Technical Magazine

CHEMICAL ENGINEERING

(AY-2021-22)

Technical Magazine

Department Of Chemical Engineering,
Gharda Institute of Technology, Lavel.
Academic Year 2021-22

****

Editorial Team

Student Editor: Miss. Pallavi Radaye

Faculty Editor: Prof. Nitish D. Galande

****

Vision of the Chemical Engineering Department:

- "Produce employable graduates through a multidisciplinary approach, equipping them with chemical engineering knowledge and research skills, for the welfare of society."

Mission of the Department

- **M1:** Impart knowledge and understanding of the diverse fields of chemical
- engineering profession through curriculum.
- **M2:** Develop chemical engineering professional and research skills to become
- technically competent professionals.
- **M3**: Inculcate the importance of social and life-long learning.

Program Educational Objectives (PEOs)

- **PEO1:** Graduates of the program will apply chemical engineering principles in Engineering practice.
- **PEO2:** Graduates of the program will have technical or professional careers in Chemical engineering or in the diverse fields of chemical engineering such as Biochemical engineering, energy and environmental engineering etc.
- **PEO3:** Pursue higher study and / or continuously upgrade the knowledge with Personal and professional growth for collective advancement of society.

Programme specific outcomes (PSOs)

POS1: Create Chemical Engineering solutions for problems and processes while taking into account separation operations, reaction kinetics, environmental issues, Waste treatment and, modelling and simulation.

PSO 2: Foster the industrial chemical production process through efficient design and modifications by applying the principles of Chemical Engineering.

PSO 3: Demonstrate responsible professional behaviour by integrating ethical Considerations, promoting safety, communicating effectively, and engaging in

Program Outcomes (POs)

Program Outcomes (POs) are as follows:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, and engineering fundamentals to solve complex chemical engineering problems.
2. **Problem Analysis:** Identify, formulate, and analyze complex engineering problems to reach substantiated conclusions using principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems that meet specified needs with appropriate consideration for public health, safety, and environmental concerns.
4. **Investigation of Complex Problems:** Conduct research-based investigations, including designing experiments, analyzing data, and synthesizing information to provide valid conclusions.
5. **Modern Tool Usage:** Select, apply, and adapt appropriate techniques, resources, and modern engineering tools, including prediction and modeling, to solve complex engineering activities.
6. **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics, 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 society at large through reports, presentations, and documentation.
11. **Project Management and Finance:** Demonstrate knowledge of engineering and management principles to manage projects in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and engage in, independent and lifelong learning in the broadest context of technological change.

INDEX

(Technical Magazine 2021-22)

Message from the Principal

It gives me immense pleasure to present the **Technical Magazine** of the **Chemical Engineering Department** for the academic year 2021-22. This magazine is a reflection of the dedication, hard work, and innovative spirit of our students, faculty, and staff. It is a platform where we celebrate achievements, breakthroughs, and the relentless pursuit of knowledge.

In a world of constant change, the role of Chemical Engineers becomes increasingly vital in solving real-world problems such as sustainability, environmental challenges, and process optimization. Our department has consistently demonstrated excellence in these areas, and this magazine is a testament to the innovative ideas and research undertaken by our students.

I extend my heartfelt congratulations to all the contributors and participants, and I encourage every student to continue exploring, innovating, and striving for excellence. Let this magazine inspire future endeavors and set new benchmarks for success.

Dr. Sandip Gharat
I/C Principal
Gharda Institute of Technology

****

Message from the Head of the Department

Dear Readers,

It is a great pleasure to present the **Technical Magazine 2021-22**, a platform that highlights the academic and technical excellence of our students. This magazine serves as a medium to showcase innovative ideas, research contributions, and advancements in the field of chemical engineering.

Our department is committed to fostering a learning environment that encourages creativity, problem-solving, and industry-oriented knowledge. The dedication and enthusiasm of our students and faculty members in bringing this magazine to life are truly commendable.

I extend my sincere appreciation to the editorial team, contributors, and all those who have worked tirelessly to make this publication a success. I hope this magazine inspires students to strive for excellence and contribute to the ever-evolving world of science and technology.

Best wishes for a bright future!

Dr. Shyam P. Tekade
Head, Department of Chemical Engineering

****

Message from the Faculty Editor

It is my immense pleasure to present the **Technical Magazine** for the academic year **2021-22**. This magazine encapsulates the remarkable academic progress, achievements, and innovative research work of our students and faculty members in the field of chemical engineering.

