Technical Magazine

CHEMICAL ENGINEERING

(AY-2024-25)

GHARDA INSTITUTE OF TECHNOLOGY
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Technical Magazine

Department Of Chemical Engineering,
Gharda Institute of Technology, Lavel.
Academic Year 2024-25

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Editorial Team

Student Editor: Miss. Vaishnavi Deshmukh

Faculty Editor: Prof. Nitish D. Galande

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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.

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Message from the Principal

It gives me immense pleasure to present the **Technical Magazine** of the **Chemical Engineering Department** for the academic year 2024-25. 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. Pramod Patil

Principal

Gharda Institute of Technology

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Message from the Head of the Department

It is with great pride and enthusiasm that I present to you the **Technical Magazine** of the **Chemical Engineering Department** for the academic year 2024-25. This magazine serves as a reflection of the collective efforts, academic brilliance, and innovative endeavors of our students and faculty.

As we move towards a more sustainable and technologically advanced future, the role of chemical engineers becomes even more critical in addressing global challenges. Our department has always emphasized a strong foundation in fundamental chemical engineering principles while fostering creativity and problem-solving skills to meet the demands of an ever-evolving industry.

This magazine showcases our department's achievements, research, and various student activities that contribute to both academic and professional growth. I encourage all students to continue their pursuit of knowledge, strive for excellence, and embrace the opportunities to innovate and make a positive impact on society.

Dr. Sunil Jayant Kulkarni

Head, Department of Chemical Engineering

Gharda Institute of Technology

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Message from the Faculty Editor

It is my immense pleasure to present the **Technical Magazine** for the academic year **2024-25**. 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

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Message from Student Editorial Coordinator

Dear Readers,

It is a privilege to present the latest edition of our **Technical Magazine** for the academic year **2024-25**. This magazine showcases the dedication, innovation, and academic excellence of our **Chemical Engineering Department**. Through research, industry collaborations, and student achievements, we continue to push the boundaries of knowledge and technical expertise.

Being a part of the editorial team has been an enriching journey. I sincerely appreciate the hard work of my fellow students, faculty members, and contributors who have made this edition possible. Their passion and commitment ensure that this magazine serves as an inspiring platform for knowledge sharing.

I hope this edition ignites curiosity, fosters learning, and encourages everyone to strive for excellence. Let's continue exploring new horizons and making meaningful contributions to the field of **Chemical Engineering**.

Ms. Vaishnavi Deshmukh
Student Editorial Coordinator

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Faculty Editor: Prof. Nitish D. Galande

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Production of Biodiesel Using KOH-Bentonite Clay Catalyst

Ghosalkar Amita K.*[1], Kambale Disha S., Pachangale Sayali S., Pawar Sanjana A.
[1]Affiliation of authors: Department of Chemical Engineering, Gharda Institute of Technology,Lavel .India.

Abstract

The increasing demand for diesel due to rapid population growth poses a risk of fossil fuel depletion. Biodiesel has emerged as a sustainable alternative to conventional diesel. This study focuses on the production of biodiesel from waste cooking oil (WCO) through transesterification using a heterogeneous catalyst derived from bentonite clay. The research investigates the impact of catalyst usage on reaction efficiency by comparing reactions with and without the catalyst and evaluating the effectiveness of regenerated catalyst. Extensive literature has explored catalyst synthesis from various sources, optimizing reaction conditions for improved biodiesel yield. This project aims to contribute to the ongoing research by analyzing transesterification reactions at different molar ratios and assessing catalyst reusability. The study provides insights into the role of bentonite-based catalysts in biodiesel production, enhancing process sustainability and efficiency.

Keywords: Catalyst, Bentonite powder, Transesterification, Waste Cooking Oil, Biodiesel Production.

Study of Fluidized Bed Experimental and Simulation

Kondhalkar Shreyash Dhanaji*[1]., Lad Gaurav Bharat[1]., Mohite Aryan Anil[1]., Palkar Amar Pradip[1].

[1]Affiliation of authors: Department of Chemical Engineering, Gharda Institute of Technology, Lavel-Khed, India.

Abstract

This study explores fluidized bed behavior through a combination of experimental analysis and computational fluid dynamics (CFD) simulations. Fluidized beds are widely utilized in industries such as chemical processing, gasification, and pharmaceuticals due to their superior mixing and mass transfer characteristics. The experimental phase involves constructing a laboratory-scale fluidized bed apparatus, systematically varying parameters like particle size, bed height, and gas flow rate. Key measurements, including bed expansion, pressure drop, and particle velocity, offer insights into fluidization dynamics.

In parallel, CFD simulations using a multiphase flow model replicate experimental conditions. The Eulerian-Lagrangian approach effectively captures fluid-solid interactions, and simulation results are validated against experimental data. Findings indicate that the CFD model accurately predicts bed behavior under diverse operating conditions, emphasizing the importance of particle-fluid and particle-particle interactions. This research enhances fluidized bed design and scalability, contributing to improved efficiency in industrial applications.

Keywords: Computational Fluid Dynamics, Fluidized Beds, Multiphase Flow, Ansys, Fluid-Solid Interactions.

Removal of Dye by Using Natural Adsorption

Dalavi Sujal Sunil*[1]., Rajeshirke Suyash Deepak[1]., Sagvekar Jeevan Shrikrushna[1]., Sakpal Aditya Santosh[1].

[1]Affiliation of authors: Department of Chemical Engineering, Gharda Institute of Technology, Lavel-Khed, India.

