YNU International Symposium 2025

" Innovations for a Carbon-Neutral Tomorrow "

Organized by
YOKOHAMA-SXIP Organizing Committee
Supported by
MEXT-JSPS “INTER-UNIVERSITY EXCHANGE PROJECT”

Program

YNU International Symposium 2025
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Contents

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Preface

Welcome to Yokohama and to Yokohama National University (YNU) International Symposium 2025! It is our great honor to host this global gathering of scholars, students, and professionals who are dedicated to advancing knowledge and shaping a sustainable future.

Today, our world continues to face complex challenges—climate disruption, rapid transitions in industrial and social structures, economic uncertainties, geopolitical tensions, and the emergence of new health risks. To respond effectively, collaboration across disciplines and borders is essential. This symposium offers an opportunity to exchange ideas and explore solutions from multiple perspectives.

YNU is working closely with our YOKOHAMA-SXIP partner universities in India and Australia to identify key issues in sustainability transformation (SX) and to foster constructive dialogue. The discussions will span a wide range of fields, from engineering and information sciences to economics, management, and education.

We hope that this symposium will inspire participants to widen their research horizons, build lasting international collaborations, and contribute to the growth of the next generation who will shape a carbon-neutral and inclusive society.

Taro Arakawa

Dr. Taro Arakawa
Professor
Graduate School of Engineering
Yokohama National University

Schedule at a glance

Time/Day	Sep. 3 (Wed)	Sep. 4 (Thu)
JPN	Media Hall in Central Library	Media Hall in Central Library
9:00		4.SXIP Group Exercise Presentation Session
10:00	1.SXIP Session Ⅰ	
11:00		
12:00	Colloquium (Lunch) (Cafeteria 1)	Closing Ceremony
13:00	2.SXIP Session Ⅱ	
14:00	3.Student Poster Session	
15:00		
16:00		

Symposium Program

September 3rd (Wed) 10:20 – 15:55

Venue: Media Hall in Central Library

YNU International Symposium 2025 (Day 1)

Opening

Chair: T. Arakawa

10:20 - 10:25	Opening Remarks Motonari Tanabu, Vice President for Education and Global Affairs, YNU

1. SXIP Session I

Chair: T. Arakawa

10:25	I-01	Opportunities and Challenges for Japan's Net-Zero Energy Systems: Insights from an Energy System Model Takashi Otsuki, Yokohama National University
10:55	I-02	Embedding Sustainability in Teaching Corporate Finance Mirela Malin, Griffith University

2. Colloquium

11:45 - 13:00	Colloquium (Lunch)　（Venue: Cafeteria 1）

3. SXIP Session II

Chair: T. Arakawa

13:15 I-03 Nanomaterials for Sustainable Applications – A Special Focus on Gas Sensing and Energy Harvesting
K. Govardhan, Vellore Institute of Technology

13:45 I-04 Catalytic Strategies for CO_2 Utilization and C–H Bond Activation Toward Carbon Neutrality
Ken Motokura, Yokohama National University

4. Student Poster Session

Chair: K. Nakamura

14:25 - 15:55

P-01 Comparative study of deposition protocols for self-repairing composite catalysts: insights into activity, loading, and durability
Yadav Vinay, R.Okada, H.Wago, Shigenori Mitsushima, Yoshiyuki Kuroda
YNU

P-02 Engineering Marvels of Indian Temples
Palak Chauhan
Panjab University

P-03 Reinforcement Learning for Inverse Estimation of Defect Distribution Based on Ceramic Strength Variation
Teppei Kono
YNU

P-04 Enhanced Trace-Level Assay and Excision of Cu(II) Ions via MOF-Cellulose Nanofiber Nanohybrids
Manjot Jyoti, Kazuho Nakamura, Anupama Kaushik
YNU

P-05 Compressed Air-based Cargo Hyperloop (CABCH) System for Transporting Goods
Shivam Gupta, Kanhaiya Lal Chaurasiya, Yashaswi Sinha, Bishakh Bhattacharya
IIT Kanpur

P-06 Unique Circular Economy Products
Yusei Takeuchi
YNU

P-07 Reaction crystallization of CaCO3 for Direct Air Capture
Futa Sawano, Kazuho Nakamura, Kenji Wakui, Ryusei Yamaguchi, Yoshihiro Nakayama, Sho Fujita
YNU

P-08 Engineered biochar-attapulgite clay composite: A novel slow-release phosphorus fertilizer
Harleen Kaur, Gurwinder Singh, Marjana Yeasmin, Kavitha Ramadass, Puspamitra Panigrahi, Al an Larson, Ranjit Pati, Dane Lamb, Bo Zheng, Ehsan Tavakkoli , Lukas Van Zwieten, Ajayan Vinu
The University of Newcastle

P-09 Proposal of a probability calculation method that leads to thermal runaway in a impacted lithium-ion battery
Shun Yonezu, Yu-ichiro Izato
YNU

P-10 Kinetic analysis of continuous hydrogen fermentation using waste molasses by FO-MBR
Tomoki Ishida, Kazuho Nakamura, Kenji Wakui and Tiwari Aditya
YNU

P-11 PLASTIC : Infrastructure From Waste
Ankul Singh
Panjab University

P-12 3D printing from microscopic photography
Kein Mizukami, Taizo Nakamori
YNU

P-13 Development of the Process for Maintaining the Microbial Condition in Continuous Hydrogen Fermentation Process Using Activated Sludge
Shukla Aman, Kazuho Nakamura, Kenji Wakui
YNU

P-14 Decarbonizing Power Generation Through Smart Energy Systems
MuthuVaishnavi Anand
Anna University

P-15 Dropwise and filmwise condensation characteristics of moist air on vertical flat plate
Haruki Kurosawa, Kizuku Kurose
YNU

P-16 Effect of the sensor quantity on machine learning-based anomaly detection: A case study of hydrogen leakage from a hydrogen pipeline
Jun Furota, Jo Nakayama, Yu-ichiro Izato
YNU

P-17 Two Solvated Crystals of Chlorinated Diketopyrrolopyrrole Derivatives with Ethyl and Butyl Groups at the N Positions
Ryota Mizuguchi, Shinya Matsumoto
YNU

P-18 Life cycle assessment of conventional fuel and biofuel: A comparative analysis
Kaviyaa B, Dhivagar S, Sajith L N
VIT

P-19 Purification and characterization of a microtube-forming protein from Haliscomenobacter hydrossis
Mishal Shafiq, Chen Shiqian, Minoru Takeda
YNU

P-20 PLASTICS WASTES TO GREEN ENERGY – A SUSTAINABLE RECYCLING APPROACH
Abhik Sengupta, SK Kansal
Panjab University

P-21 Polymorphs of a N,N'-diethyl chlorinated diketo-pyrrolo-pyrrole derivative
Haruto Yasuda, Shinya Matsumoto
YNU

P-22 Indoor Air Quality Analysis across different seasons for Classrooms with varying Ventilation Conditions
Aadya Umrao, Anubha Goel, Asit Kumar Mishra
IIT Kanpur

P-23 Correlations between preparation conditions, pore size, number of adsorption sites, and uptake of heavy metal cations in organically-modified SBA-15 motif mesoporous silica
Shusuke Saigusa
YNU

P-24 Sustainability in Indian Households: Culture Rooted in Conservation
Harshnoor Kaur
Panjab University

P-25 Development of fouling mitigation method in MBR by surface modification
Fatima Gul, Kazuho Nakamura, Kenji Wakui
YNU

P-26 Spatially Distributed Multivariate Time Series Model for Meteorological grid data
Sosuke Ikuma
YNU

P-27 Circular economy as a pathway to net-zero emissions: An Indian perspective
Sanjeetha Shree P, Dhivagar S, Kaviyaa B
VIT

P-28 Layered Polysilsesquioxane: new support materials for metal/silica solid catalysts
Masato Nakayama
YNU

P-29 Bio-inspired shape memory alloy-based artificial muscle actuator for medical and cable driven parallel robot (CPDR) enabled application
Ruchira Kumar Pradhan, Kanhaiya Lal Chaurasiya, Keval S. Ramani, Bishakh Bhattacharya
IIT Kanpur

P-30 Electroviscous effects and their control for energy-saving in microfiltration processes
Monami Kimura, Manami Wakasa, Kazuho Nakamura, Kenji Wakui
YNU

P-31 From Vedic Wisdom to Sustainable Futures: Science, Cycles, and Circularity
Eishrat Panjeta
Panjab University

P-32 Three polymorphs of N-ethyl chlorinated diketopyrrolopyrrole derivative
Iori Aihara, Shinya Matsumoto
YNU

P-33 Blockchain-Driven Carbon-Neutral Sustainable Supply Chains in India
Karthik Krishna
Anna University

P-34 Pseudo-Multimodal Contrastive Learning for Acute Coronary Syndrome Diagnosis using 12-Lead Electrocardiograms
Mengyu Wang, Kozo Okada, Takafumi Goto, Natsuko Jinba, Hiroki Yamaya, Kiyoshi Hibi, Tomoki Hamagami
YNU

P-35 Carbon Neutrality and Financial Market Incentives
Jose Felipe Garcia Pulido, Khoulud Alhoush, Yadan Noerdin
Griffith University

P-36 Stabilisation of Cu2＋by using amine ligands in direct synthesis of Cu/SBA-15 mesoporous catalysts
Kanata Takahashi
YNU

P-37 Evaluation of interactions between solutes and solid-liquid interfaces by HPLC and HSP
Kenta Sakamoto, Kenji Wakui, Kazuho Nakamura
YNU

P-38 Innovating Technology for a Sustainable Future
Neelakandan S
Anna University

September 4th (Thu) 9:30 - 12:30

Venue: Media Hall in Central Library

YNU International Symposium 2025 (Day 2)

5. SXIP Group Exercise Presentation Session

Chair: A. Suzuki

9:30 - 12:00

Group 1

Ruchira Kumar Pradhan	IIT Kanpur
Shivam Gupta	IIT Kanpur
Aadya Umrao	IIT Kanpur
Teppei Kono	YNU
Haruki Kurosawa	YNU
Koichi Nagasaku	YNU

Group 2

Sanjeetha Sree P	VIT
Kaviyaa Balasubramani	VIT
Dhivagar Saravanan	VIT
Ren Fujiwara	YNU
Yonezu Shun	YNU
Kein Mizukami	YNU

Group 3

Karthik Krishna	Anna University
Muthu Vaishnavi A	Anna University
Neelakandan S	Anna University
Takuro Tanaka	YNU
Haruhisa Tokuue	YNU
Yuki Yoshihara	YNU

Group 4

Ankul Singh	Panjab University
Eishrat Panjeta	Panjab University
Harshnoor Kaur	Panjab University
Taiki Kawashima	YNU
Daichi Takeshita	YNU
Ryosuke Sato	YNU

Group 5

Palak Chauhan	Panjab University
Abhik Sengupta	Panjab University
Harleen Kaur	The University of Newcastle
Yusei Takeuchi	YNU
Shunsuke Wakamei	YNU
Keiju Tokita	YNU

Group 6

Khoulud Alhoush	Griffith University
Yadan Noerdin	Griffith University
Jose Felipe Garcia Pulido	Griffith University
Ruriko Tanaka	YNU
Miyu Fujii	YNU
Eri Honda	YNU

Closing Ceremony

Chair: T. Arakawa

12:00 – 12:30	Closing Ceremony Motonari Tanabu, Vice President for Education and Global Affairs, YNU

YNU International Symposium 2025

Abstracts

Invited Speakers

YNU International Symposium 2025
September 3 -4, 2025, Yokohama, Japan

Opportunities and Challenges for Japan's Net-Zero Energy Systems: Insights from an Energy System Model

Takashi OTSUKI[1, 2, 3]

[1] Faculty of Engineering, Yokohama National University, [2] Institute of Advanced Sciences, Yokohama National University, [3] Clean Energy Unit, The Institute of Energy Economics, Japan

Abstract:

Energy system transition is crucial for Japan to achieve the national goal of carbon neutrality by 2050. To evaluate cost-effective pathways and examine future uncertainties, many research institutes have developed energy system models that inform Japan's energy policy-making process. For example, the Japanese government invited six models, including ours, to contribute to the formulation of the previous 6th and the current 7th Strategic Energy Plans, which outline Japan's medium- to long-term energy policy directions. This presentation provides an overview of our national energy system model for Japan—the New Earth_Japan (NE_Japan) model—and discusses its policy implications.

The NE_Japan model is formulated as a linear programming problem that determines the cost-effective energy mix over the period 2015–2080. Japan is represented as five geographic regions to capture the regionality, such as local resource endowments, and to reflect the topology of the national power grid. A salient feature of the model is its high temporal resolution—8760 hours per year for electricity balances—enabling explicit representation of variable renewable energy (VRE) and the associated system integration costs.

Simulation results for Japan's net-zero energy systems indicate that a diversified portfolio—comprising renewable energy, nuclear power, fossil fuels with carbon capture and storage, and hydrogen-based fuels—is critical to reducing CO_2 emissions cost-effectively (Fig.1a). The cost-optimal share of renewable energy in power generation is projected to be about 50-60% in 2050. By contrast, energy systems with a very high share of VRE may face economic challenges: for example, the average shadow price of electricity in 2050 under a 100% renewable power system is estimated to be about twice that of the cost-optimal mix, due to the costs of relatively expensive renewable energy, such as floating offshore wind turbines, and long-duration energy storage technologies (Fig.1b-c).

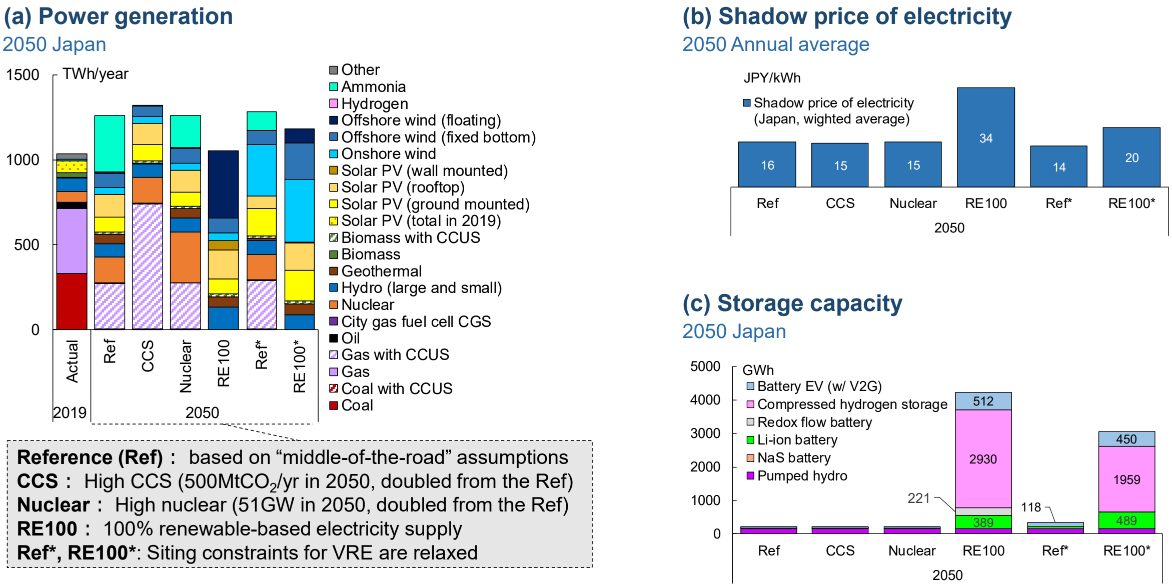

Fig. 1: Projected power generation, shadow price of electricity, and energy storage capacity for 2050 in Japan [1]

References
[1] Takashi Otsuki, Hideaki Obane, Yasuaki Kawakami, Kei Shimogori, Yuji Mizuno, Soichi Morimoto, Yuhji Matsuo, Energy mix for net zero CO_2 emissions by 2050 in Japan, Electrical Engineering in Japan, e23396, (2022)
[2] Takashi Otsuki, Yoshiaki Shibata, Yuhji Matsuo, Hideaki Obane, Soichi Morimoto, Role of carbon dioxide capture and storage in energy systems for net-zero emissions in Japan, International Journal of Greenhouse Gas Control, Volume 132, 104065 (2024)
[3] Takashi Otsuki, Ryoichi Komiyama, Yasumasa Fujii, Hiroko Nakamura, Temporally Detailed Modeling and Analysis of Global Net Zero Energy Systems Focusing on Variable Renewable Energy, Energy and Climate Change, Volume 4, 100108, (2023)

Biography

Takashi OTSUKI, Yokohama National University, Associate Professor
The Institute of Energy Economics, Japan, Principal Research Fellow
Doctor of Engineering (The University of Tokyo, 2019)

The Institute of Energy Economics, Japan (2014-2022),
Yokohama National University (2022-Present)

Awards: The Japan Institute of Energy Award for Encouragement (2020)
The 16th Best Paper Award, Japan Society of Energy and Resources (2020)
The Japan Institute of Energy Award for Distinguished Paper (2020)
The Japan Institute of Energy Award for Progress (2025)

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I-02

Embedding Sustainability in Teaching Corporate Finance

Mirela Malin

Department of Accounting, Finance and Economics, Griffith University, Gold Coast, Australia

Abstract:

Growing public scrutiny on sustainability, and other social concerns has put the pressure on businesses to view the concept of environmental, social, and governance (ESG) issues as a basic risk management concept. Sustainability in finance education is increasingly recognized as essential for preparing future professionals to address global challenges such as climate change, inequality, and resource scarcity. The integration of sustainability principles—particularly those aligned with the UN Sustainable Development Goals (SDGs)—into finance curricula reflects a shift toward responsible investing, ethical decision-making, and long-term value creation. This presentation documents how sustainability principles are embedded in a traditional finance course and highlights how ESG initiatives relate to various topics in a first year Corporate Finance course.

Biography
Mirela Malin, Griffith University, Senior Lecturer
Ph.D. (Finance) (Griffith University, 2008)
Award: Excellence in Teaching Award (2016)
Research Interests: Higher Education Teaching and Learning, Online Learning

Contacts
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E-mail: m.malin@griffith.edu.au

Nanomaterials for Sustainable Applications – A Special Focus on Gas Sensing and Energy Harvesting

Dr K Govardhan[1]

[1] Department of Micro and NanoElectronics, School of Electronics Engineering, Vellore Institute of Technology, Tamil Nadu, India

Abstract:

Nanomaterials are being explored extensively for diverse applications. Many of the challenges faced in the domains of pollution control, renewable energy etc need novel materials and innovative products to enhance the efficiency of these systems. Nanomaterials can be tailor made to bring about the much-sorted performance enhancement. Air pollution represents the uncontrolled release of various harmful gases into the atmosphere. Highly sensitive and selective gas sensors are the need of the hour to accurately sense individual gases down to few PPB levels. Tailor doped semiconductive metal oxide nanomaterials exhibit a high sensitivity and selectivity towards toxic pollutants. Testing of gas sensing systems is an interesting domain on its own. Novel gas sensing system was developed based on FEM based modelling and CFD simulations. The designed system was fabricated and was used to test the thin film based gas sensors developed in the research labs.