Our department has always been committed to fostering an environment that encourages critical thinking, practical skills, and creativity. The technical magazine is a testament to the hard work and dedication of our students who continue to excel in various academic and co-curricular activities. It is not just a collection of achievements, but a symbol of the continuous learning culture we promote.

As faculty, we take pride in shaping the engineers of tomorrow and guiding them towards research, innovation, and industry excellence. I hope this magazine inspires future generations to push boundaries, explore new ideas, and contribute meaningfully to the world of chemical engineering.

Prof. Nitish D. Galande
Faculty Editor, Department of Chemical Engineering
Gharda Institute of Technology

****

Message from the Student Editorial Board

Dear Readers,

It gives me immense pleasure to present the Technical Magazine 2021-22, a platform that showcases the knowledge, creativity, and technical excellence of our students. This magazine reflects the hard work and dedication of budding engineers who have contributed innovative ideas, research, and insightful articles.

In a rapidly evolving world, staying updated with technological advancements is crucial. Through this magazine, we aim to inspire students to explore new frontiers in science and engineering. I sincerely appreciate the efforts of the entire editorial team, faculty members, and contributors who made this edition possible.

I hope this magazine enriches your knowledge and encourages you to think beyond textbooks. Let us continue this journey of learning and innovation together.

Happy Reading!

Miss Pallavi Radaye
Student Editorial Board
Technical Magazine 2021-22

****

Technical Magazine

Department Of Chemical Engineering,
Gharda Institute of Technology, Lavel.
Academic Year 2021-22

****

Editorial Team

Student Editor: Miss. Pallavi Radaye

Faculty Editor: Prof. Nitish D. Galande

****

PROCESS INTENSIFICATION OF EXTRACTION OF AZADIRACHTIN FROM NEEM SEEDS"

Ms. Gauri Shinde, Mr. Krutik Navale,Ms. Deesha Narvankar

ABSTRACT

Compound called Azadirachtin, a tetranorterprnoid belonging to Meliaceae family of Neem tree(Azadirachta indica) is studied. Having molecular formula of C35H44O16 shows antifungal, antibacterial, pesticidal properties. It is present in all parts of neem tree in small fractions. Being extracted from nature it shows no any adverse effect on soil, water and human beings. It is great replacement for chemical pesticides. Azadirachtin is extracted using various methods like maceration, percolation, Soxhlet apparatus, hot pressure method, sonicator, etc. These methods are conventional, yield obtained is small. As use of extracting solvent, temperature-pressure, residence time plays important role. In this paper we are extracting our compound using Supercritical CO2. As temperature and pressure are maintained at critical conditions of CO2 it will not damage the cellular activity of our thermolabile compound. While having both liquid and gas like properties it increases the mass transfer rate and solvating power for maximum extraction of Azadirachtin. Various other co-solvents can be incorporated along with SC-CO2 like methanol, hexane, toluene, acetone, etc. The extracted compound then can be used for further use.

Keyword: Azadirachtin, Supercritical CO2 extraction, Co-Solvent as methanol.

MODELLING OF GAS-LIQUID-SOLID FLUIDIZED BED USING CFD

Mr. Aniket Subhash Dhanawade, Mr. Saurabh Satish Nikam, Mr. Shivam Sanjay Bhojane

ABSTRACT

Gas–liquid-solid fluidized beds are used extensively in the refining, petrochemical, pharmaceutical, biotechnology, food, and environmental industries. Some of these processes use solids whose densities are only slightly higher than the density of water. Because of the good heat and mass transfer characteristics, three-phase fluidized beds or slurry bubble columns have gained considerable importance in their application in physical, chemical, petrochemical, electrochemical, and biochemical processing. Gas-liquid-solid (three-phase) fluidized beds have good heat and mass transfer characteristics. We will study the modelling of three-phase fluidized beds using CFD software (ANSYS 14.0). The project is divided into three parts Importance of three-phase fluidized bed, CFD methodology, and validation of CFD result with the experimental value from literature or by performing experiments in the laboratory. Parameters studied will be pressure drop, gas hold up, and bed expansion. We can save experimental costs by performing simulations and reduces risk factors as well.

Key Words:
Three-phase fluidized bed, CFD modeling, ANSYS 14.0, gas-liquid-solid, heat transfer, mass transfer, pressure drop, gas holdup, bed expansion, simulation.

