalyst through the transesterification process. Coconut 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, and reaction temperature. There performance in biodiesel production was compared. The biodiesel yield, physical property (specific gravity), and compliance with ASTM standards were analysed.

The results indicate that coconut oil biodiesel produced with methanol achieved a yield (47.29%), with optimal reaction conditions being 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 coconut 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.

A Project Report

DWSIM Simulation of Large-Scale Hydrogen Production via Water Electrolysis
Using Renewable Energy Sources.

in partial fulfilment of the requirement for the completion of Third Year B.Tech.
Chemical Engineering

submitted by

Shivam Kumar (220221154)

under the guidance of

Dr. Saurabh Meshram

Associate Professor



**DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)**

May 2025

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Department of Chemical Engineering
SoS of Engineering & Technology, GGV



Dr. Saurabh Meshram

Associate Professor

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SoS of Engineering & Technology, GGV

A Generalized ANN Framework for Predicting Extraction Efficiency in Reactive Separation of Organic Acids

A Project Report

In Partial Fulfilment of the Requirement for Award of Degree of
Bachelor of Technology of the 3rd Year in Chemical Engineering

Submitted By

Shreyansh Shukla (22021155)

Under the Guidance of

Dr. Vishnu Prasad Yadav

Assistant Professor



**DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
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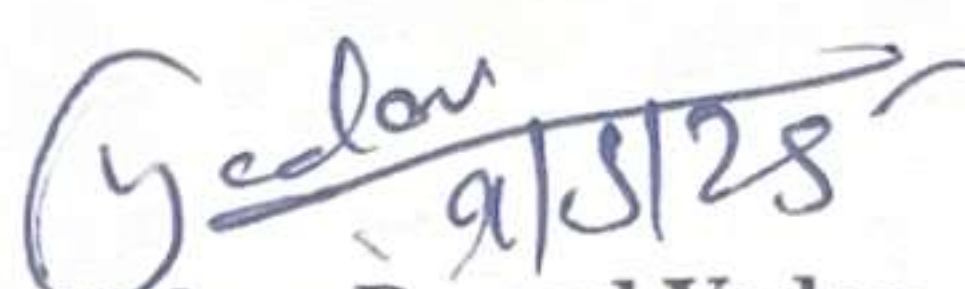
May 2025

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A Project Report

on

FORMULATION OF LIQUID HANDWASH

In Partial Fulfilment of the Requirement for Award of Degree of
Bachelor of Technology of the 3rd Year in Chemical Engineering

Submitted By

Sujit kumar (22021158)

Under the Guidance of

Dr. Neeraj Chandraker (Associate Professor)

And

Dr. Satyajit Bhattacharjee (Assistant Professor)



**DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)**

May 2025

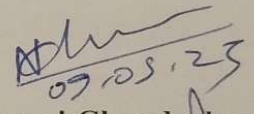
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Certified that the Major Project Report entitled "*Formulation of Liquid handwash*" submitted by Sujit Kumar of B.Tech. 6th Semester, in partial fulfillment of the requirements for the award of degree in Bachelor of Technology (B. Tech) in Chemical Engineering, is according to the students their own investigation carried out by them in the Department of Chemical Engineering, School of Studies of Engineering & Technology, GGV, during the session 2024-25.

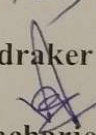
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A Review on
“REACTIVE EXTRACTION OF CITRIC ACID”

A Project Report

In Partial Fulfilment of the Requirement for Award of Degree of
Bachelor of Technology of the 3rd Year in Chemical Engineering

Submitted By

Tejavath Veeranna (22021161)

Under the Guidance of

Dr. Vishnu Prasad Yadav

Assistant Professor



DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWA VIDYALAYA, BILASPUR (C.G.)

May 2025

CERTIFICATE

Certified that the Major Project Report entitled “ **A Review on Reactive Extraction of Citric Acid**” submitted by Tejavath Veeranna of B.Tech.(6th 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 of Engineering & Technology, GGV, during the session 2024-25.

Prof. Amit Jain
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Department of Chemical Engineering
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Dr. Vishnu Prasad Yadav
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ABSTRACT

Citric acid, a widely used organic acid in food, pharmaceutical, and chemical industries, has seen a continuous increase in global demand. Traditional methods for its recovery are often energyintensive and inefficient. This project explores reactive extraction as a more effective alternative for citric acid separation. The study focuses on the use of tri-n-octylamine (TOA) as an extractant in various diluents such as octanol, cyclohexanol, iso-butyl alcohol, and paraffin oil. Experiments were conducted for both physical and reactive extraction, highlighting the superior performance of TOA-based reactive systems. The extraction efficiency improved significantly up to 90%-when TOA was used in combination with suitable diluents. Furthermore, the process was enhanced by back-extraction using sodium carbonate as a stripping agent, enabling solvent recycling. The optimized setup demonstrates a sustainable approach for citric acid recovery, particularly from biomass sources like oil palm empty fruit bunches post-biocatalytic conversion.

Project Report on

This study used Red flower's Leaves of Banana to prepare carboxy Methyl Cellulose (CMC)

Submitted in partial fulfilment of the requirement of Credits in Third year of Bachelor of Technology in Chemical Engineering



Submitted by

Group No:-06

Sandeep kumar

B.tech 6th semester

Date:-09/05/25

Session 2024-25

Guided by: -

Dr. Neeraj Chandrakar

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Co-Guided by: -

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(A central university established by the central university Act, 2009)

CERTIFICATE OF APPROVAL

This is to certify that the project entitled "**Preparation of Carboxy Methyl Cellulose(CMC) from Banana Flower's leaves**" submitted by Sandeep Kumar Roll No(22021151) in partial fulfilment of the requirements of Credits in Third year of **Bachelor of Technology, Chemical Engineering** is a record of Bonafide and original research work carried out by them under our guidance and this project does not include any work which has previously been submitted for the award of other degree, diploma, associate-ship, fellowship, or other similar titles to them. We, further certify that the work reported in this project was carried out independently by the candidate.

Sandeep Kumar

Roll No:-22021151

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

Date: 09/05/25

Approved by

Professor. Amit Jain

Head
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Dr. Neeraj Chandrakar

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