Energy harvesting and waste water treatment are two diverse domains that too need a great attention across the globe. A novel system to harvest usable levels of energy from a highly sustainable waste water treatment system would be a welcome requirement for many industries. The proposed system uses a green based approach to treat waste water by converting heavy metals into to stable compounds at the same time derive energy from the relevant chemical reactions.

Fig.1 Gas Sensing Setup.

References
[1] K. Govardhan., Muthuraja, S. ., & Grace, A. N. . (2022). Multiphysics modeling and optimisation of gas flow characteristics in a novel flow metric based gas sensing chamber with integrated heater. Journal of Materials NanoScience, 9(2), 138–146 (2022)
[2] K. Govardhan, A. Nirmala Grace (2016), Temperature Optimized Ammonia and Ethanol Sensing Using Ce Doped Tin Oxide Thin Films in a Novel Flow Metric Gas Sensing Chamber, Journal of Sensors, Volume 2016 https://doi.org/10.1155/2016/7652450 (2016)

Biography
Dr K. Govardhan, Vellore Institute of Technology, Associate Professor (Sr)
Ph.D. (Nanomaterial based Gas Sensing System) (VIT, 2017)
Vellore Institute of Technology (2005-Present)
Research Interests: Nano Sensors, MEMS, Smart Materials

Contacts
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Catalytic Strategies for CO_2 Utilization and C–H Bond Activation Toward Carbon Neutrality

Ken Motokura

Faculty of Engineering, Yokohama National University

Abstract:

Recycling end-of-life solar panels presents significant challenges due to the large volume of discarded panels. Among the composition of the solar panel, the recovery and reuse of silicon (Si) wafers have garnered increasing attention. In this study, we integrated the recycling of waste Si wafers with the catalytic conversion of CO_2 from the exhaust gas of a thermal power plant (Fig. 1A)[1]. The catalytic conversion of CO_2 using silicon wafers as a reducing agent produced formic acid and formamides in high yields. The direct functionalization of C–H bonds enables a streamlined synthetic process, minimizing byproduct formation (Fig. 1B). Bimetallic catalysts proved effective for activating inert bonds: RhRu and PdRu bimetallic oxide clusters successfully facilitated the acetoxylation and biaryl synthesis of benzene via C–H bond activation, employing molecular oxygen as the sole oxidant.[2,3]

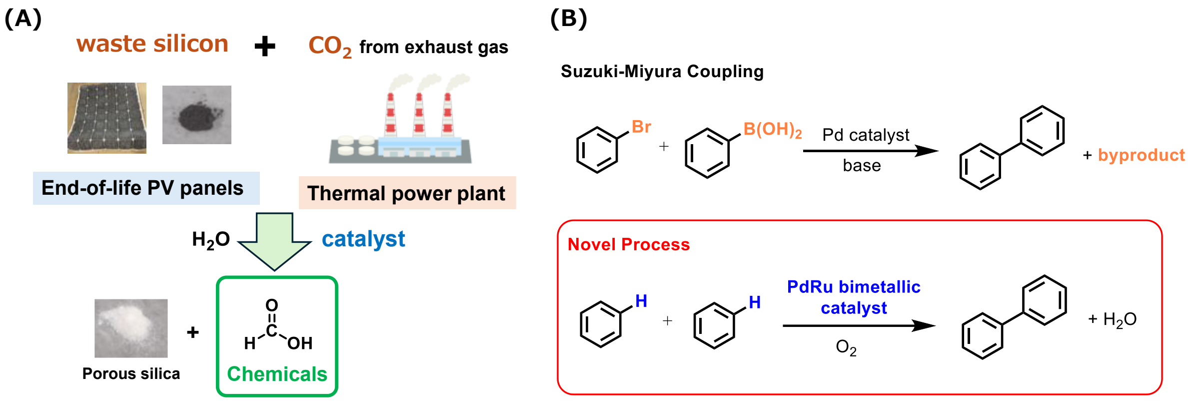

Fig.1 (A) Conversion of CO_2 with silicon waste, (B) C-H activation for biaryl synthesis.

References
[1] Ken Motokura et al., Conversion of CO_2 in Exhaust Gas to Formic Acid and Formamides with Wasted Silicon Recovered from End-of-Life Solar Panels, *ACS Sustainable Resource Management*, 2, 1220-1227 (2025).
[2] S. Hasegawa, Ken Motokura, et al. RhRu Bimetallic Oxide Cluster Catalysts for Cross-Dehydrogenative Coupling of Arenes and Carboxylic Acids, *Journal of the American Chemical Society*, 146, 19059-19069 (2024).
[3] S. Hasegawa, Ken Motokura, et al. Pd Nanoparticles Decorated by Oxidized Ru Clusters for Efficient C–H/C–H Coupling of Arenes, *ACS Catalysis*, 15, 487-493 (2025).

Biography

Ken Motokura received his Ph.D. (2006) degree from Osaka University. Subsequently, he moved to The University of Tokyo as an Assistant Professor. He joined Tokyo Institute of Technology as a Lecturer in 2008, and was promoted to Associate Professor in 2017. In 2021, He moved to Yokohama National University as a Professor. He has received the Young Scientist Award of the Catalysis Society of Japan (2014), the Chemical Society of Japan Award for Young Chemists (2016), the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, the Young Scientists' Prize (2019), and the JACI GSC Award for Young Scientist (2020). His research interests include the precise design of multiactive sites on catalytic surfaces for highly efficient organic synthesis and catalytic transformation of CO_2/C-H bonds.

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YNU International Symposium 2025

Abstracts

Posters

P-01

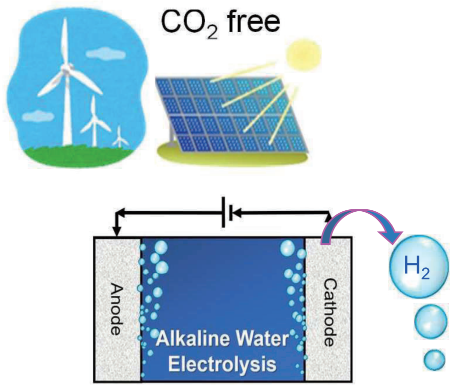
Comparative study of deposition protocols for self-repairing composite catalysts: insights into activity, loading, and durability

Yadav Vinay,[1] R. Okada,[1] H. Wago,[1] Shigenori Mitsushima,[1,2] Yoshiyuki Kuroda[1,2] E-mail: yadav-vinay-rn@ynu.jp

[1]Grad. School of Eng. Sci., Yokohama Natl. Univ., [2]Adv. Chem. Energy Res. Center, Inst. of Adv. Sci., Yokohama Natl. Univ., 79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan

Abstract:

Demand of renewable energy is increasing, yet fluctuating power supply is one of the problems. Therefore, technology for energy storage such as alkaline water electrolysis is required. When an alkaline water electrolyzers is powered by renewable energy, electrodes degrade due to reverse current generated on shutdown. Self-repairing catalysts based on hybrid cobalt hydroxide nanosheets[1] (Co-ns) and β-FeOOH nanorods[2] (Fe-nr) are expected to improve durability of electrodes. Co-ns forms thick catalyst layer with highly conductive framework, whereas Fe-nr forms a thin layer with much higher OER activity than that of Co-ns. Combining these catalysts in an electrolyte, self-repairing composite catalysts[3] is developed. In this study, the deposition strategies, activity, durability and effects of Fe-nr concentration on the composite catalyst will be discussed by intermittent and continuous protocol.

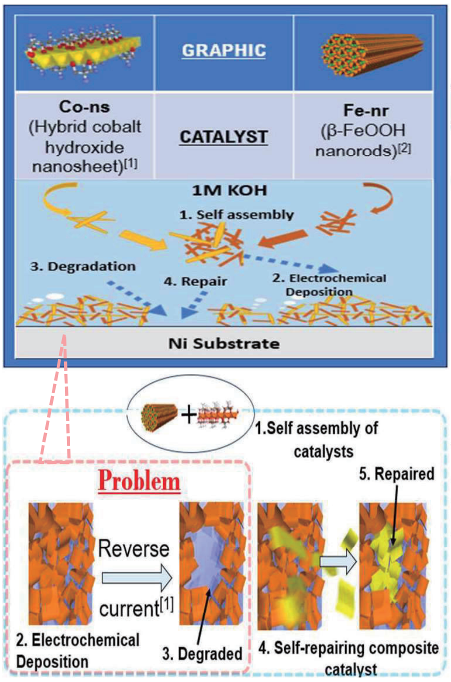


H_2 for energy storage and transportation

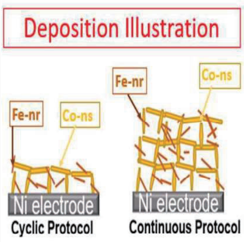
Acknowledgements: A part of this study was supported by KAKENHI (Grant-in-Aid for Scientific Research 20H02821) from Japan Society for the Promotion of Science (JSPS).

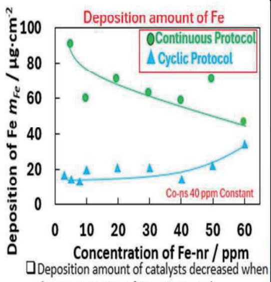
[Reference]
[1] Y. Kuroda *et al.*, *Electrochim. Acta.* **323**, 1348122 (2019). [2] Y. Kuroda *et al.*, *J. Sol-Gel Sci. Technol.*, **104**, 647-658 (2022).
[3] Y. Kuroda *et al.*, *Adv. Energy Sust. Res.* 2400196 (2024).

Composite Catalyst Illustrations

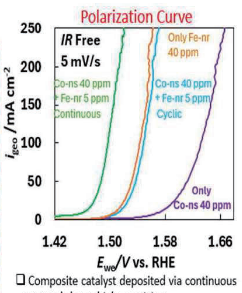


Experimental Results

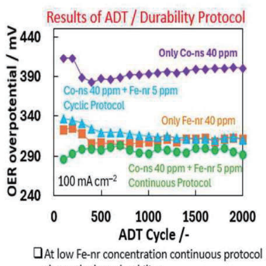




❑Deposition amount of catalysts decreased when the concentration of Fe-nr increased.



❑Composite catalyst deposited via continuous protocol shows higher activity.

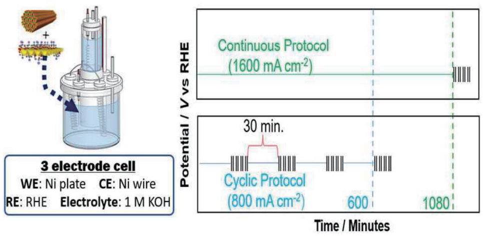


❑At low Fe-nr concentration continuous protocol shows the best durability.

Objective

- ▶ Investigation of optimum compositions and methods to achieve highly active and durable composite self-repairing catalysts.
- ▶ Effects of Fe-nr in composite catalyst

Experimental setup



Conclusion

- ▶ Continuous protocol shows higher deposition amount of composite catalyst and activity than the cyclic protocol. redox reaction of catalysts should be minimized during the initial catalyst deposition process to form thicker and durable catalyst layer.
- ▶ Fe-nr provides the active site for OER.

P-02

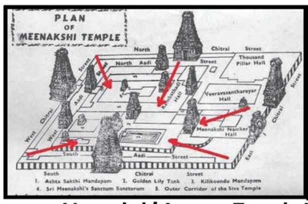
Engineering Marvels of Indian Temples

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

Palak Chauhan
BE(Chemical) 3rd Year
Panjab University , palakchauhan6450@gmail.com

Ancient Indian temples are not only centers of spiritual devotion but also masterpieces of science, engineering, and sustainable design. From precise astronomical alignments to sophisticated water management systems, temple architecture reflects a deep understanding of mathematics, materials, and environmental harmony. Structures like the Konark Sun Temple act as giant sundials, while the Jagannath Temple's design creates the illusion of a shadowless main dome. The Brihadeeswarar Temple demonstrates advanced load distribution and granite construction without binding mortar. Stepwells and temple tanks reveal indigenous hydro-engineering for sustainable irrigation and groundwater recharge. These innovations showcase how art, culture, and science coexisted seamlessly, producing buildings that have withstood centuries of time and weather. This poster explores temples, decoding their architectural principles, astronomical significance, and sustainable engineering methods. By blending heritage with scientific insight, it highlights how ancient Indian design continues to inspire modern architecture and environmental solutions across all over the world.

Water & Cooling System



Meenakshi Amman Temple,Madurai

- **Golden Lotus tank** replenished by underground channels.
- Stone corridors- natural cooling effect.
- *Material Used: Granite, Marble & Lime Plaster.*

Acoustic & Vibration Science

a)Vitthala Temple, Hampi (Musical Pillars)

- Each carved pillar produces musical notes when tapped.
- *Material Used: Granite.*

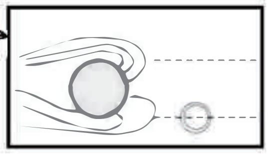
b)Airavatesvra Temple, Tamil Nadu

- Steps produce distinct musical notes when tapped due to precise carving and stone density that create **resonant frequencies**.
- *Material Used : Granite and Soapstone .*

Sunlight & Airflow Engineering

a)Brihadeeswarar Temple, Tamil Nadu

- (1010 CE, Chola): 66m vimana → minimal noon shadow.
- Thus helping in Passive cooling.
- *Built from Granite.*

Karman Vortex Street
$40 < Re < 100{,}000$

b)Jagannath Temple, Puri

- Flag always flutters opposite to wind direction.
- No shadow of main dome is visible at any time of day.
- *Material Used: Khondalite Rock.*

Astronomy & Timekeeping

Konark Sun Temple, Odisha

- Stone wheels function as sundials showing time accurate
- 13th-century structure shaped like a chariot.
- *Material Used: Chlorite,Laterite & Sandstone.*

P-03

Reinforcement Learning for Inverse Estimation of Defect Distribution Based on Ceramic Strength Variation

Teppei Kono, Shingo Ozaki
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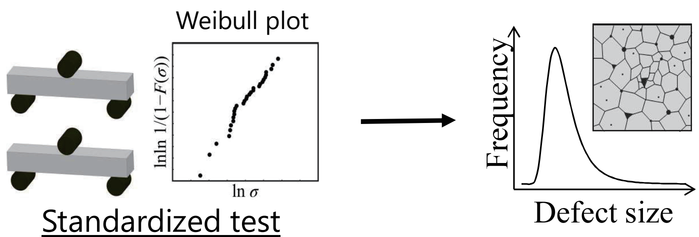
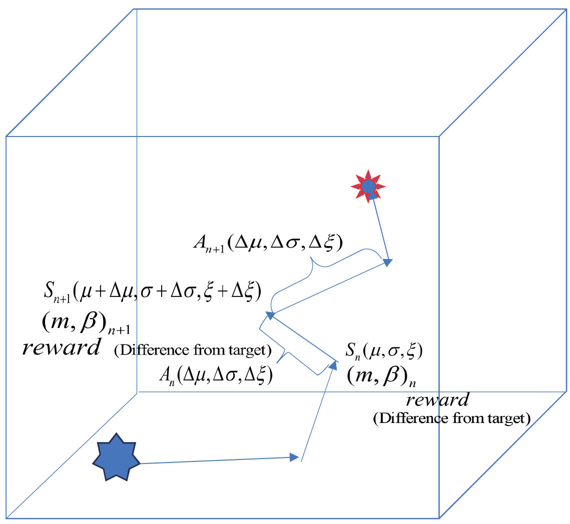
Abstract (100-200word, 16 point)

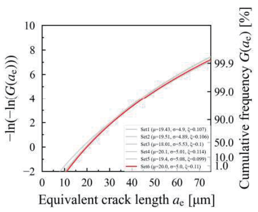
Ceramics are structural components that require high strength, high heat resistance, high corrosion resistance and high reliability. In recent years, demand for ceramics has been increasing in line with the development of science and technology, with applications in superfine ceramics for next-generation communication technology, rocket engines and semiconductors, and the market size is expected to reach approximately USD 300 billion by 2029.However, brittle fracture occurs due to defects that inevitably occur stochastically in the manufacturing process, and strength varies even in the same manufacturing process. Previous research in my laboratory, including myself, has already carried out a sequential analysis to predict strength prediction from internal defect information using numerical simulation. I will perform the inverse analysis using a reinforcement learning algorithm (Soft Acter Critic) to predict internal defect information that satisfies the strength properties required by the designed product, thereby enabling strategic material design.