STUDY OF GAS-SOLID FLUIDISED BED USING CFD:2D & 3D

Mr. Akshay Prakash Ghanekar ,Mr. Sunil Mahadev Pawar, Mr. Aniket Manohar Chalke

ABSTRACT

Gas-Solid fluidized bed is widely used in industries. In this project we will study fluidization phenomena of gas-solid particles using CFD software (Ansys 14.0). 2D & 3D geometry will be used to carry out simulations. Simulations results will be validated with experimental data from literature or performing experiments in laboratory. Parameters such as pressure drop, bed height and particle size will be varied in
simulations.

Keywords: Fluidized bed, Fluidization, CFD.

ANALYSIS OF DISSOLVED OXYGEN AND ORGANIC MATTER CONTENT OF FLOWING STREAM AND IT'S TREATMENT FOR ORGANIC MATTER REMOVAL.

Vikram Shantaram Nimbare, Omkar Shinde, Pritam More

ABSTRACT:

The analysis of dissolved oxygen (DO) and organic matter content in flowing streams is crucial for assessing water quality and ecosystem health. Organic pollutants from industrial and domestic sources reduce DO levels, affecting aquatic life and environmental balance. This study focuses on evaluating the DO levels and organic matter content in a flowing stream, identifying pollution sources, and exploring treatment methods for organic matter removal. Various physical, chemical, and biological treatment techniques, including aeration, coagulation, and biofiltration, are considered to improve water quality. The study aims to optimize treatment processes to enhance DO levels and reduce organic contaminants, ensuring a sustainable and eco-friendly approach to water purification. Effective treatment methods not only restore the ecological balance of water bodies but also promote the safe reuse of water for various applications.

Keywords:
Dissolved oxygen, organic matter, water quality, pollution, wastewater treatment, aeration, biofiltration, coagulation, environmental sustainability, stream purification.

EXTRACTION OF ESSENTIAL OIL FROM ALMOND

Miss. Manasi Narayan Madav, Mr. Rohit Jotiram Mane, Mr. Vishal Vilas Phalaskar

ABSTRACT

Essential oils extracted from almonds have significant applications in the food, pharmaceutical, and cosmetic industries due to their therapeutic and aromatic properties. This study focuses on the extraction of essential oil from almonds using different techniques such as steam distillation, solvent extraction, and cold pressing. The efficiency of these methods is evaluated based on yield, purity, and chemical composition. Factors like temperature, pressure, and extraction time play a crucial role in optimizing the process. The extracted oil is analyzed for its physicochemical properties, including aroma, viscosity, and bioactive compounds. The study aims to determine the most efficient and sustainable extraction technique for obtaining high-quality almond essential oil. This research contributes to enhancing the commercial viability of almond oil extraction while promoting eco-friendly and cost-effective methods.

Keywords:
Essential oil, almond oil, extraction techniques, steam distillation, solvent extraction, cold pressing, bioactive compounds, yield optimization, sustainability, commercial applications.

DESORPTION STUDIES FOR LOW COST ADSORBENTS

Mr. Jayraj Sharad Perane, Mr. Harshad Somnath Jagtap, Mr. Suraj Sanjay Dhamak,

ABSTRACT

Adsorption is a highly effective method for removing pollutants from wastewater due to its simplicity, cost-effectiveness, and high removal efficiency. However, to enhance its environmental and economic feasibility, the regeneration and reuse of adsorbents are crucial. This study reviews various techniques used for the recovery of adsorbates and the regeneration of adsorbents, ensuring their repeated use. Methods such as solvent washing, chemical and electrochemical treatments, and thermal regeneration are explored for their effectiveness in restoring adsorbent capacity. The study highlights the advantages and limitations of each method, focusing on optimizing regeneration processes to improve sustainability and cost efficiency. By enabling the reuse of adsorbents, the overall waste generation is reduced, making adsorption a more eco-friendly solution for wastewater treatment.

Keywords:
Adsorption, regeneration, adsorbent reuse, pollutant removal, wastewater treatment, recovery methods, solvent washing, chemical regeneration, thermal treatment, sustainability.

