Report on Recent Research Topics in Chemistry
Department of Chemistry
Krishnagar Women's College

Introduction

This report summarizes recent research topics explored by the Department of Chemistry at Krishnagar Women's College. The research spans a range of topics including advanced materials for water filtration, the role of nuclear chemistry in energy and medicine, polymer synthesis and properties, and the application of metal complexes and chelating ligands in medicine. Each study aims to address significant challenges and explore novel solutions within their respective fields.

Course Overview

The Department of Chemistry at Krishnagar Women's College has facilitated an advanced project-based course for 6th Semester Chemistry (Honors) students. This course provides students with an opportunity to engage deeply in cutting-edge research and practical applications in the field of chemistry. The projects undertaken by the students cover a diverse range of topics, including carbon materials for water filtration, nuclear chemistry, polymer synthesis, metal complexes in medicine, and self-healing hydrogels. The focus is on developing research skills, enhancing scientific understanding, and applying chemistry concepts to real-world problems.

Objectives

1. ***To Develop Research Skills and Methodologies***
    - Equip students with the skills necessary to design, conduct, and analyze scientific experiments.
    - Provide experience in using advanced laboratory techniques and instrumentation.
2. ***To Promote Critical Thinking and Problem-Solving Abilities***
    - Encourage students to approach scientific problems with a critical mindset and develop innovative solutions.
    - Facilitate the application of theoretical concepts to practical scenarios.

3. ***To Foster Collaboration and Communication Skills***
    - Provide opportunities for students to collaborate with peers, share ideas, and work as part of a research team.
    - Enhance students' ability to communicate scientific concepts and findings effectively through written reports and presentations.
4. ***To Prepare Students for Advanced Studies and Professional Careers***
    - Prepare students for further academic research or professional roles in chemistry and related fields.
    - Develop competencies that are valuable for careers in industry, academia, and research institutions.
5. ***To Address Current Challenges in Chemistry***
    - Focus on projects that address pressing issues such as water purification, sustainable materials, medical applications, and environmental impacts.
    - Promote the development of new technologies and materials that can contribute to solving global challenges.

Research Topics and Participants

S. No.	Title of the Project	Student Name
1	Carbon Material for Water Filtration	Aditi Sarkar
2	Nuclear Chemistry - Application and Effects on Biosphere	Amrita Das
3	Synthesis of Different Types of Polymers	Dipanwita Biswas
4	Metal Complexes and Chelating Ligands in Medicine	Shreya Ghosh
5	Self-healing Polymers Hydrogel: A Highly Functional Material for Biomedical Applications	Supriya Ghosh
6	Structure and Properties of Different Types of Polymers	Sangita Halder

Project Submission Date: 1st August, 2023

Methodology

Each research topic involved a detailed theoretical study supported by practical experiments where applicable. The methodologies included:

- **Literature Review**: Comprehensive reviews of existing research to establish a foundation for new studies.
- **Experimental Work**: To become familiar with laboratory experiments and synthesis procedures to validate theoretical concepts and test material properties.
- **Data Analysis**: Evaluation of experimental data to draw conclusions and propose future research directions.

Findings

- Activated Carbon (AC), Carbon Nanotubes (CNTs), and Graphene are effective for water filtration due to their adsorption capabilities and efficiency in removing various contaminants.
- Nuclear power provides significant energy with minimal carbon emissions; radioactive isotopes are crucial for medical imaging and treatment, though radioactive waste management and potential accidents are challenges.
- Condensation polymerization produces step-growth polymers like nylon and Bakelite. Copolymers combine multiple monomers to create materials with varied properties.
- Metal complexes, such as Cisplatin and gadolinium-based agents, are used in cancer treatment, detoxification, and MRI imaging, with ongoing research in targeted drug delivery and immunotherapy.
- Self-healing hydrogels with hydrophilic monomers and dynamic interactions are valuable in tissue engineering, wound healing, and drug delivery due to their autonomous repair capabilities.
- Polymers are common in everyday items and biological substances, with properties influenced by their structure and monomer type.

Outcomes

1. **Enhanced Understanding**: The research highlights advancements in material science, specifically in water filtration and polymer applications.
2. **Practical Applications**: Findings offer potential solutions to real-world challenges, including improved water purification methods and advanced medical treatments.
3. **Future Research Directions**: Identified areas for further investigation include reducing production costs for advanced materials, improving the stability of new polymers, and developing more efficient and targeted therapeutic applications.

Conclusion

The research conducted by the Department of Chemistry at Krishnagar Women's College has provided valuable insights into the development and application of advanced materials and technologies. Each study addresses critical issues and proposes innovative solutions, contributing to the broader scientific understanding and practical applications in environmental science, medicine, and material chemistry.

Recommendations

1. **Interdisciplinary Collaboration**: Foster more collaborative research efforts across different scientific disciplines to tackle complex problems.
2. **Cost Reduction**: Focus on reducing production costs for advanced materials like CNTs and graphene to enhance their practicality and accessibility.
3. **Enhanced Research**: Continue exploring new applications and improvements in material science, including biodegradable polymers and targeted drug delivery systems.