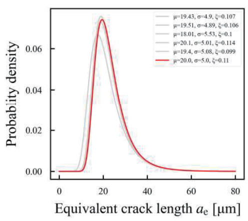


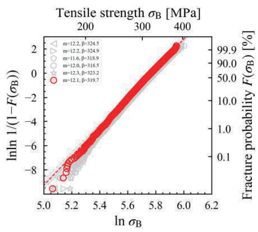
Standardized test

✓ Method: soft actor-critic, Extreme Value Statistics ,LSTM









➢ Successes
Grey: predicted values
Red: target value

State	Action	reward
$S_{n+1}(\mu+\Delta\mu,\sigma+\Delta\sigma,\xi+\Delta\xi)$	$A_n(\Delta\mu,\Delta\sigma,\Delta\xi)$	Distance to target（MSE）
・passed on from the environment ・GEV distribution	・Determining the amount of μσξ to move closer to the target.	・Difference between m,β and target m,β (MSE), analysed forward with predicted μσξ

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

Enhanced Trace-Level Assay and Excision of Cu(II) Ions via MOF-Cellulose Nanofiber Nanohybrids

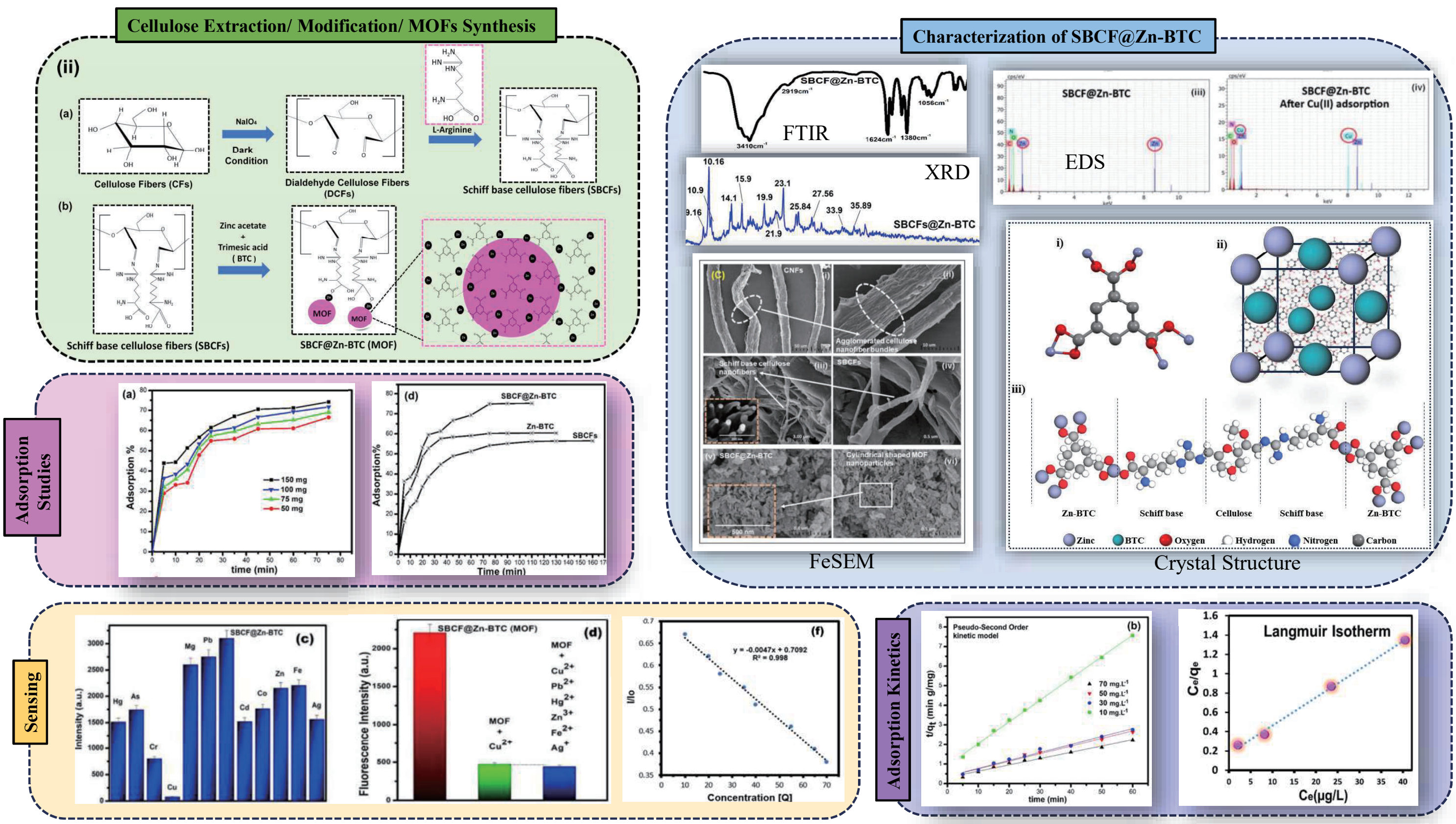
(Yokohama Nat. U.) ○(学)Jyoti Manjot・(正)Nakamura Kazuho・(Panj. Univ. India) (正) Kaushik Anupama

Abstract

Metal-organic frameworks (MOFs), synthesized as nano-sized particles, have innumerable applications. This study synthesized novel nanohybrids by anchoring Zn-BTC MOFs on the surface of Schiff base cellulose nanofibers (SBCFs) (SBCF@Zn-BTC) using the hydrothermal method. The cellulose nanofibers (CNFs) were derived from waste rice straw to warrant a sustainable bio-economy.

The nanohybrids exhibited significant fluorescence quenching and also showed excellent adsorption of Cu(II) ions due to porous structure of MOF. FTIR, SEM, EDS and XRD results confirmed the synthesis and adsorption of Cu(II) ions. Nanohybrid selective for Cu(II) ions with a detection limit of 0.254 μM.

Removal efficiency was 82.8%, substantially higher than SBCFs and Zn-BTC MOF, respectively. The maximum adsorption capacity was 263.5 mg·g−1 (Co=400 mg·L−1) at pH 8 and after 75 minutes of contact time. Facile recovery and recyclability up to 10 cycles with only a 5% descent in adsorption efficiency warranted their efficient performance and potential in wastewater remediation.



P-05

Compressed Air-based Cargo Hyperloop (CABCH) System for Transporting Goods

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Abstract

The conventional transportation systems used for coal, ores, minerals, and commercial goods–such as roadways, railways, conveyor belts, and slurry pipelines–face significant challenges, such as air pollution, material losses, extended travel times and unreliable delivery schedules. In contrast, a closed conduit pipeline transportation system offers substantial advantages by effectively addressing these challenges. The current research focuses on developing a solution to the transportation congestion, speed, and environmental impact of traditional cargo/raw material transportation systems by developing an in-pipe transportation system, which can be conceptualised as a cargo-specific adaptation of a hyperloop system. The Compressed Air-based Cargo Hyperloop (CABCH) mobility system is an alternative method for transporting coal/commercial goods via compressed air-based pipelines. The working proof-of-concept has been designed and developed, which envisages in-pipe robots, viz. cargobot, designed to carry goods in the pipeline, utilising energy harnessed from compressed air flow. This innovative approach minimises land use, prevents environmental degradation, and eliminates fossil fuel dependency, significantly reducing pollution and providing a sustainable solution for long-distance goods transportation.

❖ Novelty in Compressed Air-based Cargo Hyperloop (CABCH) system

Cargobot is a flow-driven in-pipe robot with a wall-pressed leg module for high stability & adaptability.

- Fully-covered underground transportation system
- Better utilization aspect of land usage and land cover (LULC)
- Real-time pipeline health monitoring during transportation
- Huge impact on the time savings for coal transportation operation
- Simple Structure and navigate through long and narrow pipelines
- High stability during high-speed movements
- Ability to move without active actuators

Fig. 1 – Problems with conventional modes of transportation

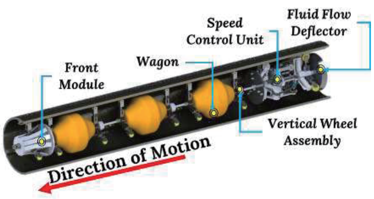

Fig. 2 - Cargobot assembly with marked sub-assemblies and indicated direction of motion

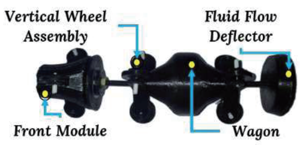

Fig. 3 – Proof-of-concept model of the cargobot assembly

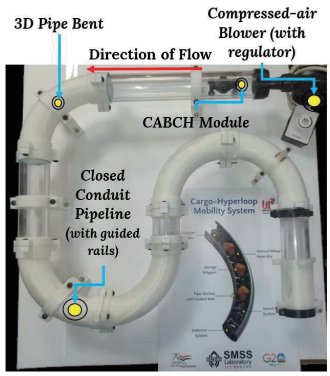

Fig. 4 – Proof-of-concept setup of the CABCH system

References:

[1] - Bhattacharya, B., Chaurasiya, K. L., Sinha Y. (2022). “HYPERLOOP TRANSPORTING SYSTEM WITH ROBOT VEHICLE FOR TRANSPORTING GOODS”, 2023 [Patent No. 541539] (Country: India)

[2] - Chaurasiya, K. L., Gupta, S., Bhattacharya, B., Biswas, G., & Varma, A. K. (2023). “AIR-LEVITATION BASED HYPERLOOP TRANSPORTING SYSTEM WITH ROBOT VEHICLE FOR TRANSPORTING GOODS”, 2023 [Patent No. 550600] (Country: India).

YNU Symposium2025
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Unique Circular Economy Products

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I'd like to introduce Unique Circular Economy products around the world.

As you know, the Circular Economy is a concept of reusing materials over the long period of time. The design for circular economy starts by focusing on optimizing the economic potentials of the available resources through a new model that aims to restore natural resources. And the action will help us to achieve the world climate change. For this reason, governments and companies are doing a lot of efforts based on the circular economy.

I will share five of the unique products designed on the circular economy basis.

1st is Tokyo 2020 Medals – Recycled electronics

2nd is Nike Space Hippie – Sneakers from trash

3rd is Instock Restaurant – Meals from rescued food

4th is Fabula Concrete – Building material from vegetables

5th is TACHIMNey Eco-Cement – Cement from waste ash

Unique Circular Economy Products

The medals given to Olympic champions at Tokyo 2020 incorporated precious materials made from recycled electronics. The original idea, which is announced over four years ago by the Tokyo Olympics organizing committee, became a reality when the Olympic medal-making campaign asked members of the public to donate old devices such as smartphones, laptops, and gaming consoles to make the medals.
The campaign, called "Making medals for Urban Mines", finally collected nearly 80 tons of electronics over the 2years. Once processed, the recycled electronics extracted 32kilos(equals to 70 pounds) of gold, 3,500kilos(equals to 7,700pounds) of silver, and 2,200kilos(equals to 4,850 pounds) of bronze. The materials were then used to produce approximately 5,000 medals for the games.

Nike has released a new sustainable trainer made from trash laying around in 2020. This is the most sustainable sneaker ever in Nike history. It contains 90% of reusable materials. This trainer is called "Space Hippie". There is this idea in space exploration that if you're going to fly to the moon, fly to the Mars and stay there and do something, you have to create things with what you find there. Say there's no resupply mission coming to Mars. There's no resupply to coming the Earth either. This idea led to the creation of the most sustainable shoe.

Instock is a restaurant located in the center of Amsterdam and they offer dished made of the rescued products of local supermarkets and bakeries. Moreover, every dish they offer is always full of surprises and creativity, and very delicious. This is because all chefs working for Instock are experienced and professional. There are a lot of unsold products that are still edible in supermarkets. One third of the world's food goes to waste every year. So the innovative Dutch restaurant, Instock, addresses this issue through a unique circular economy approach.

Fabula is a start-up company launched in Tokyo that creates new construction materials made from food waste, such as vegetables that do not meet customer standards or leftovers from cutting vegetables during cooking. This company says that Cabbage has the highest bending strength among vegetables and it is 4 times stronger than concreate. A cabbage plate just 5 millimeters thick can support a weight of 30 kilograms. This material has a potential to be used in construction in the future. Actually the venture is addresses climate issues through its vegetable concreate.

TACHIMNey is a waste-to-energy facility located in Tachikawa city, in the center of Tokyo, which began operations in 2023. The facility generates electricity from thermal energy obtained by burning municipal waste. Non-organic waste, such as plastics burns more easily than organic waste, so residents are required to separate garbage into at least organic and non-organic. The facility also create a unique type of cement made from the ash generated by the thermal power plant. The fly ash is collected and recycled into eco-cement, which is then used for paving walkways in Tachikawa city. This is an example of the importance of local cooperation between residents and businesses in creating a sustainable community.

P-07

YNU Symposium2025
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Reaction crystallization of $CaCO_3$ for Direct Air Capture

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To achieve carbon neutrality, it is necessary not only to reduce CO_2 emissions but also to absorb CO_2 from the atmosphere. Direct air capture is one of the methods for collecting CO_2 from the atmosphere. This study aims to develop a crystallization process for CO_2 sequestration using CO_2 absorption with alkaline solution followed by the reactive crystallization of calcium carbonate.

One of the challenges is that the formation of small particles during the crystallization process reduces the efficiency of the subsequent filtration process.

The particle size distribution is affected by the nucleation rate and the crystal growth rate. Both of these rates are influenced by the concentration of the reaction solution.

In this study, reactive crystallization experiments using an up-flow column were conducted to examine the effects of the concentration of the reaction solution on the particle size distribution of the particles.

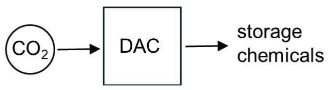
Experiments were conducted using calcium chloride concentrations ranging from 0.1 to 2 M against 1 M sodium carbonate. As a result, the particle size was the largest at a calcium chloride concentration of 0.5 M. This is because aggregation of multiple particles became prominent under this condition.

Introduction

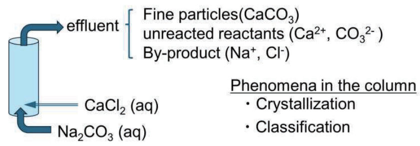
○ To achieve carbon neutrality

carbon neutrality
emission ＝ absorption

Direct Air Capture (DAC)
CO2 absorption from air



○ Up-flow column



○ Objective

Investigation of effect of reaction solution concentration on particle size distribution and recovery rate

Method

$Na_2CO_3(aq) + CaCl_2(aq) \rightarrow CaCO_3(s) + 2NaCl\ (aq)$

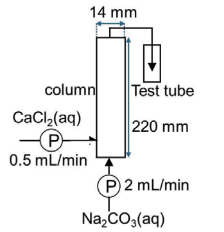


Fig. Experimental setup

Table. Experimental condition

Run	Na_2CO_3 [M]	$CaCl_2$ [M]
1	1	0.1
2		0.5
3		1
4		2

Result

$CaCl_2$Conc.[M]	0.1	0.5	1	2

Images of column

Recovery rate [%]	29	89	73	-

Fig. Particle distribution in the column at the end of the experiment and recovery rate

$$\text{Recovery rate [\%]} = \frac{W_{\text{in}}\ [\text{g}]}{W_{\text{in}}\ [\text{g}] + W_{out}[\text{g}]} \times 100$$

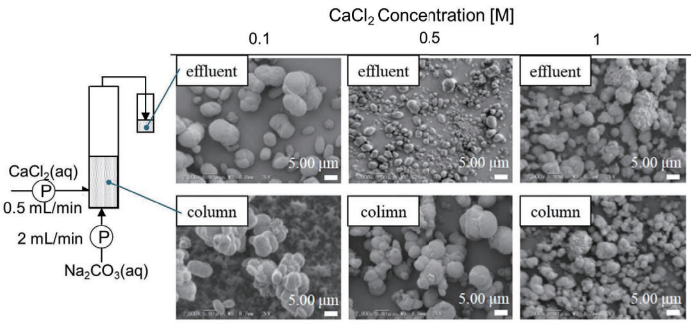


Fig. SEM of particles in the column and effluent

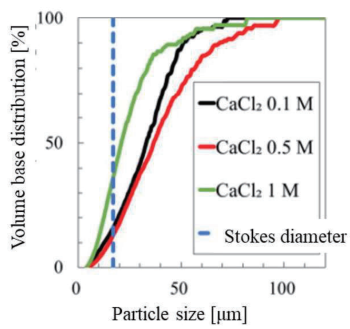


Fig. particle size distribution of particles in the column

・The particle size was largest at a $CaCl_2$ concentration of 0.5 M
⇒ Due to the growth of individual particles and the aggregation of multiple particles.

・At a $CaCl_2$ concentration of 2 M, crystallization occurred only at the interface between the two aqueous solutions
⇒ Due to insufficient mixing caused by the density difference and increased viscosity of the solutions.

Engineered Biochar-attapulgite clay composites: A novel slow-release phosphorus fertilizer

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Aim and background

- **Phosphorus (P)** is crucial for crop growth but often becomes **chemically fixed** in topsoil, limiting its availability in deeper layers and causing **stratification**.
- This research aims to create a **slow-release P fertiliser** to help address soil stratification over the long term.
- **Canola waste biochar**, combined with **attapulgite** (ATP) clay, can form cost-effective **nanocomposites** for optimal P loading. These biochar-clay composites offer a **sustainable** approach to improve P **availability** in soils.

Methodology

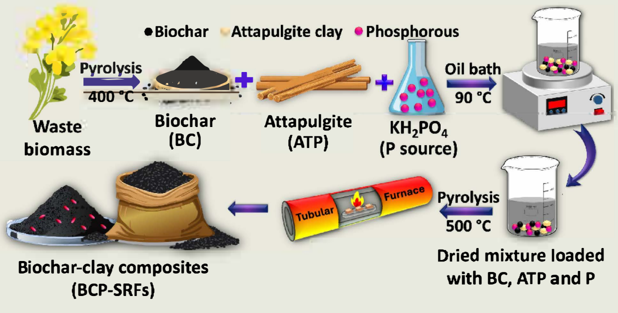

Figure 1: Schematic illustration of the synthesis of biochar clay composites based slow-release fertilizers (BCP-SRFs),

Preliminary Research Results

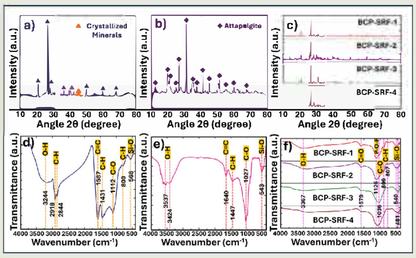

Figure 2: **a-c)** powder X-ray diffraction patterns, and **d-f)** Fourier Transform Infra-Red spectra of biochar (BC), attapulgite (ATP), and BCP-SRFs.

- The **PXRD** of biochar (**BC**) and clay show crystalline peaks from minerals. Significant peaks in attapulgite (**ATP**) were observed at 2θ positions: 13.86, 16.40, 19.84, 20.80, 24.09, 27.94, 28.77, 34.51, 34.87, and 35.31 [1].
- In BCP-SRFs, peak intensity decreases, indicating a reaction between phosphate and calcite present in the clay.
- **FTIR** of biochar and clay contains a diverse range of functional groups, including O-H, C-H, C=C, C-O and Si-O.

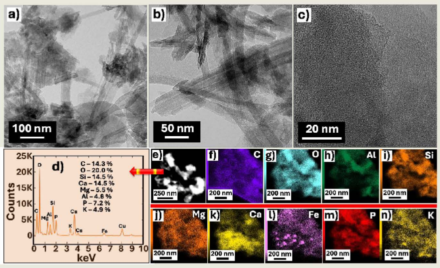

Figure 3: **a-c)** TEM images, **d)** TEM-EDS elemental quantification, and **e-n)** TEM elemental mapping of BCP-SRF3

- **Figure 3** shows attapulgite as a single or multiple **rod-like structure** and BC as an amorphous **sheet/layered** type domain.
- **TEM-EDS** confirms the presence of various elements in BCP-SRF-3, where P tends to bind with elements like Mg, Ca, Al, and Fe.

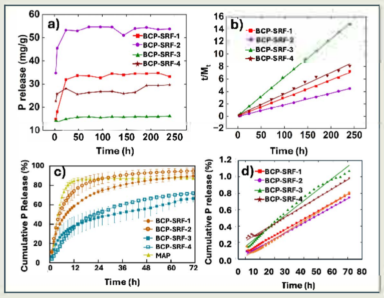

Figure 4: P release kinetics from BCP-SRFs obtained using the **a)** static method and **c)** dynamic method, **b & d)** pseudo-second-order model fitting for P release.

- **Figure 4 (a & c)** shows the static and dynamic release profile of BCP-SRFs material.
- **Figure 4 (b & d) illustrates** the pseudo-second-order model, which best describes the P release kinetics for static and dynamic release with R^2 = 0.99 for static and R^2 = 0.988 for dynamic release.
- BCP-SRF-3 and 4 released 20–30% (**Figure 4c**) less phosphorus in the first 24 hours than BCP-SRF-1 and 2, which showed consistently higher release.