"SYNTHESIS OF ALKYD RESINS FROM POLYETHYLENE TEREPHTHALATE"

Miss Aakanksha Mukesh Mhatre,Mr. Nandakumar Vijay Gurav

ABSTRACT

Chemical recycling of polyethylene terephthalate (PET) has gained significant attention due to its potential as a valuable raw material for various chemical processes. The primary goal of PET recycling is to maximize monomer yield while reducing reaction time and maintaining mild reaction conditions. In this study, post-consumer PET bottles were depolymerized through glycolysis using glycols such as diethylene glycol. The process utilized an organic solvent to minimize reactant usage and operate at lower temperatures and pressures. Zinc acetate was employed as a phase-transfer catalyst to enhance the reaction efficiency. The glycolytic PET products (oligomers) were further reacted with maleic anhydride, phthalic anhydride, and propylene glycol to synthesize unsaturated polyester resins. These resins have applications in paints, varnishes, and clear coatings. The study highlights glycolysis as a fast and effective method for PET depolymerization, ensuring sustainable recycling with enhanced efficiency.

Keywords:
PET recycling, glycolysis, depolymerization, alkyd resins, polyester resins, zinc acetate, post-consumer PET, phase-transfer catalyst, sustainability, waste valorization.

"DEGRADATION OF MORDANT DYES USING COMBINATION OF ADVANCE OXIDATION PROCESS."

MR.Ambre Shubham Santosh, MR.Waje Aditya Ashok, MR.Pachakale Surendra Suresh

ABSTRACT

Wastewater from the textile industry contains unutilized dyes that pose serious environmental concerns due to their intense color and high toxicity. These pollutants can have acute or chronic effects on exposed organisms. Conventional treatment methods often face limitations in efficiency and processing. This study focuses on developing novel degradation techniques using ultrasound and hydrodynamic cavitation in combination with oxidants. Additionally, process intensification is explored by integrating cavitation effects with advanced oxidation processes such as photocatalysis, ozone treatment, hydrogen peroxide (H_2O_2), and Fenton chemistry. The use of various additives is also investigated to enhance the efficiency of dye degradation. These advanced treatment approaches aim to provide a more effective and sustainable solution for textile wastewater treatment, ensuring reduced environmental impact and improved pollutant breakdown.

Keywords:
Degradation, Fenton chemistry, ozone treatment, photocatalysis, hydrodynamic cavitation, wastewater treatment, textile dyes, oxidation processes, process intensification, pollutant removal.

MICROENCAPSULATION OF FRAGRANT OIL VIA IN SITU POLYMERIZATION BY USING MELAMINE-FORMALDEHYDE"

Mr. Akash Suresh Ghadage., Mr. Shubham Rajesh Devalekar. Mr. Shubham Ramesh Kherade.

ABSTRACT

Microencapsulation is a technique used to protect and control the release of active ingredients. In this study, fragrant oil was microencapsulated using in situ polymerization with melamine-formaldehyde resin as the encapsulating material. The process involved the formation of a polymeric shell around the fragrant oil droplets, ensuring stability and controlled release. Various parameters such as pH, reaction temperature, and stirring speed were optimized to obtain uniform microcapsules with high encapsulation efficiency. The resulting microcapsules were analyzed for their morphology, size distribution, and release characteristics. The encapsulated fragrant oil exhibited prolonged fragrance retention and enhanced stability, making it suitable for applications in cosmetics, textiles, and household products. This study demonstrates the effectiveness of melamine-formaldehyde microcapsules in preserving and controlling the release of volatile compounds.

Keywords:
Microencapsulation, fragrant oil, in situ polymerization, melamine-formaldehyde, controlled release, encapsulation efficiency, fragrance retention, stability, polymeric shell, volatile compounds.

Mass Transfer Study And Cfd Simulation In Dual Impeller Ruston Turbine In Stirred Tank Reactor

Shantanu Shailesh Chavan, Manal Mubeen Khot, Sanket Dhondiram Kokare

ABSTRACT

Mass transfer plays a crucial role in the performance of stirred tank reactors, especially in chemical and biochemical industries. This study focuses on the mass transfer characteristics and Computational Fluid Dynamics (CFD) simulation of a dual-impeller Rushton turbine in a stirred tank reactor. The Rushton turbine, known for its efficient radial flow, is analyzed for its hydrodynamic behavior, power consumption, and gas-liquid mass transfer performance. The study includes experimental validation and CFD modeling using ANSYS Fluent to evaluate parameters such as flow patterns, turbulence, gas dispersion, and oxygen transfer rate. The effect of impeller spacing, speed, and fluid properties on mass transfer efficiency is also investigated. The CFD results provide insights into optimizing reactor design for improved mixing and mass transfer. The findings help in scaling up stirred tank reactors for industrial applications.

