K.K. Wagh Education Society's
K.K. Wagh Institute of Engineering Education and Research, Nashik.
Chemical Engineering Department
Vol.: 3, Issue:2
TECHNICAL NEWS LETTER

July 2023 - December 2023

The Department of Chemical Engineering was established in 1999 with the objective of creating a center of excellence in Chemical Engineering, with an annual intake of 60 students. The department has been accredited twice by the National Board of Accreditation (NBA), AICTE, New Delhi and got the NBA extent ion for 3 years from July 2022 to June 2025. The department boasts experienced faculty members with several years of academic expertise and veteran supporting staff with strong research interests in both conventional and emerging areas of Chemical Engineering. Emphasizing continuous knowledge enhancement, the department has been sponsoring faculty members for postgraduate and research programs in recent years. It is equipped with state-of-the-art infrastructure and laboratories designed to meet the requirements of the university syllabus. Additionally, the department has an adequate number of computers with the latest configurations and internet facilities. To support teaching and learning, the department provides advanced computational tools, including professional software such as UNISIM, DWSIM, BricsCAD, and MATLAB. It also maintains an in-house library with reference books for all subjects and a comprehensive Chemical Engineering encyclopedia.The department has an excellent track record of academic results. Students have secured top ranks in university examinations and achieved success in competitive exams such as GATE, GRE, and others. They have also been recruited by leading national and international Chemical industries. In addition to focusing on basic sciences and engineering subjects, the department encourages students to participate in various national events such as project exhibitions, paper presentations, model-making competitions, and sports activities. Association of Chemical Engineering Students (ACES), a student's association, functions in the department and provides strong platform for overall development of the students. The students get a chance to interact in Seminars, Workshops, Cultural Programmes, Expert Lectures on various topics like Personality Development, Preparation for competitive examination, study abroad etc. through ACES. The department is proactive for good industry institute interaction. Department has signed MoUs with various industries for mutual benefit. Industry experts are regularly invited, and industrial visits are organized each year to bridge the gap between theory and practice.The department organizes internships for third-year students every year in various renowned industries in the region.

Details of Faculty of Chemical Engineering:

S.N.	Name of Faculty	Qualification	Area of specialization	Designation
1.	Prof. Dr.Venkat S. Mane	Ph.D.	Chemical Engineering	Professor & H.O.D.
2.	Prof. Dr. Suyog N. Jain	Ph.D.	Chemical Engineering	Assistant Professor
3.	Prof. Vijay N. Mawal	Ph.D. Pursuing	Chemical Engineering	Assistant Professor
4.	Prof. Dr.Gaurav B.Daware	Ph.D.	Chemical Engineering	Assistant Professor
5.	Prof. Sandeep N. Derle	Ph.D. Pursuing	Chemical Engineering	Assistant Professor
6.	Prof. Piyush P. Joshi	M.Tech.	Chemical Engineering	Assistant Professor
7.	Prof. Zameer K. Deshmukh	M.Tech.	Chemical Engineering	Assistant Professor
8.	Prof. Tejmal B. Mahale	M.Tech.	Chemical Engineering	Assistant Professor
9.	Dr. Yennam Rajesh	Ph.D.	Chemical Engineering	Assistant Professor
10.	Dr. Neha B. Gautam	Ph.D.	Chemical Engineering	Assistant Professor
11.	Dr. Prashant Kumar	Ph.D.	Chemical Engineering	Assistant Professor

Expert Lectures and Career Guidance Sessions Organized:

- Expert talk on "Cavitation Phenomena for Process Intensification" was delivered by Dr. B. N. Thorat, Professor, ICT, Mumbai, on 4th December 2023.
- Expert talk on "Entrepreneurship" was delivered by Harsh Deodhar, Angel Investment, Investment Banking, Partnership Maverik on 25th November 2023.
- Expert talk on "Energy Conservation and Auditing" was delivered by Mr. Pramod N. Daspute, B.E.E Certified Energy Auditor, Ahmed Nagar on 27th October 2023.
- Expert talk on "Management Principles in Chemical Industry" was delivered by Ms. Shweta Deshmukh, Associate Consultant, Native World, Mumbai on 25th October 2023.
- Expert talk on "Mental Health Awareness" was delivered by Mr. Dattatraya Ahire, Ex. Principal, Govt. ITI and Motivational Speaker, Nashik on 23rd October 2023.
- Expert talk on "Manufacturing of Sulphuric acid" was delivered by Dr. V. G. Pangarkar, Retd. Professor, Chemical Engineering Department, ICT Mumbai on 10th October 2023.
- Expert talk on "Multifunctional Reactors in Chemical Process Industries" was delivered by Mr. Ketan Gandhi, Deputy Manager, Adani New Industries Ltd., Ahmedabad on 16th September 2023.
- Expert talk on "Chemical Equilibrium Concepts in CO_2 Capture and Utilization" was delivered by Ms. Nandini Yadav, Sepadu Academy Pune, on 13th September 2023.