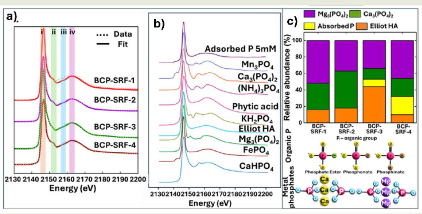

Figure 5: a) P K-edge XANES spectra of BCP-SRFs, **b)** P K-edge XANES spectra of various standards used for LCF of XANES data, and **c)** bar graph showing the distribution of P species in BCP-SRFs and the chemical/visual representation of organic P and metal phosphates

- **XANES P-k edge** spectra revealed peaks at 2145 eV and 2155 eV, corresponding to Ca phosphate and Mg phosphate [2,3].
- These results also correspond with the LCF fitting of **XANES** data.

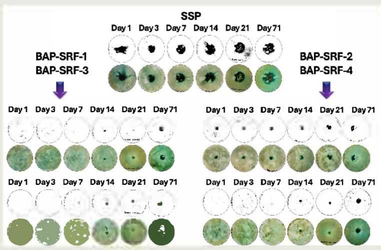

Figure 6: Visual Diffusion of P in soil studied using BCP-SRF and SSP

- **Visual diffusion of P** revealed that the synthesised material demonstrated the slow release.
- However, commercially available SSP (single superphosphate) has a rapid release of P within the first 24 h.

Conclusion :
BCP-SRF 3, biochar-clay composite, demonstrated significantly **slower P release** than commercially available MAP (mono-ammonium phosphate),and SSP, highlighting its potential as an effective slow-release fertiliser.

References:

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Cooperative Research Centres Program

P-09

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Proposal of a probability calculation method that leads to thermal runaway in a impacted lithium-ion battery

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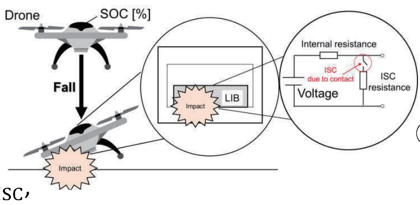
Abstract (100-200word, 16 point)

Drones are expected to be used in industrial applications, particularly in chemical plants, for equipment inspection and monitoring. However, the widespread use of drones has led to an increase in the number of drone crashes, raising concerns about the possibility of similar incidents occurring in chemical plants. In particular, there have been reported cases in which the lithium-ion batteries (LIBs) onboard drones were damaged during crashes, resulting in thermal runaway and fires. Operating drones in chemical plants requires risk assessments of various risks, including human contact, noise pollution, and invasion of privacy. However, no risk assessment has been conducted on the risk of LIB thermal runaway in the event of a drone crash. Therefore, in this study, we propose a method for calculating the probability of LIB thermal runaway following an impact, aiming to establish a method for calculating the risk of LIB thermal runaway in the event of a drone crash. We then estimated this probability for pouch-type LIBs.

●Theory

Event progression when a drone crashes



①The drone crashed and the LIB on board was impacted

$\boldsymbol{P_{\mathrm{ISC}}}$

②Impact causes an internal short circuit

$\boldsymbol{P \cong 1}$

③Heat is generated by Joule heat from an internal short circuit

$\boldsymbol{P_{\mathrm{SOC}}}$

④Leads to thermal runaway

P_{TR} can be expressed as the product of P_{ISC}, the probability that an internal short circuit will occur, and P_{SOC}, the probability that the charge rate will lead to thermal runaway when an internal short circuit (ISC) occurs.

$$P_{\mathrm{TR}} = P_{\mathrm{ISC}} \times P_{\mathrm{SOC}}$$

P_{ISC} can be shown as a Weibull distribution with respect to impact energy (Fig. 1).

$$P_{\mathrm{ISC}} = 1 - \exp\left(-\frac{E}{\lambda}\right)^{k}$$

k, λ : Shape parameters

E : Impact energy

P_{SOC} can be expressed as follows using the probability density function of the β distribution:

$$P_{\mathrm{SOC}} = \int_{\mathrm{SOC}}^{100} f(x;\alpha,\beta)\,dx \qquad f(x;\alpha,\beta) = \frac{x^{\alpha-1}(1-x)^{\beta-1}}{B(\alpha,\beta)}$$

α, β : Shape parameters

x : SOC

The minimum charge rate at which LIBs go into thermal runaway

●Results and Discussion

Estimated for pouch-type LIB (Fig. 2)

$$P_{\mathrm{ISC}} = 1 - \exp\left(-\frac{E}{37.32}\right)^{28.87} \qquad P_{\mathrm{SOC}} = 0.972$$

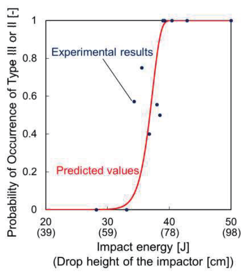


Fig. 1 Relationship between P_{ISC} and impact energy

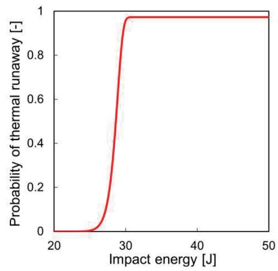


Fig. 2 Relationship between P_{TR} and impact energy

It was found that if a pouch-type LIB receives impact energy exceeding 35.8 J, the probability of thermal runaway exceeds 50%.

Designing a drone to minimize impact on the LIB during a crash is crucial for safe drone operation.

P-10

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Kinetic analysis of continuous hydrogen fermentation using waste molasses by FO-MBR

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Abstract

Green hydrogen is considered one of the most promising sources of hydrogen for a hydrogen society, and there is a need to establish fermentation hydrogen production technology using biomass. However, one of the issues with hydrogen fermentation processes is the treatment of wastewater and residues generated during the fermentation process.

Therefore, by combining MBR (Membrane BioReactor) and forward osmosis membranes, it is possible to retain microorganisms, treat wastewater, and concentrate all soluble components, including substrate components, thereby enhancing reactor efficiency.

In this study, we conducted FO-MBR operation and solute kinetic analysis using waste molasses as a substrate and a bacterial community selected from activated sludge.

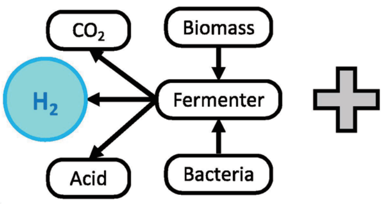
In the operational tests of CSTR and FO-MBR, stable fermentation was observed after a certain period of time in CSTR. After switching to FO-MBR, the concentrations of each solute were observed. The yield improved from 1.49 mol H_2/mol Hexose in CSTR to 1.78 mol H_2/mol Hexose in FO-MBR.

Additionally, model analysis was able to explain concentration changes in nearly all substances, except during the initial unstable phase of fermentation. This analysis enabled quantitative evaluation of metabolic rates for each substance in both CSTR and FO-MBR.

Introduction

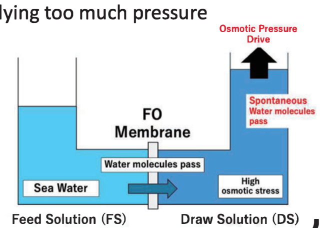
Hydrogen Fermentation

→ Method of generating hydrogen from organic waste by microbial reaction



Forward Osmosis (FO) Membrane

→ Drain the water by using Feed Solution (FS) and Draw Solution (DS) without applying too much pressure



Operating **FO-MBR**

- Improved yield through solute concentration
- Reduced load in residue and wastewater treatment

Aim! FO-MBR operation evaluation
Kinetic analysis for each solute

Method

1. Preculture of microflora
2. Batch
3. CSTR
4. FO-MBR
5. Analysis

Repeatedly Perform

<Experimental Condition>

Materials : Molasses
Fish Meal
Temp. : 37 °C
pH : 5.5
Bacteria : Bacterial flora from Heat-selected (90 °C, 1h)
HRT : 12 h

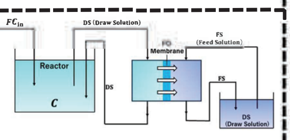


Fig.1 FO-MBR

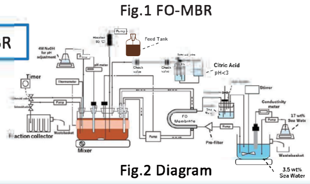


Fig.2 Diagram

Result

1. FO-MBR Operating

Amount : CSTR and FO-MBR have the same slope
FO-MBR : H_2 Yield **UP↑**
Rate **DOWN↓**
Metabolites : CSTR → **A steady state**
FO-MBR → **Concentrated** (Excluding Glucose)

Table1 Hydrogen Yield & H_2 Production Rate

Status	HY [mol H_2/mol Hexose]	H_2 Production Rate [mL/min]
1st CSTR	1.49	15.7
1st FO-MBR	**1.78**	**13.2**
2nd CSTR	1.40	15.1
2nd FO-MBR	**1.44**	**12.6**

2. Kinetic analysis

<Formula>

$$V\frac{dC}{dt} = FC_{\mathrm{in}} - FC_{\mathrm{ou}} - rV$$

(V ⋯ Reactor Volume、F ⋯ Flux、C ⋯ Concentration、r ⋯ Solute metabolism rate
CSTR ⋯ $C_{out} = C$、FO − MBR ⋯ $C_{out} = 0$)

Other than lactic acid
→ Experimental values and analytical values are the **same**

Lactic acid
→ Does not match the model
Possible changes in metabolic pathways

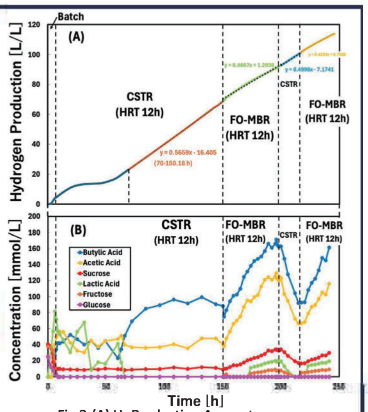


Fig.3-(A) H_2 Production Amount
Fig.3-(B) Concentration changes in each solute

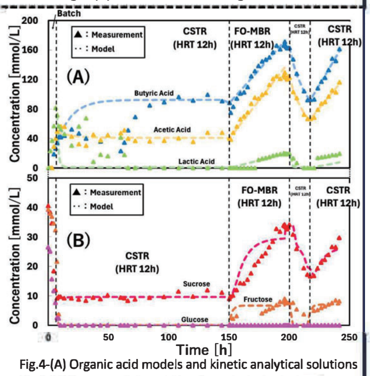


Fig.4-(A) Organic acid models and kinetic analytical solutions
Fig.4-(B) Sugar models and kinetic analytical solutions

P-11

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

PLASTIC : Infrastructure from Waste

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Abstract

Plastic waste, often considered a burden, reveals its potential when redirected into sustainable infrastructure. India, grappling with over 3 million tonnes of plastic waste annually, has pioneered applications such as plastic-bitumen roads, compressed plastic bricks, and upcycled benches and tiles for public spaces. Utilizing shredded thermoplastics—like LDPE, HDPE, and PP—this approach combines local waste with conventional binders to yield robust, low-cost infrastructure components.

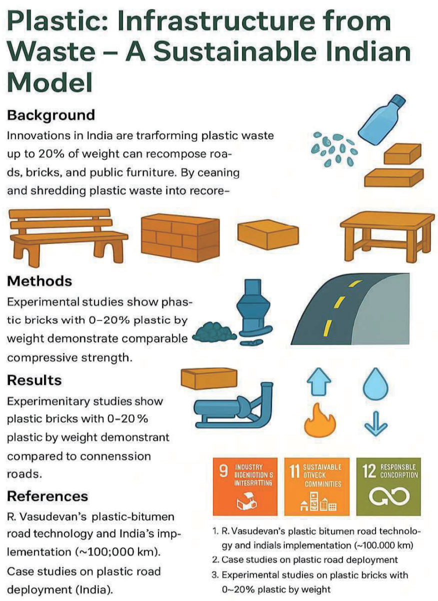
Experimental results indicate that adding 0–20% plastic to traditional bricks enhances compressive strength, improves thermal insulation, and lowers moisture absorption, while plasticized road surfaces demonstrate improved resilience and skid resistance. Nationwide, over 100,000 km of plastic roads have been constructed, diverting significant waste volumes from landfills. These innovations not only support SDG 9 (Industry & Infrastructure) and SDG 11 (Sustainable Cities) but also embody circular economy values under SDG 12 (Responsible Consumption & Production). This poster presents a replicable Indian model, combining environmental impact, scalability, and socio-economic benefits, for global sustainable infrastructure.

Scope of the Study

- Explore innovative reuse of plastic waste in infrastructure (roads, bricks, tiles, and furniture)
- Present India's scalable model (e.g. 100,000+ km of plastic-bitumen roads)
- Assess environmental and socio-economic benefits aligned with SDGs (9, 11, 12)
- Showcase the potential for global replication of Indian innovations

Key Results

- Plastic bricks (0–20% plastic by weight): Comparable compressive strength, reduced water absorption, and lower carbon footprint
- Plastic-bitumen roads: Higher durability, resistance to water damage, and longer lifespan
- Impact: Significant reduction in landfill waste, cost-effective infrastructure, and contribution to the circular economy
- Societal Benefit: Creation of green jobs and cleaner public spaces



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P-12

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3D printing from microscopic photography

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Abstract

Soil animals come in a variety of shapes and sizes. They are only a few millimeters, so it is difficult to display in museums and educational settings. A magnifying glass is required to view them. In addition, the creation, maintenance, and management of biological specimens for display require significant costs and human resources, which is a cause for concern. To address this issue, soil animals can be modeled in 3D and enlarged models can be created to promote education. However, modeling techniques for organisms measuring only a few millimeters in length have not yet been established, and 3D models have only been created for larger animals. Therefore, this study aimed to create 3D models of springtails, which exhibit diverse forms, and to create enlarged models from them.

Introduction

- Conventional 3D scanning technology and photography techniques are difficult to use for organisms that are only a few millimeters long.

Method

- 40～50 images while adjusting the angle in 15° increments
- Using modeling software (3Dzephyr)to create 3D models
- Import the created 3D data into Bumbu studio, a 3D printing software, edit it, and print it.

Process

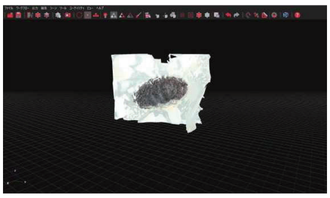
1

Take pictures about 40 to 50 pieces

2

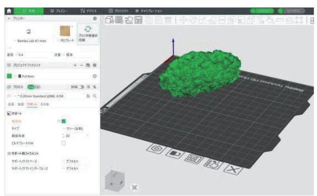
Collect images from different angles

3



Upload images to the generation software and create 3D models

4



Process 3D models and convert them into data that can be printed.

Result and discussion

- It is possible to create physical models from images captured with a microscope.
- However, it is not yet possible to create clear models due to issues such as focus errors.
- objects can only be reproduced up to 180 degrees.

P-13

Development of the Process for Maintaining the Microbial Condition in Continuous Hydrogen Fermentation Process Using Activated Sludge

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1. Introduction

In the pursuit of sustainable energy solutions, bio hydrogen fermentation has emerged as a promising waste-to energy concept, serving as a bridge between SDGs 6 and 7. Hydrogen production through dark fermentation is a biological process in which anaerobic bacteria convert organic substrates, such as glucose, into hydrogen gas and CO2 without the presence of light. This method offers a sustainable and low-energy pathway for biohydrogen generation from renewable biomass and waste materials. Traditionally, pure bacterial cultures *Clostridium* or *Enterobacter* species are used; however, they are prone to contamination and performance decline due to environmental shifts. In this study, a novel approach is employed by enriching hydrogen-producing bacteria from activated sludge through controlled heat treatment and maintaining their activity via continuous feeding, ensuring a stable and efficient microbial consortium in the fermenter.

2. Method and Materials

Dark fermentation was conducted in a 500 mL anaerobic bioreactor at 37 °C and pH 5.5, adjusted using 2 M NaOH. The synthetic feed (mimicking sugar industry effluent) contained per half Liter 22.04 g molasses, 4 g yeast extract, 0.05 g sodium sulphite, 0.1 g L-Cysteine HCl monohydrate, 400 mL fish meal, and 100 mL hot water. The mixture was stirred and autoclaved at 121 °C for 20 minutes. To enrich hydrogen-producing spore-forming bacteria, the inoculum (activated sludge) was heat-treated at a defined temperature for 1 hour to enrich spore-forming hydrogen-producing bacteria and supressing methanogenic one. The treated sludge was then fed into the fermenter using an ON/OFF peristaltic pump (ON time: 7.8 s, OFF time: 60 min), resulting in an approximate flow rate of 0.23 mL/min. The process began in batch mode and transitioned to semi-continuous feeding during the 48-hour experimental period.

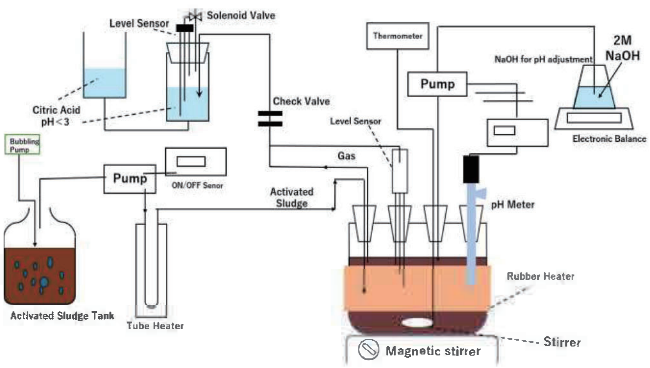

Fig. 1 Activated Sludge based Fermentation Set-up

Hydrogen gas was analysed using Shimadzu GC-8A, and soluble metabolites (sugars, organic acids) were quantified every 3 hours using HPLC (L-C610H-S).

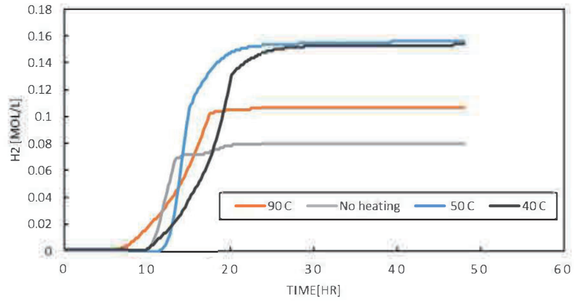

Fig.2 H2 (mol/L) vs time (hr) for batch at1 atm & 25 C

Fig.3 Metagenesis analysis for no heating , at 50 C & at 90 C respectively.

3. Results and Discussions

At 1 atm, 25 deg C, and pH 5.5, hydrogen production was significantly influenced by AS pretreatment temperature. Maximum yield (~0.165 mol) was achieved with AS heated at 50 °C, followed by 40 °C, indicating optimal microbial enrichment. AS heated at 90 °C showed reduced yield (~0.11 mol), likely from thermal inhibition. *Clostridium sensu stricto 1* abundance significantly increased from 0.062% in unheated sludge to 96.7–98.8% at 40–50 °C, and remained high (92.75%) at 90 °C, indicating that thermal pretreatment selectively enriched hydrogen-producing bacteria, as confirmed by metagenomic analysis. Thus, 50 °C and 40 °C are optimal, though slower in onset than standard preculture.