Keywords:
Mass transfer, CFD simulation, Rushton turbine, stirred tank reactor, hydrodynamics, gas-liquid dispersion, oxygen transfer rate, ANSYS Fluent, mixing efficiency, reactor optimization.

4o

HYDRODYNAMIC STUDY AND CFD SIMULATION IN RECTANGULAR PHOTO BIO REACTOR

Prathamesh N. Gawande, Yogesh Iswalkar, Saim Gite

ABSTRACT

Photo-bioreactors (PBRs) are essential for cultivating microalgae and other photosynthetic organisms for biofuel production, wastewater treatment, and biopharmaceutical applications. This study focuses on the hydrodynamic behavior and Computational Fluid Dynamics (CFD) simulation of a rectangular photo-bioreactor. Using ANSYS Fluent, fluid flow, light distribution, and gas-liquid interactions are analyzed to optimize reactor performance. The study investigates key parameters such as velocity profiles, turbulence, shear stress, and gas hold-up, which significantly impact microalgae growth and CO_2 mass transfer. Experimental validation is performed to ensure model accuracy. Results help in improving mixing efficiency, minimizing dead zones, and enhancing light penetration for maximum biomass production. The CFD analysis provides valuable insights into optimizing photo-bioreactor design for large-scale applications in biofuel and bioprocess industries.

Keywords:
Photo-bioreactor, CFD simulation, hydrodynamics, gas-liquid interaction, ANSYS Fluent, microalgae cultivation, mass transfer, turbulence, light distribution, reactor optimization.

DEGRADATION OF TETRAZINE DYES USING COMBINATION OF ADVANCE OXIDATION PROCESS."

MR. Sachin Karbhari More., MR. Chetan Damodar Jadhav.MR. Rushikesh Shiledar.

ABSTRACT:

Wastewater from the textile industry, containing unutilized dyes, poses a severe environmental threat due to its intense color and high toxicity, leading to both acute and chronic effects on exposed organisms. Conventional treatment methods have limitations, necessitating the development of novel degradation techniques. This study explores the use of ultrasound and hydrodynamic cavitation combined with oxidants to enhance dye degradation. Additionally, the integration of cavitation effects with advanced oxidation processes such as photocatalysis, ozone treatment, hydrogen peroxide (H_2O_2), and Fenton chemistry is investigated for process intensification. The study also examines the role of different additives in improving degradation efficiency. These advanced techniques offer a sustainable and efficient approach for treating dye-laden wastewater, reducing environmental impact.

Keywords: Degradation, Acoustic Cavitation, Photocatalysis, Hydrodynamic Cavitation, Advanced Oxidation Processes.

EXPERIMENTAION ON FIXED BED ABSORBER FOR VARIOUS PARAMETERS AFFECTING ADSORPTION

Mr. Sagvekar Shubham Shashikant.,Mr. Shahaji Shoaib Noor Mohammad.

ABSTRACT:

Fixed-bed adsorption is widely used in industrial wastewater treatment due to its efficiency in pollutant removal. This study evaluates the potential of new adsorbent materials for the recovery of Au(III) from real wastewater in a fixed-bed column under dynamic conditions. The adsorbent, Amberlite XAD-7 resin functionalized with L-glutamic acid, was tested for adsorption efficiency based on key parameters such as effluent volume, adsorbent quantity, and bed height. Experimental data were analyzed using Bohart–Adams, Yoon–Nelson, Thomas, and Clark models to understand the adsorption mechanism. Desorption studies were conducted using 5% HNO_3 over five cycles, with desorption efficiency decreasing from 84% to 34%. Additionally, the study explored the use of activated carbon derived from sugarcane bagasse for phenol removal in a fixed-bed column. Adsorption isotherms were analyzed using Langmuir and Freundlich models, with the Langmuir model providing the best fit. Breakthrough curves, bed capacity, and adsorption dynamics were also evaluated.

Keywords: Fixed-bed adsorption, Au(III) recovery, Amberlite XAD-7, sugarcane bagasse, Langmuir isotherm, breakthrough curves, desorption efficiency.

Editorial Team:

- **Editor-in-Chief:** Prof. Nitish Galande
- **Student Coordinators:** Miss. Pallavi Radaye

Department of Chemical Engineering

Academic Year 2021-22.