ABSTRACT

Methylene blue (MB) is a widely used cationic dye, commonly applied in textile, paper, and leather industries for coloring purposes. However, MB is environmentally persistent, toxic, carcinogenic, and mutagenic, making its removal from wastewater a critical environmental and health concern. The discharge of MB-containing wastewater into groundwater and surface water poses a significant threat to both human health and aquatic ecosystems. At doses greater than 5 ml/kg, MB can induce serotonin toxicity in humans, adding to its hazardous nature. Numerous methods have been proposed for the removal of MB from wastewater, including chemical, biological, and adsorption-based techniques. This review synthesizes findings from approximately 240 research articles on various decontamination strategies for MB dye. The study highlights the drawbacks of chemical methods, such as the generation of secondary pollutants, and the limitations of biological methods, which suffer from enzyme sensitivity to pH. Adsorption technology has shown promise as a more effective and sustainable solution. Future research directions are also discussed.

Keywords: Methylene Blue, Dye Removal, Wastewater Treatment, Toxicity, Adsorption Technology, Decontamination Strategies.

Comparison of Effectiveness of Acoustic and Hydrodynamic Cavitation for Degradation of Sunset Yellow Dye

Sakpal Chandan Suhas*[1]., Patil Durvesh Dayanand[1]., Patil Vivek Dattatray[1]., Shelar Hitesh Rajendra[1].

[1] Department of Chemical Engineering, Gharda Institute of Technology, Lavel-Khed, India.

ABSTRACT

Dyes are aromatic synthetic compounds widely used across various industries, including textiles, plastics, pharmaceuticals, paper, paint, and food. However, the wastewater generated by these industries, which is often laden with dyes, poses significant threats to human health and environmental sustainability. Conventional methods for dye removal present various challenges, including inefficiencies and high chemical usage. This project aims to develop a novel degradation approach using ultrasound cavitation for the removal of Sunset Yellow dye. Ultrasound cavitation utilizes high-energy zones created by the collapse of microscopic bubbles, which can effectively break down complex dye molecules with minimal chemical intervention. This method holds significant promise in efficiently degrading dyes while reducing environmental impact. By exploring ultrasound cavitation as an alternative to conventional techniques, this project seeks to provide sustainable solutions for dye-laden wastewater treatment, contributing to enhanced environmental protection and improved public health outcomes.

Keywords: Ultrasound Cavitation, Dye Degradation, Sunset Yellow, Wastewater Treatment, Environmental Protection.

Hydrogen Generation Studies in Aluminium Water Reaction in Presence of Gallium

Ahmed Mubin Burud[1]., Vaishnavi Shivaji Deshmukh[1]., Ebrahim Abdul Aziz Turuk[1].

[1] Department of Chemical Engineering, Gharda Institute of Technology, Lavel-Khed, India.

ABSTRACT

The in-situ hydrogen generation through water splitting reaction using waste aluminium wires has been studied in presence of room temperature sodium hydroxide (NaOH). Hydrogen is a promising alternative energy resource to conventional fuels, including fossil fuels. Utility of aluminium wire. However scrap remains un-recycled and ends up in municipal solid waste landfills. It is known that aluminium related reactions may be problematic for landfill operations by generating undesired heat and gasses. Aluminium produces hydrogen as it reacts readily with water at room temperature to form sodium hydroxide. In most cases it may not conventionally take place due to the presence of aluminium hydroxide that naturally coats the materials preventing it from direct contact with water. NaOH solution is added into the water to promote hydrogen production afterwards. This study focuses on the production of hydrogen gas through the reaction of aluminium powder with sodium hydroxide (NaOH) in varying concentrations, utilising industrial wastewater as the reaction medium. The experiment was designed to explore the effect of NaOH concentration (1 N and 2 N) and aluminium powder dosage (0.1 g and 0.2 g) on hydrogen production efficiency and reaction kinetics. Aluminium powder, with its high surface area, was selected to enhance the hydrogen generation rate, while NaOH served as the activator, breaking down the protective oxide layer on aluminium.

Keywords : Hydrogen generation, Waste aliminium, Sodium hydroxide, Water splitting

An Investigation into the Effect of Effluent Discharge on Quality Parameters of Vashishthi & Jagbudi River

Suyash Pradip Desai[1]., Chinmay Nitin Jadhav[1]., Nayan Dattatray Mane[1]., Jaitkumar Manwar[1].

[1]Department of Chemical Engineering, Gharda Institute of Technology, Lavel-Khed, India.

Abstract:

This study investigates the impact of effluent discharge on the water quality of the Vashishthi and Jagbudi rivers, which are critical water sources for the surrounding communities. The research focuses on analyzing various quality parameters such as pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), and concentrations of heavy metals, before and after the discharge of industrial effluents. Samples were collected from several locations along the rivers, both upstream and downstream of the discharge points. The collected data revealed significant variations in the water quality parameters, highlighting the detrimental effects of untreated effluents on aquatic ecosystems. The study aims to raise awareness about the importance of efficient wastewater treatment and its role in maintaining the health of water bodies. The findings also provide recommendations for local authorities and industries to implement better effluent management practices to protect the rivers and ensure sustainable water resources for the region.

Keywords: Effluent Discharge, Water Quality, Vashishthi River, Jagbudi River, Heavy Metals, BOD, COD.

Editorial Team:

- **Editor-in-Chief:** Prof. Nitish Galande
- **Student Coordinators:** Ms Vaishnavi Deshmukh

Department of Chemical Engineering

Academic Year 2024-25.