- Expert talk on "Career Opportunities for Chemical Engineers in IT Sector" was delivered by Mr. Vishesh Mahadik, Project Lead, Circle Tech, Pune on 9th September 2023.
- Expert talk on "Overview of Chemical Process Calculations" was delivered by Prof. Dr. Ch.V. Subbarao, MVGRCE(A), JNTU Kakinada, on 5th September 2023.
- Expert talk on "Green Chemistry Spotlight: Ethylene Innovations" was delivered by Dr. V.G. Gaikar, Professor and Ex-VC,BATU, Lonere, on 26th August 2023.
- Expert talk on "Energy and Environment Challenges" was delivered by Mr. C.R. Mohikar, Petro-Project Consultant, Nashik, on 3rd August 2023.
- Expert talk on "World Population Day Guidelines" was delivered by Mr. Vishva Dagalla, Rotaract Club, Lala Lajapatrai College, Mumbai, on 28th July 2023.
- Expert talk on "Exploring Static Mixer Operations and Their Industrial Use" was delivered by Mr. Mahesh Naik, Sr. Manager-Production, Lupin Ltd., Tarapur, Boisar, Dist. Palghar, on 25th July 2023.
- Expert talk on "Introduction to FLACS Software" was delivered by Mr. Ankit Gujrathi and Mr. Pratik Shinde, Gexcon India Pvt. Ltd., Pune, on 5th July 2023.

Industrial Visits :

S.No.	Class	Name of Industry	Date
1.	SY	Meridian Technics , Muslgoan, Sinnar	21/09/2023
2.	TE	Agrisearch India Pvt. Ltd., Nashik..	13/09/2023
3.	BE	United heat transfer, Dindori	24/08/2023
4.		R and D Therm Pvt. Ltd. Nashik	10/08/2023

FDP/ Workshop/STTP attended by Faculty:

- Prof. V. N. Mawal successfully completed an industrial training at SVAAR Process Solutions Pvt., Ltd., Nashik from 18th December 2023 to 1st January 2024.
- Dr. G. B. Daware, Prof. S. N. Derle and Prof. P. P. Joshi successfully completed Industrial Training at Hi-media Laboratory Pvt. Ltd. Nashik from 17th to 31st December 2023.
- Dr. G. B. Daware successfully attended an FDP on "AI in Education: Adaptive Learning & Personalization" organized by Dr. D. Y. Patil Institute of Engineering, Pune from 18th to 22nd December 2023.
- Dr. S. N. Jain, Prof. V. N. Mawal, and Dr. G. B. Daware successfully attended an FDP on "Sustainability in Process Engineering" organized by MIT-WPS, Alandi, Pune from 18th to 22nd December 2023.
- Dr. Prashant Kumar successfully completed a Udemy course (5 Hours) on "The Complete Introduction to LAMMPS" on 27th September 2023.
- Dr. Yennam Rajesh and Dr. Neha B. Gautam successfully attended an STTP on "Advancements in Green Energy Technologies and its Significance in Sustainable development" organized by Bharati Vidyapeeth College of Engineering, Navi Mumbai from 24th to 28th July 2023.

Papers Presented in Conference by Staff and students :

Title of Paper: Modelling and Simulation of Kinetic Parameter using Different Optimization Tools from Pyrolysis of Coconut Shell, Rice Straw, and Wood Waste

Name of Conference: Recent Advances in Biofuels and Biomaterials held at NIT Jalandhar

Names of Authors: Dr. Neha Gautam, Kalpak Shende and Omkar Shinde

Date of Conference: 13th to 14th October 2024

Abstract: This study explores the pyrolysis of different biomass sources to analyze product composition, yield, and potential applications. By comparing various biomasses, the process's feasibility for sustainable energy production is assessed. Kinetic parameters such as activation energy and the pre-exponential factor are determined through modeling and simulation to optimize the reaction system. Pyrolysis efficiently converts biomass into valuable liquid products, including hydrocarbon biofuels and petrochemicals, offering a renewable alternative to fossil fuels.