4. Conclusion

This study shows that heat-treated activated sludge, especially at 50 °C, effectively enriches hydrogen-producing bacteria and suppresses methanogens. Despite a slower start due to semi-continuous feeding, the system achieved stable hydrogen yields, proving it a sustainable method for biohydrogen production from organic waste.

5. References

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2. *Li, Y., Zhang, H., Wang, X., & Chen, Y. (2023). Enhanced biohydrogen production from heat-pretreated activated sludge via dark fermentation: Microbial community shifts and metabolic pathway analysis. Bioresource Technology, 376, 128994.*

P-14

YNU Symposium2025
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Decarbonizing Power Generation Through Smart Energy Systems

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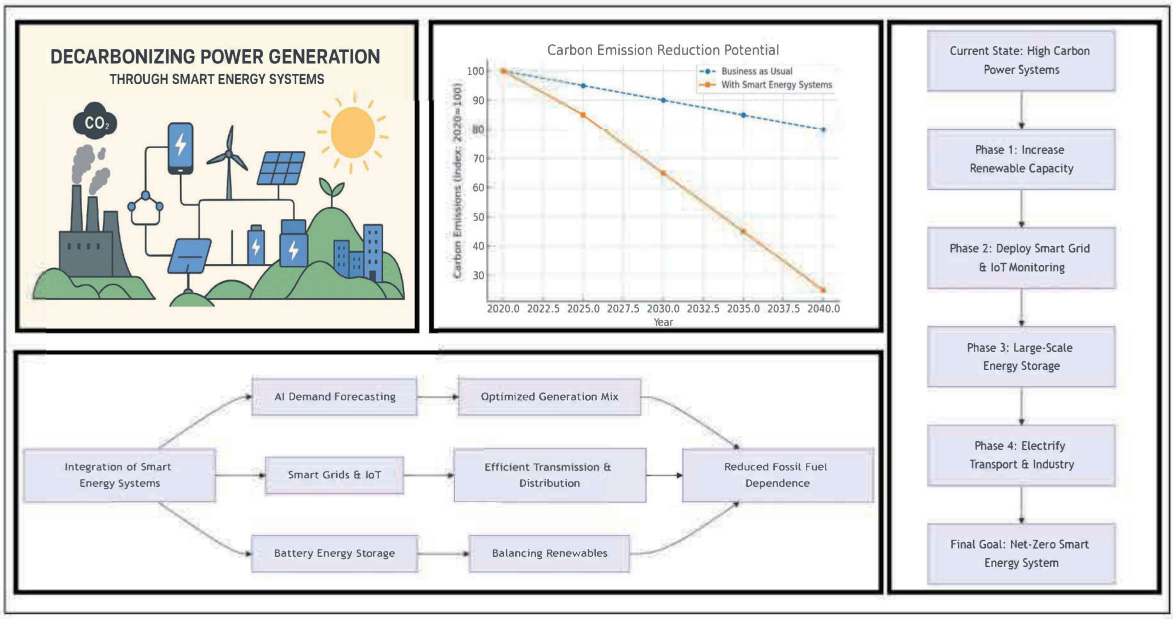
The power generation sector remains the highest contributor to carbon emissions, with coal-fired plants accounting for over 70% of electricity production. Transitioning to a carbon-neutral future requires integrating smart energy systems that enable clean generation, optimized transmission, and intelligent consumption. Technologies such as AI-based demand forecasting, real-time grid analytics, and battery energy storage are now being deployed to reduce reliance on fossil fuels and balance intermittent renewable sources. Solar and wind capacity is expanding rapidly, but without digital grid infrastructure, integration challenges limit their effectiveness. Smart grids allow dynamic load balancing, while advanced metering and demand-side management improve overall system efficiency. Pilot projects across Indian states are demonstrating how these innovations can cut emissions and improve energy access simultaneously. A shift to smart, responsive energy systems within power generation is critical for achieving deep decarbonization while ensuring stability and resilience in future energy networks.



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Dropwise and filmwise condensation characteristics of moist air on vertical flat plate

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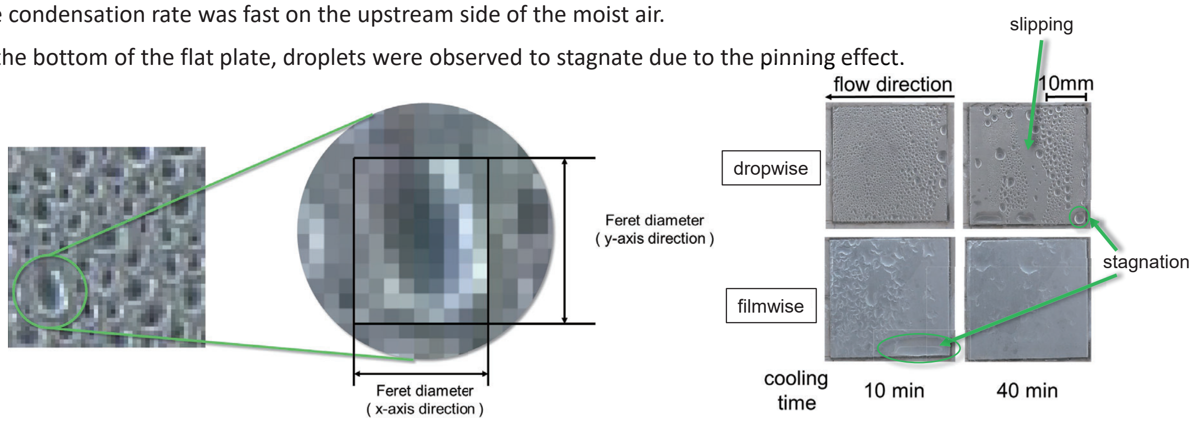
Abstract

Heat exchangers utilizing flat aluminum tubes are currently attracting significant attention due to their advantageous properties in various applications. However, a major issue is their poor drainage of condensed water. It is a known fact that the accumulation of condensation and defrost water on the external surface of the tubes negatively impacts their heat exchange performance. Therefore, predicting and controlling the characteristics of condensation and its subsequent flow, or drainage, is critically important.

In this study, we clarified the detailed process of condensation droplet formation and flow characteristics on a flat plate with a narrow width. Our observations revealed that dropwise condensation occurred on surfaces with a contact angle over 80.0°, while filmwise condensation was observed at contact angles below 25.0°. Condensation preferentially developed at the upstream section of the plate. At the bottom of the plate, droplet stagnation was observed due to the pinning effect. Additionally, we found that the rate of condensation formation increased with higher wind speeds, indicating a direct correlation between the two factors.

- Filmwise condensation was observed on coated flat plates, while droplet condensation was observed on untreated flat plates.
- The size of the droplets was quantified using the Feret's diameter.
- In droplet condensation, adjacent droplets merged and grew, and when the droplets reached the maximum Feret's diameter, they slipped and absorbed the droplets in the slip path.
- Filmwise condensation evenly wetted the heat transfer surface and formed a thin liquid film.
- The condensation rate was fast on the upstream side of the moist air.
- At the bottom of the flat plate, droplets were observed to stagnate due to the pinning effect.



YNU Symposium2025
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Effect of the sensor quantity on machine learning-based anomaly detection: A case study of hydrogen leakage from a hydrogen pipeline

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Abstract

Machine learning (ML)-based anomaly detection systems have been increasingly considered effective safeguards because of their ability to identify subtle anomalies in chemical processes. Such systems typically are composed of multiple sensors to sense flow, pressure, temperature, etc. in chemical processes, enabling the learning of potential data patterns and inter-sensor correlations. However, increasing the quantity of sensors can affect the reliability of the sensing unit. This study aimed to clarify the effect of sensor quantity on ML-based anomaly detection through a case study of hydrogen leakage from a hydrogen pipeline. First, a physical model of the hydrogen pipeline was constructed, and pressure/flow sensor data were generated for ML. Second, several ML models with different quantity of sensors were constructed using the correlation coefficients between sensor data. Then, anomaly detection was then performed with these models, and the probability of anomaly detection (P_d) and time to anomaly detection (T_d) were calculated. Finally, the reliability of the sensor units in systems equipped with these ML models was discussed. The results showed that the quantity of sensors considerably affects T_d, and that a system equipped with an ML model using data from four sensors was the most effective for this case.

Method

Construction of physical model of HPL

Table 1. Main input parameters of physical model of HPL

Parameters	Value	
Supply pressure	0.9 MPa	
Diameter of HPL	7.9 mm	
Length of HPL	(4), (5)	1000 m
	(2), (3)	500 m
	(1), (6), (7), (8), (9)	250 m
Rated power of fuel cell	(i),(ii), (v), (vi)	0.7 kW
	(iii), (iv)	4.0 kW
Pressure / Flow sensor	10 / 10	

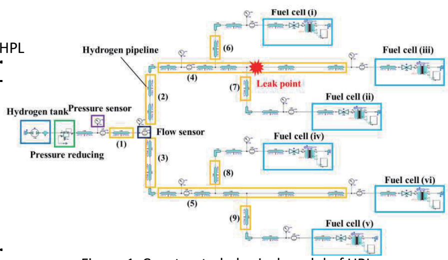

Figure 1. Constructed physical model of HPL

Construction of Machine learning models

$$c_{ij} = \frac{\sum_{k=1}^{T}(x_{i,k}-\bar{x}_i)(x_{j,k}-\bar{x}_j)}{\sqrt{\sum_{k=1}^{T}(x_{i,k}-\bar{x}_i)^2}\sqrt{\sum_{k=1}^{T}(x_{j,k}-\bar{x}_j)^2}}$$

c_{ij}: correlation coefficient between sensors

$x_{i,k}$: sensor data at time k

$\bar{x}_i$: average sensor data

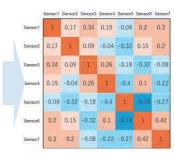

Figure 2. Image of characteristics used in ML models

Table 2. Condition of constructed ML models

ML model	Sensor quantity (n)	Sampling interval	Sampling interval
A	20	1 s	216000 s
B	8		
C	4		
D	2		

Calculation of reliability of sensor unit in ML model

R_{sensor}: reliability of each sensor

$$R_{\text{sensor}} = 1 - \frac{\lambda T}{2}$$

λ: failure rate

T: inspection interval

$$R'_{\text{sensor}} = \prod^{n} R_{\text{sensor}}$$

R'_{sensor}: reliabilityof entire sensor unit

Results

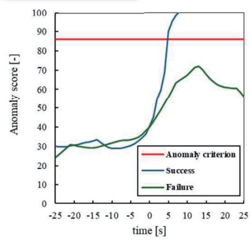

Figure 3. Example of anomaly detection

<Calculation of reliability>

$R_{\text{pressure sensor}}$

$$= 1 - \frac{5.32\times10^{-6}[/\text{h}]\times 8760[\text{h}]}{2} = 0.977$$

$R_{\text{flow sensor}}$

$$= 1 - \frac{3.63\times10^{-6}[/\text{h}]\times 8760[\text{h}]}{2} = 0.984$$

$$R'_{\text{sensor}(20)} = (R_{\text{pressure sensor}})^{10}(R_{\text{flow sensor}})^{10} = 0.690$$

Table3. Results of ML model performance

ML model	Sensor quantity (n)	Probability of anomaly detection (P_d)	Time of anomaly detection (T_d)	R'_{sensor}
A	20	0.95	6.71 s	0.690
B	8	0.95	1.95 s	0.854
C	4	0.95	3.35 s	0.924
D	2	0.95	3.99 s	0.961

Discussions

- ✓ P_d may not depend on the quantity of sensors because anomaly scores increase over time in successful cases
- ✓ T_d of ML model A and B indicate the importance of the sensor location to be selected
- ✓ P_d , T_d and R'_{sensor} are important indicators for evaluating these system as safeguards

This work was supported by JSPS KAKENHI Grant Number JP23K13522 and JP25K01463.

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Two Solvated Crystals of Chlorinated Diketopyrrolopyrrole Derivatives with Ethyl and Butyl Groups at the N Positions

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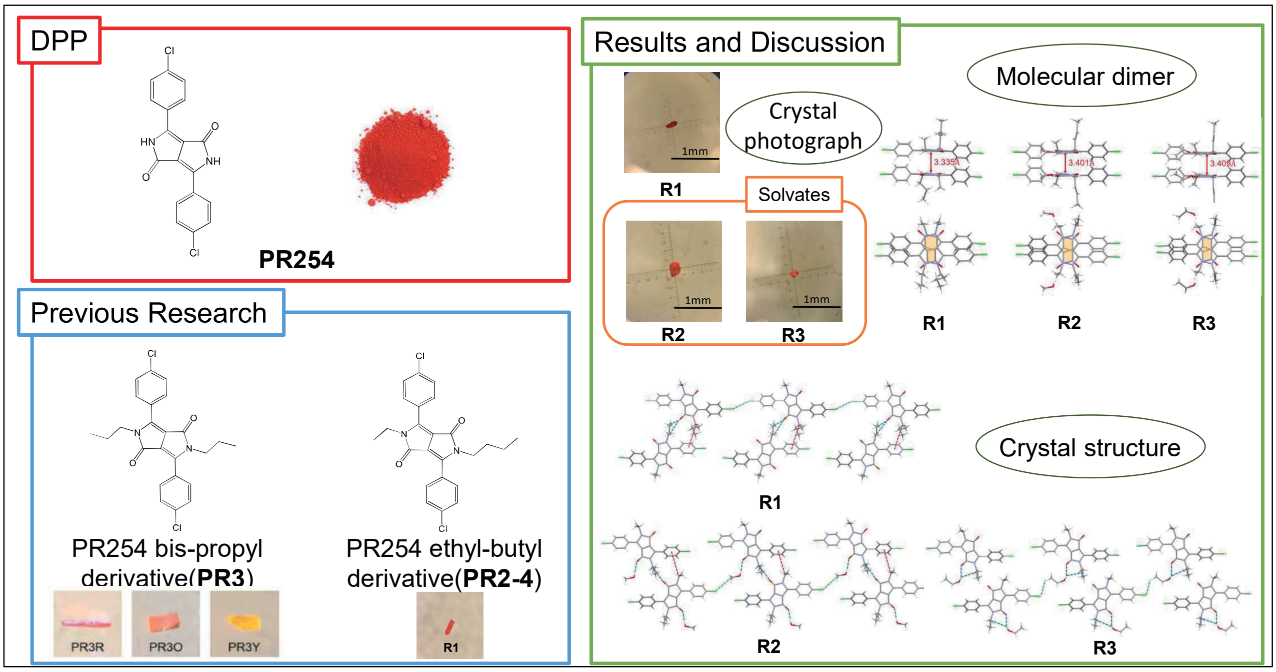
Abstract (100-200word, 16 point)

Diketopyrrolopyrrole (**DPP**) is a vivid yellowish-red pigment known for its excellent durability and has been widely used in automotive coatings. Recently, **DPP** derivatives have gained attention as functional dyes due to their high fluorescence quantum yields and strong molar absorption coefficients, with applications in dye lasers and organic solar cells. In such applications, crystal structure plays a critical role in determining solid-state properties. Therefore, it is important to investigate polymorphism in order to clarify the relationship between molecular structure and material properties in the solid state.

In this study, we synthesized a chlorinated **DPP** derivative (**PR2-4**) bearing asymmetric N-substituents—an ethyl group and a butyl group—and investigated its polymorphism through crystallization and single-crystal X-ray diffraction analysis.

As a result, in addition to the previously reported non-solvated red crystal (**R1**), two new solvated red crystals containing methanol (**R2**) and ethanol (**R3**) were discovered. In all three crystals, the PR2-4 molecules formed dimers, which stacked into one-dimensional columnar structures. In **R1**, the columns were connected through Cl···H–C interactions, whereas in **R2** and **R3**, the structures were stabilized by hydrogen bonding and CH···O interactions involving solvent molecules.



P-18 Life cycle assessment of conventional fuel and biofuel: A comparative analysis

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Abstract :

The reliance on petroleum diesel (non-renewable fuel) produced from crude oil raises many concerns due to its greenhouse gas emissions, air pollution, and resource depletion. The need for sustainable and viable alternatives has become evident for the existing engine technologies. Therefore, a biodiesel (renewable fuel) derived from used cooking oil, poultry, and cattle-based fuel is pivotal for driving toward greener fuels and combating environmental degradation. This study presents a comparative analysis of petroleum diesel and biodiesel (from poultry fat) through life cycle assessment (LCA), emphasising sustainable and viable metrics. Also, the bibliometric analysis conducted in the study suggests the need to minimise emissions and promote sustainable alternatives. Overall, the life cycle analysis reveals biodiesel as a promising alternative fuel, offering meaningful reductions in emissions and fossil energy usage, which are essential for advancing sustainable transportation solutions.

LIFE CYCLE ASSESSMENT OF CONVENTIONAL FUEL AND BIOFUEL: A COMPARATIVE ANALYSIS

OBJECTIVE:
To compare the environmental impacts of conventional fuel (diesel) and biofuel (biodiesel form poultry fat) using Life Cycle Assesment.