A kinetic model is developed to describe the pyrolysis process, incorporating two parallel reactions producing solid char and gaseous volatiles. Kinetic parameters are estimated at different temperatures, and optimization is performed using C language to obtain the best values for the reaction system. Experimental results indicate that coconut shells generate a higher amount of gaseous volatiles compared to rice straw and waste biomass.

The experimental findings are validated through simulation, demonstrating strong agreement with predicted values. This study highlights the potential of pyrolysis as a sustainable and scalable method for biomass conversion, paving the way for future advancements in biofuel production and chemical synthesis.

Title of Paper: Silica Extraction from pearl millet husk using alkaline extraction method

Name of Conference: Recent Advances in Biofuels and Biomaterials held at NIT Jalandhar

Names of Authors: Neha Gautam, Rohit Dholi and Shravya Bangera

Date of Conference: 13th to 14th October 2024

Abstract: The extraction of silica from agricultural waste has gained significant interest due to its potential industrial applications. This study focuses on the isolation and purification of silica from pearl millet husk, an abundant byproduct of agricultural processing. The extraction process involves pre-treatment, followed by alkaline extraction to dissolve silica and acid leaching to remove impurities. The extracted silica is systematically characterized using Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), X-ray diffraction

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(XRD), and elemental analysis to determine its composition, structural properties, and purity. Process parameters, including alkaline concentration, reaction temperature, and extraction time, are optimized to enhance silica yield and quality.
The findings demonstrate that pearl millet husk is a viable source of high-purity silica, suitable for applications in reinforcing materials, catalyst supports, and fillers. This study highlights the importance of agricultural waste utilization for sustainable material development and resource recovery.

- **Title of Paper:** Kinetic studies on the conversion of Parthenium Hysterophorus into Silica and their Applications
  Name of Conference: Recent Advances in Biofuels and Biomaterials held at NIT Jalandhar
  Names of Authors: Neha Gautam, Tekchand Bramhankar and Vaibhav Jadhav
  Date of Conference: 13th to 14th October 2024
  Abstract: Parthenium hysterophorus is an invasive weed that poses serious threats to agriculture, livestock, and human health, causing allergic reactions such as dermatitis and asthma. Due to its rapid growth and widespread presence, it has become a significant ecological concern. This study investigates the conversion of Parthenium hysterophorus biomass into valuable silica through pyrolysis and alkaline extraction methods. A kinetic model for primary pyrolysis is developed, focusing on biochar formation, which is rich in carbon and silica. The extraction of silica is optimized by varying NaOH concentrations, followed by acid leaching to enhance purity, with characterization performed using X-ray fluorescence (XRF) analysis. The influence of key parameters such as temperature, residence time, and kinetic behavior is examined using MS-Excel Solver and C language software. The extracted silica, with its controlled particle size, high surface area, and thermal stability, is well-suited for a range of industrial applications, including catalysis, adsorbents, and composite materials. Additionally, the residual biochar, after acid treatment, is activated with alkali hydroxides to produce activated carbon, demonstrating excellent adsorption capacity for environmental remediation and wastewater treatment. This study highlights the potential of Parthenium hysterophorus as a sustainable raw material for high-value product development, contributing to waste management and eco-friendly applications.

- **Papers Published by Staff/Students in SCI/Scopus Journal**
  Title of Paper: $ZnAs_2O_4$'s gas sensing performance
  Name of Journal: Materials Today Proceedings (Elsevier)
  ISSN Number: 2214-7853
  Names of Authors: Yennam Rajesh and Priyanka Shivde
  Abstract: Recently, there has been a lot of discussion about the significance of new materials, such as gas sensing mixed metal oxides (MMO), in monitoring air pollution, home security, public safety, hazardous industrial emissions, and automobile exhaust. The catalyst, $ZnAs_2O_4$, was synthesized via a mechanochemical method (MCh). FTIR, UV-DRS, XRD, and SEM were used to characterize this synthesized catalyst. The average particle size has been identified to be between 25 and 30 nm. $ZnAs_2O_4$'s gas sensing capabilities were investigated in relation to NH_3, CO, H_2S and Cl_2. $ZnAs_2O_4$ material has been found to have considerable gas sensing properties toward highly harmful gases, including H_2S gas emitted by sewage plants and the oil and natural gas industry. It also has superior selectivity, increased sensitivity, and a moderate temperature requirement.