Software : openLCA 2.5.0

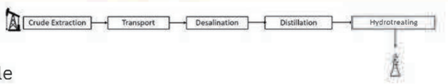


Fig.1.a: Production conventional petroleum diesel from crude oil

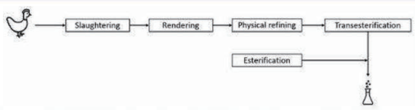


Fig 1.b: Production of biodiesel from poultry fat

BIBLIOMETRIC ANALYSIS

Fig.2: Word cloud

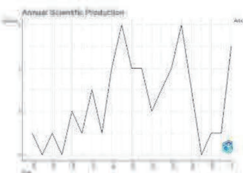


Fig. 3.a: Annual Scientific Production (without LCA)

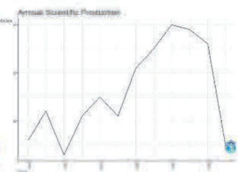
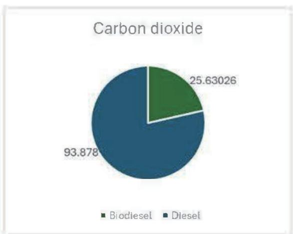


Fig.3.b: Annual Scientific Production (with LCA)

Impact category	Diesel	Biodiesel	Reference unit
Acidification: terrestrial	3.306038006	0.663012232	kg SO_2-Eq
Climate change	1064.017103	39.60417092	kg CO_2-Eq
Ecotoxicity: freshwater	17.41990615	1.135741533	kg 1,4-DCB-Eq
Ecotoxicity: marine	27.16334279	1.341610873	kg 1,4-DCB-Eq
Ecotoxicity: terrestrial	6250.63627	94.68309087	kg 1,4-DCB-Eq
Energy resources: non-renewable, fossil	10174.8565	5.633910264	kg oil-Eq
Eutrophication: freshwater	0.2720743985	0.011377938	kg P-Eq
Eutrophication: marine	0.3191267124	0.088906942	kg N-Eq
Human toxicity: carcinogenic	111.9689664	4.086081741	kg 1,4-DCB-Eq
Human toxicity: non-carcinogenic	67.3543995	26.8877589	kg 1,4-DCB-Eq
Ionising radiation	3.024800889	1.045009509	kBq Co-60-Eq
Land use	4.928436258	53.55584371	m^2*a crop-Eq
Material resources: metals/minerals	5.974037123	0.540762727	kg Cu-Eq
Ozone depletion	0.39282581	0.000414669	kg CFC-11-Eq
Particulate matter formation	2.010499076	0.117184948	kg PM2.5-Eq
Photochemical oxidant formation: human health	4.018093537	0.09578053	kg NOx-Eq
Photochemical oxidant formation: terrestrial ecosystems	4.486608095	0.093746803	kg NOx-Eq
Water use	4.392897455	2.901877776	m^3

Table 1: Impact Analysis of conventional petroleum diesel and biodiesel form poultry fat

GHG EMISSION OF BIODIESEL AND PETROLEUM DIESEL



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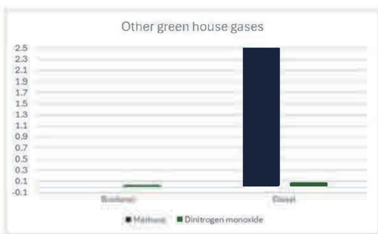

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Reference

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P-19

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

Purification and characterization of a microtube-forming protein from *Haliscomenobacter hydrossis*

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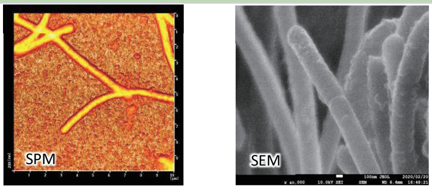
Collagen, keratin, elastin, and silk are known as fibrous proteins, all of which are derived from animals. Genetically modified bacteria have been used to ferment spider silk (an extremely tough fermented fiber), but this is also animal derived, and no bacterial fibrous protein is known.

Haliscomenobacter hydrossis is a filamentous bacterium of connected cylinder-shaped cells covered with a microtube-like sheath which is degradable with proteinases suggesting that it is an assemblage of a new type of fibrous protein.

The cells were removed from the bacterial filaments by enzymatic treatment and subsequent heat treatment in the presence of detergent. The sheath was purified by semi-dry electroelution followed by washing with water. The purified sheath was digested with trypsin, and the digests were fractionated by ultrafiltration. Fractions < 3 kDa and 3–10 kDa were subjected to reversed-phase HPLC to prepare digests suitable for partial amino acid sequence analysis using protein sequencer. Two partial amino acid sequences were successfully determined. Both of sequences were found in two unknown proteins encoded in H. hydrossis genome by homology search, suggesting that one of these two proteins is the sheath-forming protein. Computational prediction showed structures extremely rich in β-sheet without α-helix for both proteins.

INTRODUCTION



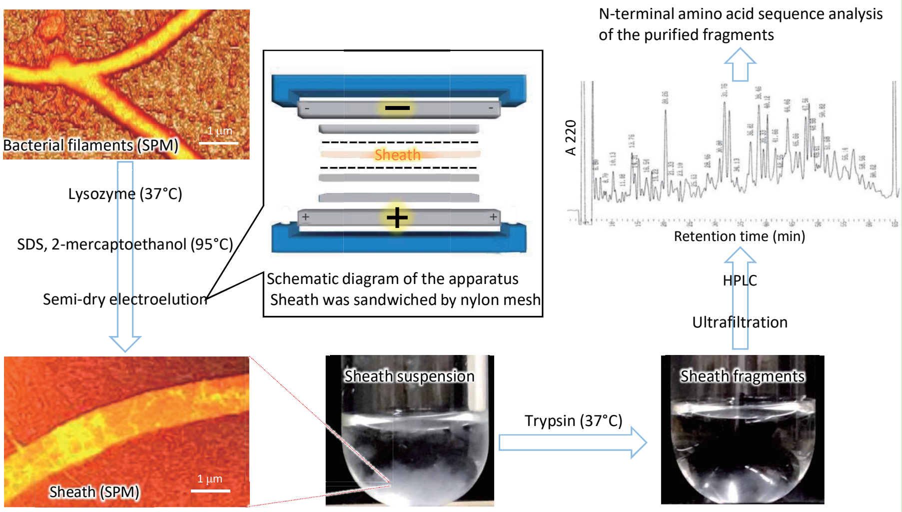
Microscopic images of *H. hydrossis*

OBJECTIVE

Purification of the microtube (sheath) of *H. hydrossis*

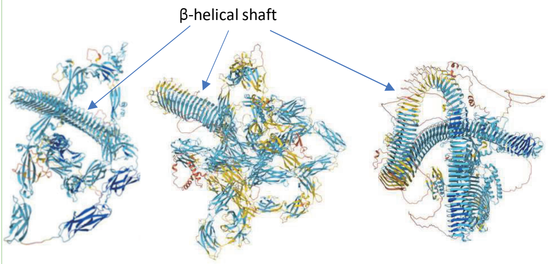
Identification of the sheath-forming protein (probably a fibrous protein)

METHDOLOGY



RESULTS

1. The sheath was resistant to lysozyme, SDS, and 2-mercaptoethanol
2. The sheath was successfully purified (contaminant proteins were removed) by semi-dry electroelution
3. The sheath was degraded by trypsin, chymotrypsin, elastase, and proteinase K
4. The sheath was resistant to papain and V8 protease
5. Two fragments (trypsin digests) of the sheath were high purity and the N-terminal amino acid sequences were successfully determined
6. Both of sequences were found in two unknown proteins encoded in *H. hydrossis* genome by homology search
7. By computational (AlphaFold3) prediction, the two unknown proteins exhibited 3D structure rich in β-sheet forming β-helical shaft typical for filamentous hemagglutinin



Predicted structures of possible sheath-forming proteins of *H. hydrossis*

Predicted structures of filamentous hemagglutinin of *Bordetella pertussis*

P-20

PLASTICS WASTES TO GREEN ENERGY – A SUSTAINABLE RECYCLING APPROACH

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ABSTRACT

Plastics have become a part of our day-to-day life due to its versatility, physiochemical properties, dimensional stability, excellent processing performance and low cost productions which makes them versatile in industry applications. The most common types of plastics are PET, LDPE, HDPE, PVC, PP, PS. Till date more than 8 billion tons of plastics have been produced but around 75% have been discarded as waste either dumped in landfills or released in the environment as pollutants due to absence of methods and technologies of reusing and recycling of plastic wastes According to statistics, if the present scenario of manufacturing, use and management of plastics wastes continues then around 12 billion tonnes of plastic wastes will accumulate in the landfills or in the environment by 2050. Different methods of recycling have been discovered and implemented to recycle these waste plastics like physical recycling which deals with heating, melting, extrusion and granulation of the plastic wastes to form new materials whereas chemical recycling deals with thermal, catalytic and electrical process to recycle the wastes. Recently, recycling plastic wastes to produce hydrogen and other valuable chemicals through thermal, electrical and catalytic processes has gained a lot of attention in research as it paves the path to green and circular economy as well as leads to sustainable environment and living. This poster gives a review of the various processes of recycling of these plastic wastes to produce hydrogen and different valuable chemicals.

INTRODUCTION

- Plastics are essential in daily life and industries due to their versatility, stability, and low cost.
- Excessive plastic production and poor waste management have led to severe environmental issues, especially microplastics.
- Common plastics include PET, LDPE, HDPE, PVC, PP, and PS.
- Over 8 billion tons of plastic have been produced, with 75% discarded as waste.
- Traditional disposal methods like incineration and landfilling cause pollution.
- Converting plastic waste into hydrogen via thermochemical, photo-reforming, and electro-reforming methods is gaining interest for sustainability.

THERMOCHEMICAL PROCESS

Thermochemical conversion is the most prominent method for plastic-to-hydrogen upcycling and generally, syngas instead of pure hydrogen gas is obtained. **Pyrolysis** (plastics converted in an inert atmosphere) and **gasification** (plastics converted under a controlled partial oxidation condition) are the main implemented thermochemical methods

PYROLYSIS

Pyrolysis is the most widely used thermochemical process for converting plastic waste into hydrogen fuel. It involves thermal degradation of polymers into smaller molecules under high heat and pressure, without oxygen. Pyrolysis is highly flexible, allowing optimization of hydrogen yield.
Key pyrolysis-based techniques:

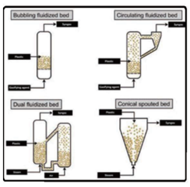
- Thermal pyrolysis-catalytic steam reforming
- Catalytic pyrolysis
- Microwave pyrolysis

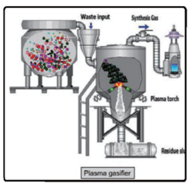
GASIFICATION

Gasification converts plastic waste into syngas (H_2, CO, CH_4, CO_2) at 700–1200°C using oxygen, steam, or air.
Types of gasification:

- Air Gasification – Uses air, produces low-energy syngas.
- Steam Gasification – Uses steam for hydrogen-rich syngas.
- Plasma Gasification – Uses plasma torches (3000–10,000°C) for complete breakdown.
- Catalytic Gasification – Uses catalysts for better gas quality.

Steam and plasma gasification are the most efficient for hydrogen production.





ELECTROREFORMING PROCESS

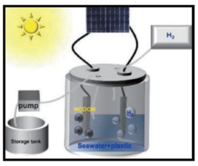
Electroreforming is an innovative electrochemical process that converts plastic waste into hydrogen and valuable chemicals, offering an eco-friendly alternative to traditional hydrogen production.

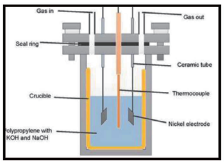
Mechanism:

1. Plastics suspended in an electrolyte and exposed to an electric current.
2. At the anode, plastics undergo oxidation, breaking into smaller hydrocarbons and releasing protons.
3. At the cathode, protons combine with electrons to form hydrogen gas.
4. Catalysts (e.g., metal nanoparticles) enhance reaction efficiency and selectivity.

Features:

- Sustainable & Low-Emission – Converts plastic waste into clean hydrogen.
- Energy-Efficient – Requires lower temperatures than pyrolysis or gasification.
- High Purity Hydrogen – Produces hydrogen with minimal contaminants.
- High Initial Costs – Needs advanced electrodes and catalysts.
- Feedstock Variability – Different plastics yield varying hydrogen outputs.



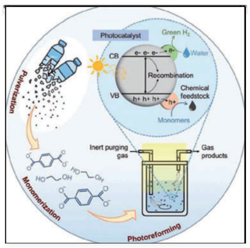


PHOTOREFORMING PROCESS

Photo-reforming (Photocatalysis) is a cheap, green, and sustainable technique for converting plastic waste into hydrogen fuel and valuable chemicals.Uses ambient temperature and pressure, relying on solar energy as the primary energy source. The process enables precise activation and breakdown of chemical bonds in plastics, allowing selective production of target chemicals. Efficient semiconductor photocatalysts facilitate plastic-to-hydrogen conversion.

Mechanism:

- Photon absorption – Photocatalysts absorb light, exciting electron-hole pairs.
- Charge carrier separation & migration – Photogenerated charges separate and move.
- Surface redox reactions –
  - Photogenerated holes oxidize plastics, breaking them down.
  - Photogenerated electrons reduce water to generate hydrogen fuel.
- The process is mild, energy-efficient, and eco-friendly, offering a promising approach to plastic waste recycling.



WATER SPLITTING AND PHOTOREFORMING

Plastic photocatalytic upcycling is more efficient than conventional water splitting due to its lower energy barrier, reducing the energy required for hydrogen production. It utilizes a larger portion of the solar spectrum, making the process more effective. Plastics act as sacrificial agents, replacing costly reagents like methanol, and co-generate value-added chemicals at a lower cost.

The simplified reactions for water splitting and plastic photoreforming are summarized below:

$$\text{Semiconductor} + h\upsilon \rightarrow h^+_{(VB)} + e^-_{(CB)} \quad (1)$$

In water splitting:

$$4\,h^+_{(VB)} + 2H_2O \rightarrow O_2 + 4H^+$$

$$2e^-_{(CB)} + 2H^+ \rightarrow H_2$$

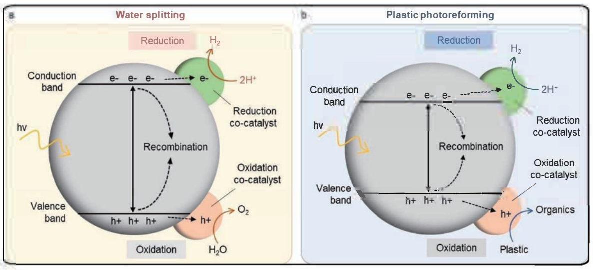
In plastic photoreforming:

$$h^+_{(VB)} + H_2O \rightarrow {}^{\bullet}OH + H^+$$

$$h^+_{(VB)} \text{ or } {}^{\bullet}OH + \text{plastics} \rightarrow$$

$$\text{intermediates} + \text{organic products}$$

$$2e^-_{(CB)} + 2H^+ \rightarrow H_2$$



SUMMARY

Upcycling waste plastics into hydrogen fuel is an environmentally and economically promising approach. Thermochemical, photocatalytic, and electrocatalytic processes offer viable plastic-to-hydrogen conversion methods, but large-scale implementation remains challenging. Photocatalytic and electrocatalytic methods produce high-purity hydrogen, while thermochemical processes generate hydrogen-rich syngas, requiring regulation or separation for purity. Co-pyrolysis and co-gasification with other wastes, such as biowaste and municipal solid waste (MSW), improve syngas production and energy efficiency, but their molecular mechanisms are not well understood.

A major challenge is the development of cost-effective catalysts, requiring research into structure-performance relationships and plastic decomposition mechanisms. While earth-abundant materials like natural ores and biochar have shown potential, further improvements are needed to enhance catalytic performance. High energy costs hinder thermochemical and electrocatalytic techniques, making solar energy integration and industrial waste heat utilization attractive solutions to reduce costs and environmental impact.

Photo- and electro-reforming processes, though in their early stages, offer a sustainable way to produce pure hydrogen from plastic waste. Further research is needed to explore diverse plastic feedstocks, develop scalable reaction systems, design efficient and cost-effective catalysts, and deepen the understanding of catalytic mechanisms to advance plastic-to-hydrogen conversion technologies for industrial applications.

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P-21

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

Polymorphs of a *N*,*N'*-diethyl chlorinated diketo-pyrrolo-pyrrole derivative

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Abstract (100-200word, 16 point)

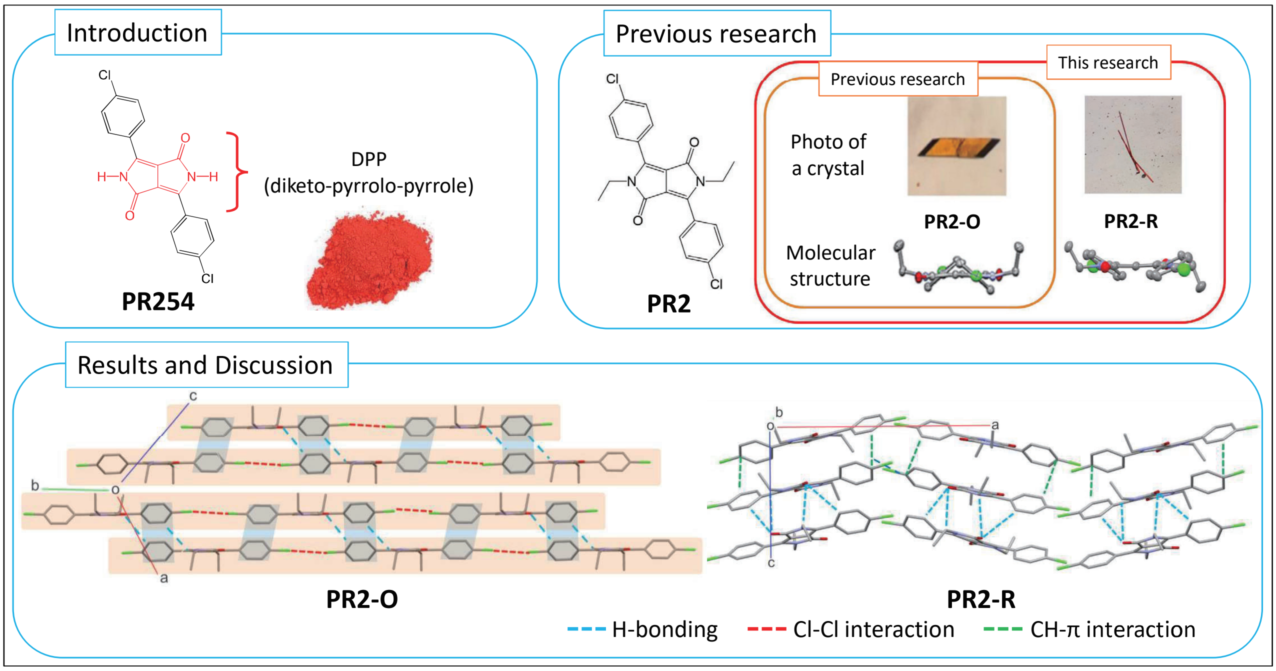
PR254 exhibits a very vivid yellowish red color and has excellent weather resistance, heat resistance, and solvent resistance. As a result, it is used as a high-performance red pigment in automotive paints, color filters, and other applications.

Many polymorphs have been reported in **PR254** derivatives. Polymorphism is a phenomenon in which substances with the same chemical formula crystallize in different crystal structures.

In this study, we synthesized, crystallized, and structurally analyzed **PR2**, which has ethyl groups introduced into the two *N* positions of **PR254**. In previous studies, orange crystals of **PR2** were obtained, and their molecular conformation and crystal structure were characterized by single crystal X-ray diffraction (SCXRD).

As a result of crystallization, new red crystals were obtained. SCXRD of the red crystals revealed that this crystal form belongs to a different space group from that of the orange crystals and thus they are polymorphs. The red polymorph is named **PR2-R**, and the orange polymorph is named **PR2-O**.

Regarding the crystal structure of these two polymorphs of **PR2**, **PR2-O** formed one-dimensional chains through Cl-Cl interactions. Adjacent one-dimensional chains were stacked through π-π interactions between benzene rings and two hydrogen bonds. In **PR2-R**, molecules didn't form one-dimensional chain and they are packed in a zigzag fashion. Adjacent molecules were stacked by four hydrogen bonds and CH-π interactions.