- **Title of Paper:** Silica extraction from bamboo leaves using alkaline extraction method
  Name of Journal: Materials Today Proceedings (Elsevier)
  ISSN Number: 2214-7853
  Names of Authors: Neha Gautam, Yennam Rajesh, Nikhil Kale, Milind Jagtap, Himani Chaudhari and Shraddha Pansare
  Abstract: The silica is most common constituent of bamboo leaves mainly varies from 75.90 to 82.86 %.In this study, silica was extracted from bamboo leaves using an alkaline extraction process. In proximate analysis, bamboo leaves were found to contain significantly more ash (24.5 %) containing 79.28 % silica and low levels of fixed carbon. However, in ultimate analysis, bamboo leaves were found to contain 57.56 % oxygen. The yield and quality of silica were improved by extracting silica from bamboo leaves ash under various operating conditions.A higher concentration of NaOH (2.5 N) resulted in a greater yield of silica (97.73 %).During the alkaline process, an acid leaching treatment was used toremove metal impurities either from bamboo leaves ash or extracted silica. The silica yield increased from 97.73 % to 98.86 % after acid leaching of feed. In an FTIR analysis, Si-O-Si, Si-O, and Si-OH bonds were identified. Modern characterization techniques such as XRF were used to determine the purity of silica. There is a significant difference between the maximum purity of acid leached silica samples (96.13 %) and that of commercial silica samples (95.52 %).As a result of this study, silica that has a wide range of applications in the food and nutrition industries, the pharmaceutical industry, and as a nano-catalyst could be produced.

- **Title of Paper:** Synthesis, characterization and adsorption studies on activated carbon adsorbent synthesized from Kigelia africana for removal of acid blue 113 dye from synthetic solution
  Name of Journal: Materials Today Proceedings (Elsevier)
  ISSN Number: 2214-7853
  Names of Authors: Yennam Rajesh, Hetansha Boricha, Aishwarya Suryavanshi, Abhijeet Gajare and Suyog Jain
  Abstract: The need for waste water treatment, which can be accomplished via adsorbents, is growing today. Adsorbents are inexpensive, environmentally responsible, and made of biodegradable materials that

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can be replenished. In this work, chemical activation is used to create powdered activated carbon from Kigelia africana. The raw material was chosen because this fruit has not been the subject of any significant research on dye removal. It is also a poisonous fruit, abundantly available in nature, has high cellulose content, carbon rich and possesses less ash content thus making it a low cost activated carbon. After activation, the surface area has increased from 5 m^2/g to 400 m^2/g, morphology studies with SEM analysis and also analyzed the functional groups with FT-IR. These properties have made our adsorbent highly efficient for dye removal. The batch adsorption studies have been carried out for the removal of acid blue 113 using various combinations of synthetic dye solution concentrations (50–300 mg/L), adsorbent dosage 0.4–7 g/L), contact time (30–300 min), and pH (2–10). The removal % efficiency and capacity (mg/g) are obtained from this work as 99.79 % and 188.89 mg/g, respectively.

- **Title of Paper:** A photoresistor-based portable digital sensor for rapid colorimetric detection of Arsenic
  Name of Journal: Microchemical Journal (Elsevier)
  ISSN Number: 0026-265X
  Names of Authors: Rajasekhar Ravula
  Abstract: The contamination of water sources with Arsenic from natural and human activities is one of the most critical global issues today. Now more than ever, it is essential to conduct continuous real-time assessments of water quality to identify the presence of Arsenic pollutants and address potential threats. However, the majority of existing laboratory and portable techniques are either expensive or time-consuming due to the expert-driven complexity of their analysis processes. This study presents colorimetric sensors for the on-site quantitative liquid-phase detection of Arsenic in water, vegetables, and rice. These sensors electronically measure the change in the color intensities of different Arsenic concentrations. The sensor was converted to a point-of-care testing (POCT)/portable device prototype and calibrated with known samples before testing with the real samples. The calibration plot showed that the intensity of the color change was proportional to the change in the resistance of the LDR. The prototype was further translated into a Portable device. The device can be used to monitor Arsenic in real samples. This device is specific, stable, and user-friendly, allowing for the rapid detection of the Arsenic contaminant in water and vegetables, and can detect Arsenic in the range of 8–100 µg/L. In the study, the LOD was 8 µg/L (ppb), and RSDs for spiked water samples were 1.01 %. For spiked through boiled vegetables and rice, RSD was 2.08 %, and for spiked soaked samples, it was 2.52 %, in comparison to AAS measurements.

- **Title of Paper:** Caustic soda treated dried foliage of Arachis hypogaea as a promising biosorbent for Chromacyl Blue GG dye removal
  Name of Journal: Biomass Conversion and Biorefinery (Springer)
  ISSN Number: 2190-6815
  Names of Authors: S. N. Jain and S. N. Derle
  Abstract: In the present research, dried foliage of Arachis hypogaea (peanut), a novel substrate, is modified based on chemical treatment for dye remediation. Caustic soda–treated Arachis hypogaea (CSTAH) was applied to treat Chromacyl Blue GG (CBGG) dye (Acid Blue 158) containing wastewater. FT-IR and SEM analysis were carried out to investigate biosorbent performance. The experiments in batch operation were conducted to assess change in pH (2–12), shaking time (15–240 min), starting concentration of solution (50-200 mg L^{-1}), CSTAH dose (1-12 g L^{-1}), and temperature (288-318 K). The adsorption of CBGG was observed to follow a second-order kinetic. Various isotherms were tested for the elucidation of sorption data. The best fit was obtained using Langmuir. Maximum uptake was reported as 53.48 mg g^{-1} at elevated temperature of 318 K, optimized dose of 6 g L^{-1}, and acidic pH of 2. Thermodynamic data established adsorption of CBGG on CSTAH to be favored at elevated temperatures. Five cycles of adsorption–desorption tests showed that the CSTAH biosorbent can be reused for CBGG dye treatment in multiple cycles. The present study thus provided a sustainable pathway for the synthesis of biomass-based substrate and subsequent application for dye remediation.

- **Title of Paper:** Synthesis of activated biochar from sustainable bamboo resources: An environment-friendly and low-cost solution for palladium (II) removal from wastewater
  Name of Journal: Chemosphere (Elsevier)
  ISSN Number: 1879-1298
  Names of Authors: Dr. Yennam Rajesh
  Abstract: This article highlights the developing capabilities of low-cost activated biochar from bamboo waste used for Palladium (II) (Pd(II)) separation from man-made electroless plating solutions (ELP). From a novelty perspective, this article addresses the effect of coupled sonication and surfactant for the adsorptive elimination of Pd(II) on Bamboo stem activated carbon (BSAC) from ELP. The optimal activation procedure referred to an acid-to-bamboo ratio of 4:1 at sintering of 600-900 °C, which provided an activated carbon (AC) adsorbent with surface area analysis (BET) of 1014.36 m2/g, a value comparable to the commercially procured AC. Pd(II) adsorption characteristics in the solution of Pd with 50-500 mg/L concentration range were evaluated utilizing both agitation and sonication.
  Adsorption time, pH, dose, and adsorbate concentration were among the pertinent optimal batch adsorption parameters that were found. When utilizing ELP solutions without surfactant, the proposed adsorbent for agitation-assisted adsorption had a simultaneous improvement in metal intake of 6.68-43.2 mg/g and removal efficiency of 72.96-54.5% (cTAB). For cTAB-containing solutions, sonication and agitation-assisted adsorption were outperformed in terms of removal efficiency of 80.32-60.16% and metal uptake of 6.69-50.13 mg/g. Equilibrium, kinetic, and thermodynamic models with good fitting to the reported Pd(II) adsorption properties have been developed.

Achievements

- Pankaj Shinde, Final year student of Chemical engineering won the prize for his participation in the "Essay Competition" organized by Indian Institute of Chemical Engineers (IIChE), on 22nd September 2023.

Prof. Dr. V. S. Mane
HOD, Chemical Engg.

Prof. Dr. K. N. Nandurkar
Principal