P-22

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

Indoor Air Quality Analysis across different seasons for Classrooms with varying Ventilation Conditions

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Abstract

Indoor air quality (IAQ) is a critical determinant of student health, comfort, and cognitive performance, yet it remains understudied in the context of Indian classrooms. This research analyzes IAQ variations across four classrooms at Kendriya Vidyalaya, IIT Kanpur, during different seasonal conditions, with a focus on how ventilation, classroom orientation, and occupancy influence pollutant levels and perceived comfort. Measurements were conducted using a Hobo logger for CO_2 levels and an AtmosPro Tube for particulate matter (PM_1, $PM_{2.5}$, PM_{10}), complemented by continuous outdoor meteorological data collection including rainfall, temperature, humidity, wind speed, and solar radiation. Additionally, real-time student feedback surveys captured perceptions of thermal comfort, focus, and well-being.

The results indicate distinct differences in IAQ across classrooms: those facing open fields exhibited elevated levels of particulate matter and volatile organic compounds (VOCs), while building-facing classrooms generally recorded lower pollutant concentrations. Temporal analysis revealed that pollutant peaks coincided with classroom occupancy hours, reflecting the influence of student activity and ventilation usage. Relative humidity and atmospheric pressure remained largely consistent across sites, while solar intensity and microclimatic differences contributed to intra-classroom variability.

Overall, the study highlights that classroom orientation and ventilation strategies play a significant role in shaping IAQ and student comfort. The findings underscore the need for context-specific interventions, such as optimized ventilation designs and activity-based management, to improve the learning environment in Indian schools.

❖ Introduction

Indoor Air Quality (IAQ) significantly influences student health, comfort, and learning efficiency.

— In Indian schools, classrooms mostly rely on natural ventilation, making IAQ sensitive to seasonal and outdoor conditions.

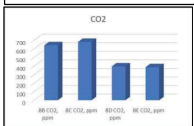
— ***Key parameters studied***: particulate matter (PM_1, $PM_{2.5}$, PM_{10}), CO_2 levels, VOCs, temperature, humidity, and pressure.

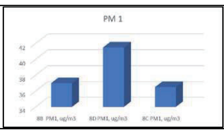
— ***Devices used***: Hobo Logger for CO_2 and AtmosPro Tube for PM measurements.

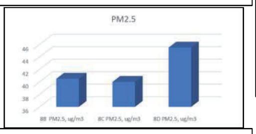
— Study conducted in 4 classrooms of Kendriya Vidyalaya, IIT Kanpur, with varying orientations and ventilation conditions.

Hobo Logger for CO_2

AtmosProTube for PM levels







❖Results

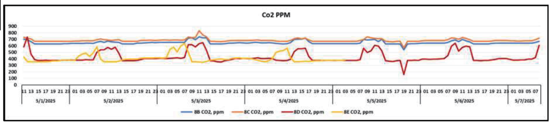
— CO_2 levels were higher in open-field facing classrooms compared to building-facing ones.

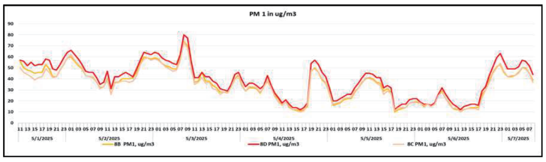
— Particulate matter (PM_1, $PM_{2.5}$) concentrations peaked in building-facing classrooms, especially during active school hours.

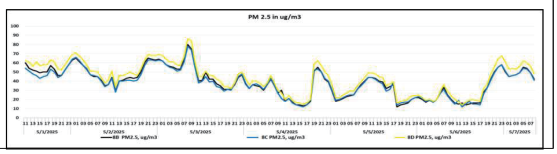
— Clear diurnal variations observed, strongly linked to occupancy and ventilation.

— Student comfort responses aligned with measured IAQ variations.

(Further seasonal analysis is ongoing as part of the next phases.)







P-23

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

Correlations between preparation conditions, pore size, number of adsorption sites, and uptake of heavy metal cations in organically-modified SBA-15 motif mesoporous silica

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Abstract

Organically-modified SBA-15 mesoporous silica is a promising adsorbent for the removal of heavy metal cations owing to its large surface area, tunable pore structure, and functionalizable surface chemistry. In this study, the correlations between preparation conditions, pore size, number of adsorption sites, and uptake of heavy metal cations were systematically investigated. We hypothesized that an increase in pore size and pore volume would facilitate deeper diffusion of species into the mesopores, thereby allowing a higher degree of organic functional group modification. Furthermore, larger pore size and volume were expected to increase the internal wall surface area, leading to higher adsorption capacity. SBA-15 was synthesized with sodium fluoride as a catalyst, and the pH during synthesis was varied to analyze the resulting structural properties by nitrogen adsorption measurements. For surface modification, two types of amino silane—3-aminopropyltrimethoxysilane and N-(2-aminoethyl)-3-aminopropyltriethoxysilane—were employed. Adsorption experiments were carried out using copper ions as the target species.

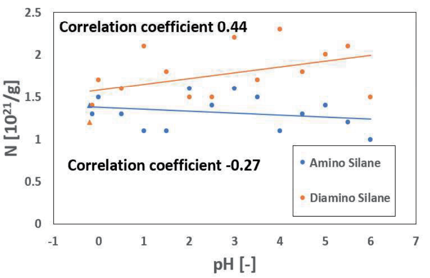

Fig.1 correlation between pH and N[10^{21}/g].

Fig. 1 shows the correlation between pH and N [10^{21}/g] for SBA-15 modified with amino silane and diamino silane.

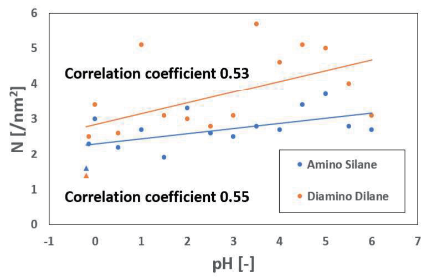

Fig.2 correlation between pH and N[/nm^2].

Fig. 2 shows the correlation between pH and N [/nm^2] for SBA-15 modified with amino silane and diamino silane.

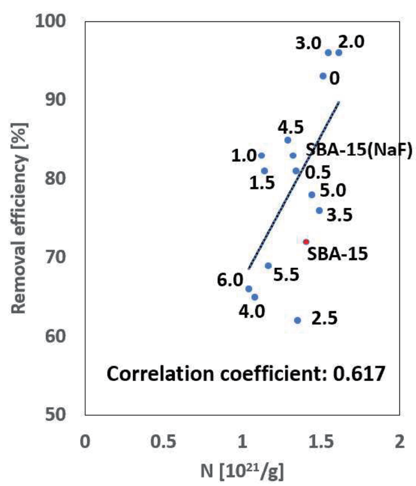

Fig.5 correlation between N[10^{21}/g] and removal efficiency[%].

Fig. 5 shows the correlation between removal efficiency [%] and N [10^{21}/g] for SBA-15 modified with amino silane. A correlation can be observed.

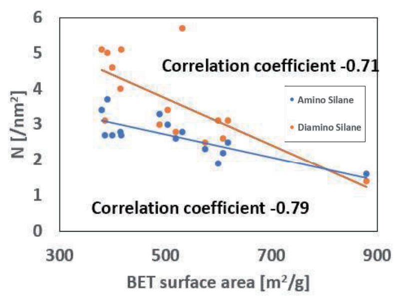

Fig.3 correlation between BET surface area[m^2/g] and N[/nm^2].

Fig. 3 shows the correlation between BET surface area[m^2/g] and N [/nm^2] for SBA-15 modified with amino silane and diamino silane. N [/nm^2] was found to depend on BET surface area.

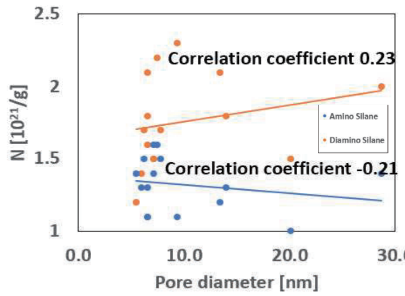

Fig.4 correlation between pore diameter[nm] and N[10^{21}/g].

Fig. 4 shows the correlation between pore diameter[nm] and N [10^{21}/g] for SBA-15 modified with amino silane and diamino silane. An optimal pore diameter for N[10^{21}/g] is considered to exist.

P-24

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

SUSTAINABILTY IN INDIAN HOUSEHOLDS

Culture rooted in Conservation

Long before sustainability became a global concern and terms like "eco-friendly" and "carbon footprint" entered everyday vocabulary, Indian households were already embracing sustainable living through their cultural practices and traditions. Rooted in the philosophy of ***"live with less and waste nothing"***, Indian homes, especially in rural and middle-class settings, have long followed conservation-centric lifestyles. From **clay pots (*matkas*)** and steel utensils replacing plastic, to practices like composting kitchen waste, reusing clothes as **quilts (*godris*)**, or growing herbs like ***Tulsi*** at home, these traditions reflect an inherent balance between living and preserving nature.

This poster explores how sustainability was not taught as a separate concept but lived daily, interwoven with spirituality, frugality, and respect for nature. Highlighting examples from Indian kitchens, living spaces, and gardens, it reveals how culture has been a powerful tool in conserving resources. In a world increasingly chasing innovation for sustainability, perhaps the answers also lie in revisiting and revaluing our roots. Through this lens, we understand how Indian culture has long exemplified sustainability; not as a modern trend, but as a timeless way of life.

PRESENTED BY: HARSHNOOR KAUR
PANJAB UNIVERSITY, harshnoorkaur660@gmail.com

SUSTAINABILTY IN INDIAN HOUSEHOLDS

Culture rooted in Conservation

Khadi: The Fabric of Freedom & Sustainability

Hand-spun, hand-woven, zero-carbon fabric; for conscious living.

India's Khadi industry saved over 8 million liters of water in 2022 compared to mill-made textiles.

Rainwater Harvesting in Courtyards

Ancient water collection systems in Indian homes to reuse and store rain.

Traditional rainwater harvesting in India can save 40,000–100,000 liters of water per household annually.

Kulhads & Mitti Pots

Earthen cups and cookware: fully biodegradable and culturally iconic.

A kulhad decomposes in less than 30 days, while plastic cups take 450 years to degrade.

Tulsi in Every Courtyard

Acts as a natural air purifier, mosquito repellent, and herbal healer -deeply sacred in Indian tradition.

Releases oxygen 20 hrs/day, absorbs CO_2 & SO_2, and cuts 70% airborne bacteria.

Culture of Reuse and Repurpose

Indian households have long practiced reuse by repurposing jars, fabrics, and containers, turning everyday items into tools of sustainability.

Globally, reusing items can cut household waste by up to 25%.

Ayurveda & Yoga

Natural healing and mindful living rooted in Indian homes, reducing waste and promoting balance with nature.

Global Ayurveda market expected to reach USD 16B by 2028 & Yoga reduces healthcare costs by 30% (WHO)

"The Earth is our Mother, and we are Her children"
- Atharva Veda

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

Development of fouling mitigation method in MBR by surface modification

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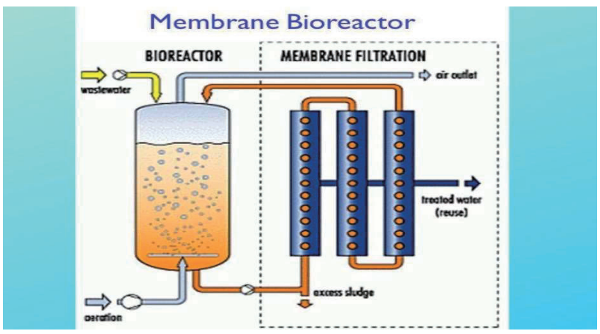
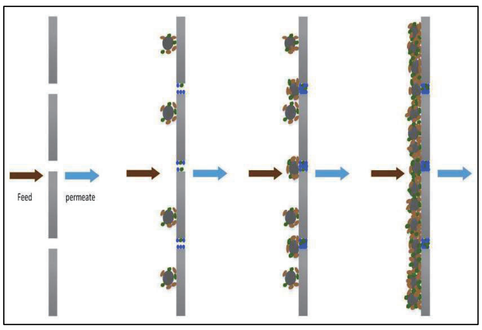
Abstract

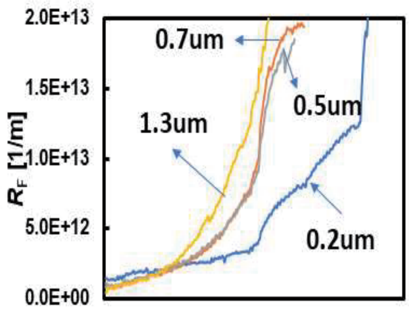
This study explored the impact of pore size and surface modification on fouling and cleaning behavior in porous alumina microfiltration membranes used in membrane bioreactors (MBRs) with backwashing. Membranes with pore sizes of **0.2, 0.5, 0.7,** and **1.5 µm** were tested, and surface modifications included silane coupling agents, 3-Aminopropyltrimethoxysilane (APTMS) (positive charge), Chlorotrimethylsilane TMS (weak hydrophobicity), and Trichlorooctadecylsilane (ODS) (strong hydrophobicity). The smallest pore size **(0.2 µm)** demonstrated the best anti-fouling effect due to pore blocking by similarly sized particles. Among surface treatments, **TMS-**modified membranes performed best in reducing fouling, likely because the adsorption layer formed early on hindered further foulant buildup, whereas APTMS and ODS were less effective. **Unmodified hydrophilic** membranes showed the greatest ease of **cleaning** after fouling with both physical and chemical methods. Additionally, fouling generally caused a decrease in the zeta potential magnitude, attributed to foulant adsorption. These findings suggest that smaller pores combined with weak hydrophobic surface modification optimize anti-fouling performance, while hydrophilic unmodified membranes offer superior cleanability, providing important guidance for membrane selection and design in MBR applications.



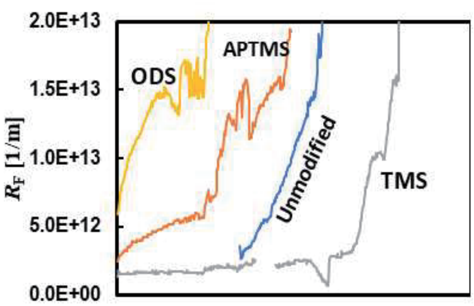
MBR : combines membrane filtration technology with biological processes such as activated sludge to treat waste water.



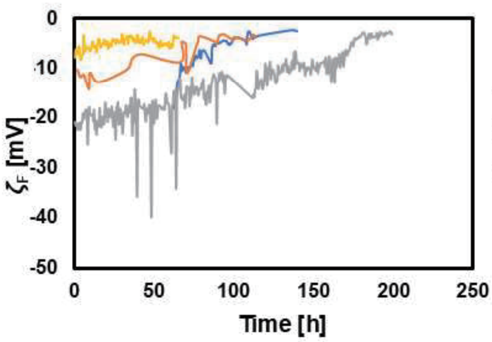
Challenges during MBR operation
"fouling mitigation"

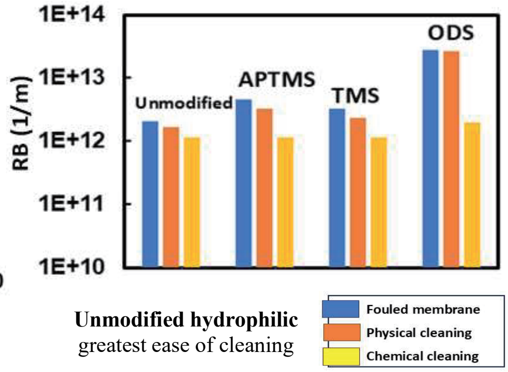


Possible strategies to remove fouling
pore size and surface modification on fouling and cleaning behavior in porous alumina microfiltration membranes



TMS (weak hydrophobic) membrane have highest anti-fouling performance





Unmodified hydrophilic
greatest ease of cleaning

YNU Symposium2025
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Spatially Distributed Multivariate Time Series Model for Meteorological grid data

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Abstract

In recent years, advances in IoT technology have made it possible to collect data from a variety of locations, leading to an increase in the acquisition of multivariate time series data with spatial expansion. By integrating such data and training AI with multivariate spatiotemporal data, it is expected that advanced Cyber-Physical Systems will be realized. On the other hand, data obtained from spatially different locations can be imbalanced, resulting in decreased accuracy in spatial domains with small amounts of data. In this study, we address one such challenge by focusing on the problem of predicting dam inflow using meteorological grid data. Previous studies have attempted to improve prediction accuracy by using multivariate time series models (MTSM) specialized to each dam[1]. However, for dams with limited data, the significant differences in spatial domains make transfer learning difficult. To address this issue, we proposes a new multivariate time series model, "Spatially Distributed MTSM (SD-MTSM)," which considers spatial spread. In this method, a spatial processing layer is added to the multivariate time series model TSMixer[2] to construct a foundation model that considers spatial domain information. Furthermore, by fine-tuning on this model for target dams with limited data, transfer learning that accounts for differences between spatial domains.

References

[1]Riko SAKAMOTO, Yosuke KOBAYASHI, Makoto NAKATSUGAWA, "COMPARISON OF MATHINE LEARNING METHODS FOR THE PREDICTION OF DAM WATER LEVEL DURING AN ABNORMAL FLOOD," *Japanese Journal of JSCE*, B1 Vol.74, No.5, I_1327-I_1332, 2018.

[2]Si-An Chen, Chun-Liang Li, Nathanael C. Yoder, Sercan Ö. Arık, Tomas Pfister, "TSMixer: An All-MLP Architecture for Time Series Fore- casting," Transactions on Machine Learning Research, 2023.

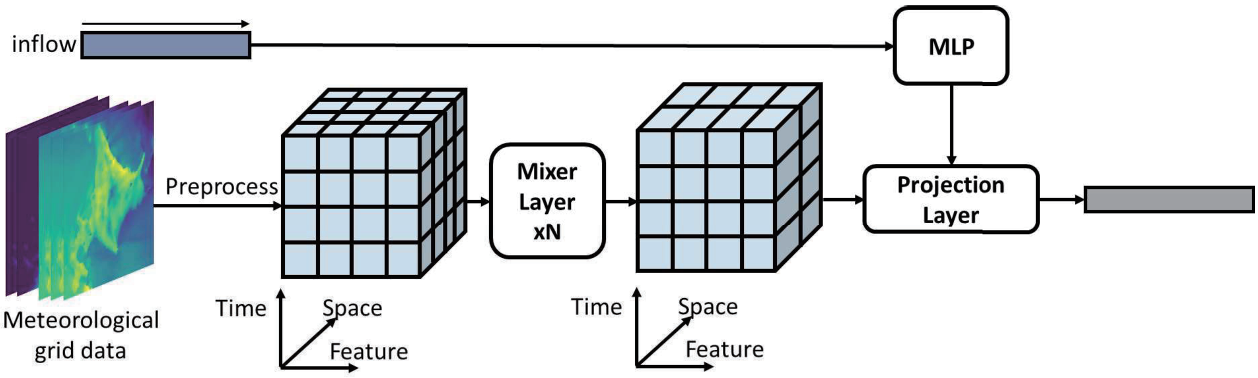

Figure 1. Architecture of the proposed model

- In this study, data was collected from three dams (Gosho dam, Miwa dam, and Sagae dam) and the results of learning from scratch with small amounts of data(1 year) and fine-tuning(4 year to 1 year) were analyzed.
- In few-data learning from scratch, high accuracy was achieved compared to the base model TSMixer.
- Even in fine tuning, it achieved high accuracy compared to TSMixer.
- When comparing scratch learning and fine tuning, it was confirmed that accuracy improved when using dams with large catchment areas as the source and dams with small catchment areas as the target.

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Circular economy as a pathway to net-zero emissions: An Indian perspective

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Abstract :

In view of the UN Climate Change Conference (COP26) and the growing need to reach net-zero, India has committed to achieve net-zero emissions by 2070. The goal to attain a net zero economy necessitates the decoupling of economic growth and environmental degradation. Circular economy, different from the traditional take-make-dispose (linear) model, aims at extending the lifespan of the material and minimizing resource consumption through regenerative and restorative practices. This study focuses on the role of circular economy and various legislative and policy frameworks, in advancing net-zero emission, focusing on their applications in key sector such as manufacturing, agriculture and energy. The study also examines the implementation of noteworthy plans such as, EPR (Extended Producer Responsibility), circular economy action plans, the clean energy mission etc to promote circularity, and analyses barriers unique to India's socio-economic landscape. The findings emphasise the potential of environmental governance in achieving net-zero, leading to triple bottom line benefits (environmental, social and economic).

Circular economy

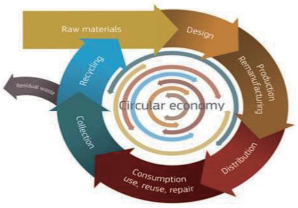


Fig1: circular economy

India's GHG Emissions by Gas

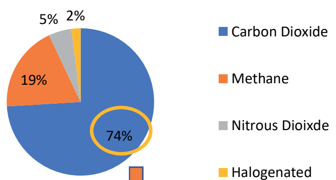


Fig2:

More than 70% of the India's GHG emissions come from CO2 emissions

India's emissions scenarios

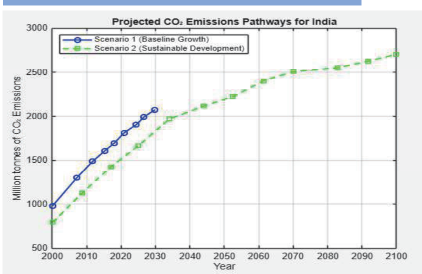


Fig3: Million tonnes of CO_2 Emissions VS Year

India's Clean Energy Mission

1. **Clean Energy as a National Mission**
- Union Minister Pralhad Joshi reaffirmed:
- Clean energy = national mission, not just environmental goal.
- Target: 500 GW non-fossil capacity by 2030 (critical for Net-Zero 2070).

Replacing fossil energy with renewables → resource efficiency + carbon neutrality

2. **PM-KUSUM & PM-KUSUM 2**
- Success in Rajasthan, Gujarat, MP → next phase soon.
- Supports farmers with solar pumps, decentralized renewable energy.

3. **Flagship Policies Driving Transition**
- PM-KUSUM → Solar pumps for farmers
- PM Surya Ghar: Muft Bijli Yojana → Rooftop solar for households

Circular economy cell

National Level

- Supports India's net-zero 2070 mission.
- NITI Aayog created CE Cell and develops sectoral roadmaps (steel, cement, agriculture)

Industry Level

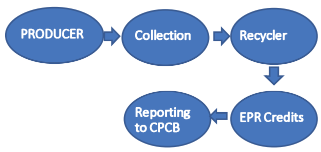
- FICCI -industry engagement, CE summits, research reports.
- CII -Resource Efficiency & Circular Economy Centre → helps industries adopt CE models.

State Level

- States like Maharashtra & Tamil Nadu exploring CE cells in Pollution Control Boards and Urban Development.

Extended Producer Responsibility

1. **India's Framework**
- Plastic Waste Management Rules, 2016
- EPR Guidelines (2022 amendment)
- CPCB online portal for registration, tracking & compliance.



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Layered Polysilsesquioxane: new support materials for metal/silica solid catalysts

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Abstract

Polysilsesquioxane (PSSQ) is an organic–inorganic hybrid material composed of a siloxane (Si–O–Si) backbone with organic groups attached to silicon atoms. This unique structure provides both the stability of silica and the tunability of organic polymers. In particular, layered PSSQ can accommodate metal ions between its layers, making it an attractive candidate as a catalyst support.

In this study, transition metal ions were adsorbed onto layered PSSQ to prepare metal-loaded catalysts. Structural changes were investigated by X-ray diffraction and electron microscopy, revealing partial exfoliation of the layered structure upon metal adsorption. The catalytic activity was evaluated using the degradation of 4-chlorophenol as a model reaction.

These findings demonstrate that layered PSSQ is a promising support material that combines structural flexibility and stability. It provides a new pathway for designing next-generation catalysts for environmental purification.

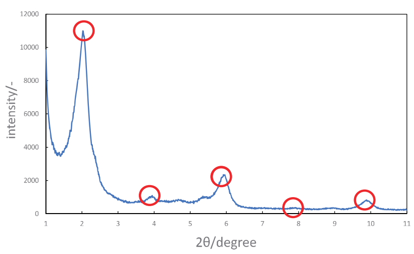

Fig.1 XRD of lamellar PSSQ.

The synthesized PSSQ exhibits an XRD peak assigned to the layered structure.

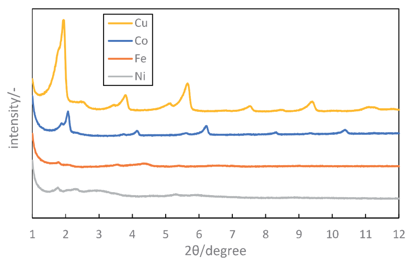

Fig.2 XRD of lamellar PSSQ adsorbed metal ions.

Peaks corresponding to the layered structure were clearly observed for Cu and Co samples. In contrast, no such peaks were detected for Fe and Ni samples, indicating that the layered structure was disrupted and exfoliation had significantly progressed.

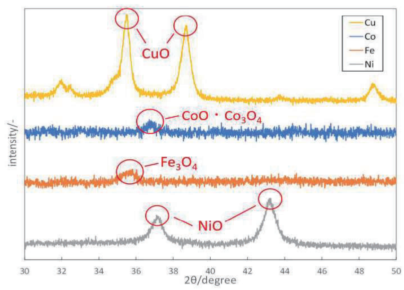

Fig.3 XRD of catalysts.

In each of the synthesized catalysts, peaks corresponding to metal oxides were observed.

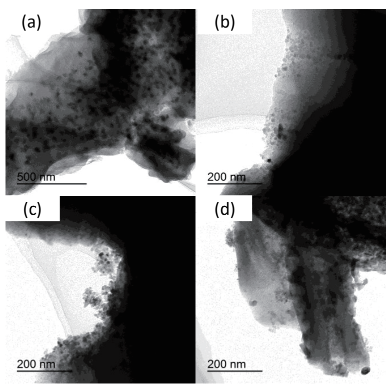

Fig.4 TEM of catalysts.
(a) Cu (b) Co (c) Ni (b) Fe

Table.1 Amount of metal atoms supported in the catalysts.

Metal species	Oxidation state	Metal atom loading (wt%)
Cu	CuO	37.3%
Co	CoO	39.4%
	Co_3O_4	38.0%
Fe	Fe_3O_4	57.5%
Ni	NiO	51.8%

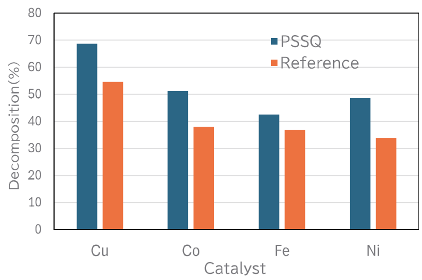

Fig.5 Decomposition of 4-chlorophenol.

For all transition metals examined, the catalysts using PSSQ as the support exhibited higher degradation rates and demonstrated greater catalytic activity compared with the reference catalysts.

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Bio-inspired shape memory alloy-based artificial muscle actuator for medical and cable driven parallel robot (CPDR) enabled application

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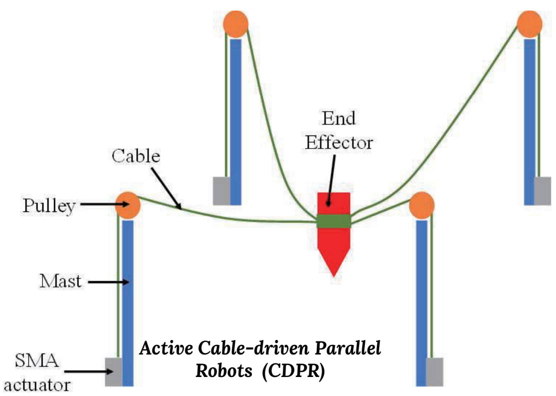
Abstract

With the advent of Cable Driven Parallel Robots (CDPRs), CDPRs offer increased flexibility, cost efficiency, enhanced load handling, precision and control, applications in harsh environments, improved safety, and expanded use in large-scale projects, making them highly versatile and effective for a wide range of industrial applications. The world is shifting towards smart or active systems from conventional systems. The traditional CDPR systems use motors, mechanisms, and links for robotic applications and operations. The lacuna of these systems is that such systems possess higher self-inertia, low payload to self-weight ratio, noisy operation, lesser work volume, and inconvenient for mobility and integration. The modern world is emerging with the use of cables across many fields, one of them being active cable-driven parallel robots (ACDPRs).

These active CDPRs are actuated by Shape memory alloy (SMA), which provides large range of tension for the end effector to perform the desired task, which gives a higher payload-to-weight ratio. The higher tension in the cable is achieved by the bipennate structure of SMA. These robots have provided a cutting edge in terms of large workspace, linear and rotary motion with minimum noise, lower the system's inertial force and easy integration. The present study focuses on the critical aspects of tension calculation, defining minimum and maximum tension thresholds, reaching a maximum print speed (750mm/s) which is 1.5 times of the value reported in open literature, determining the reachable workspace, and developing a comprehensive mathematical model for the active CDPR. It is observed that for certain types of architecture configurations of SMA can result in achieving a large tension in cable as compared to other existing configurations.

Active–Cable Driven Parallel Robots (A–CDPR)



Light-weight motion architecture:
- Cables
- Shape memory alloy (SMA) actuators

End-Effector:
- Extruder + nozzle for 3D/4D printing
- Rehabilitative assistance

Hypothesis

- Novel lightweight motion architecture coupled with intelligent controllers can result in 3D/4D printers that can match or even exceed performance of conventional 3D printers in terms of accuracy as well as productivity.
- Similar architecture proposed for enhancing the conventional cable-driven systems used for rehabilitation.

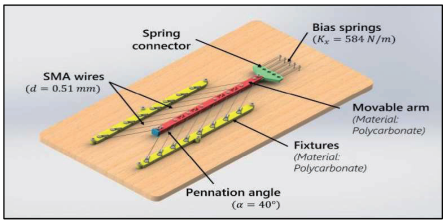


Fig: SMA based Bioinspired Actuator [1]

Challenges	Solutions
Slow actuation speed of SMA-based actuators	Design as well as thermal optimization
Nonlinear vibrations and cable slack	Intelligent motion control
Over/under feedback to the End-effector	Synchronized control

SMAs Potential
- High power-to-weight ratio
- Noiseless operation
- Adaptability to miniaturization

[1] Chaurasiya, K. L., et al. (2022). Design and development of non-magnetic hierarchical actuator powered by shape memory alloy based bipennate muscle. Scientific Reports, 12(1), 10758.

YNU Symposium2025
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Electroviscous effects and their control for energy-saving in microfiltration processes

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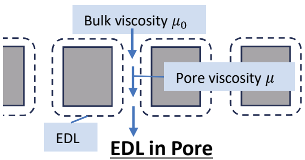
Abstract

Microfiltration membranes are widely used in various industries due to their simplicity and high performance. However, membrane fouling—seen as increased pressure drop and decreased flux—is a significant issue. While microfiltration is primarily based on size exclusion, the surface charge of membrane pores and particulate matter also affects separation performance and fouling behavior.

This study investigates the effects of ionic solution properties (pH, electrical conductivity, and ion type) and surface modifications (APTMS, ODS, TMS) on the zeta potential and electroviscous effect of alumina microfiltration membranes with a pore size of 0.2 µm. The results show that both the ionic environment and surface chemistry significantly influence zeta potential and flow resistance.

In particular, high electroviscous effects—which lead to increased pressure drop—were observed under alkaline conditions, low ion concentrations, and on hydrophobic surfaces. These conditions enhance the formation and overlap of the electrical double layer (EDL) within the membrane pores, increasing flow resistance. Therefore, when the zeta potential is negative value, electroviscous effect is high and it is hard to flow because of EDL constructed by negative charge.

Introduction



Electroviscous effect: Increase of viscosity in pore structure caused by EDL overlapping

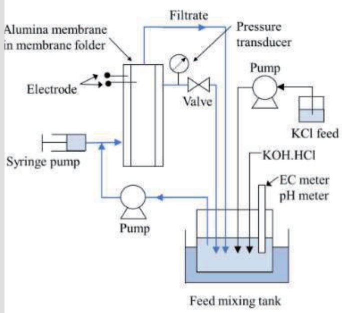
Objective

We used the alumina microporous membrane (0.2 µm) and check following impact.

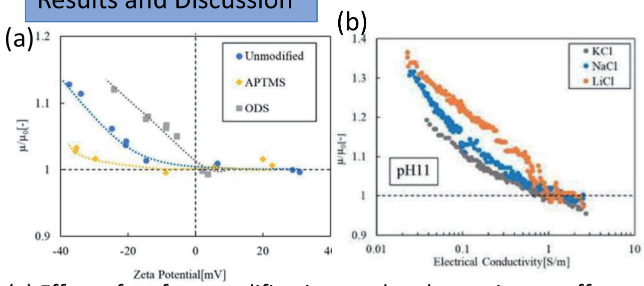
・Effect of surface modification on the electroviscous effect

・Effect of salt type on electroviscous effect

Experiment



Results and Discussion



(a) Effect of surface modification on the electroviscous effect

(b) Effect of salt type on electroviscous effect

(a)Hydrophobic membrane(ODS) increases relative viscosity.
→The water molecules near the hydrophobic groups become structured, making it difficult for molecules and ions to move within the pores.

(b)The relative viscosity increased in low concentration solutions, and the relative viscosity increased in the order of LiCl>NaCl>KCl.
→Since the mobility is in the order of K+>Na+>Li+, the electroviscous effect reflects the difference in the hydration structure of these ions.

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From Vedic Wisdom to Sustainable Futures: Science, Cycles, and Circularity

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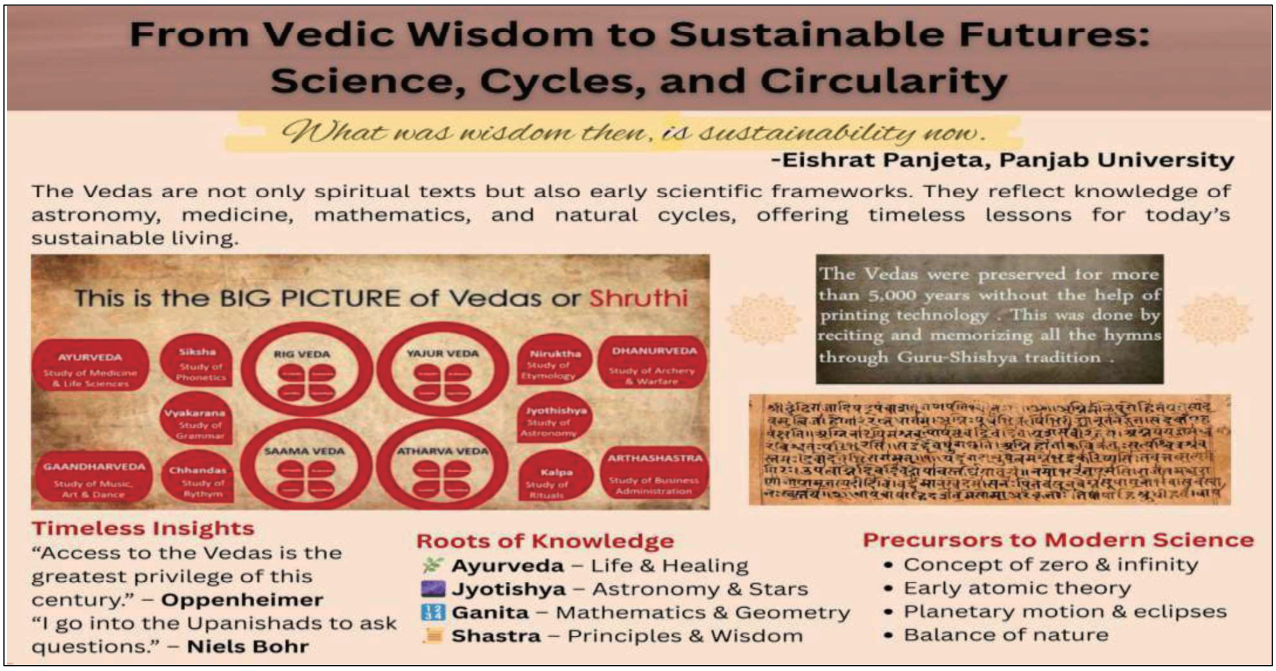
The Vedas are not merely ancient scriptures but repositories of scientific wisdom built upon cycles of nature, balance, and sustainability. Long before modern laboratories, Indian sages envisioned principles of physics, chemistry, astronomy, and mathematics through eco-conscious inquiry. Maharshi Kanad's atomistic theory reflected nature's indivisible building blocks, while Agastya's descriptions of electrochemical cells highlight renewable energy concepts. Rasayan Shastra (Vedic chemistry) demonstrated early circular economy practices—recovering metals, preventing corrosion, and reusing by-products as medicinal bhasmas, echoing today's nanotechnology and zero-waste ideals. Surya Siddhanta mapped planetary cycles and time as regenerative loops, anticipating sustainability through alignment with cosmic rhythms. Ganita Shastra pioneered the place-value number system, trigonometry, and calculus, enabling precise astronomical models that linked mathematical logic with ecological timekeeping.

Revisiting these traditions shifts our perception of ancient science from myth to method and from isolated knowledge to integrated sustainability. The Vedic worldview reminds us that science, when practiced in harmony with natural cycles, not only advances technology but also safeguards planetary well-being. This legacy offers a blueprint for circular and carbon-neutral innovations in the 21st century.



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Three polymorphs of N-ethyl chlorinated diketopyrrolopyrrole derivative

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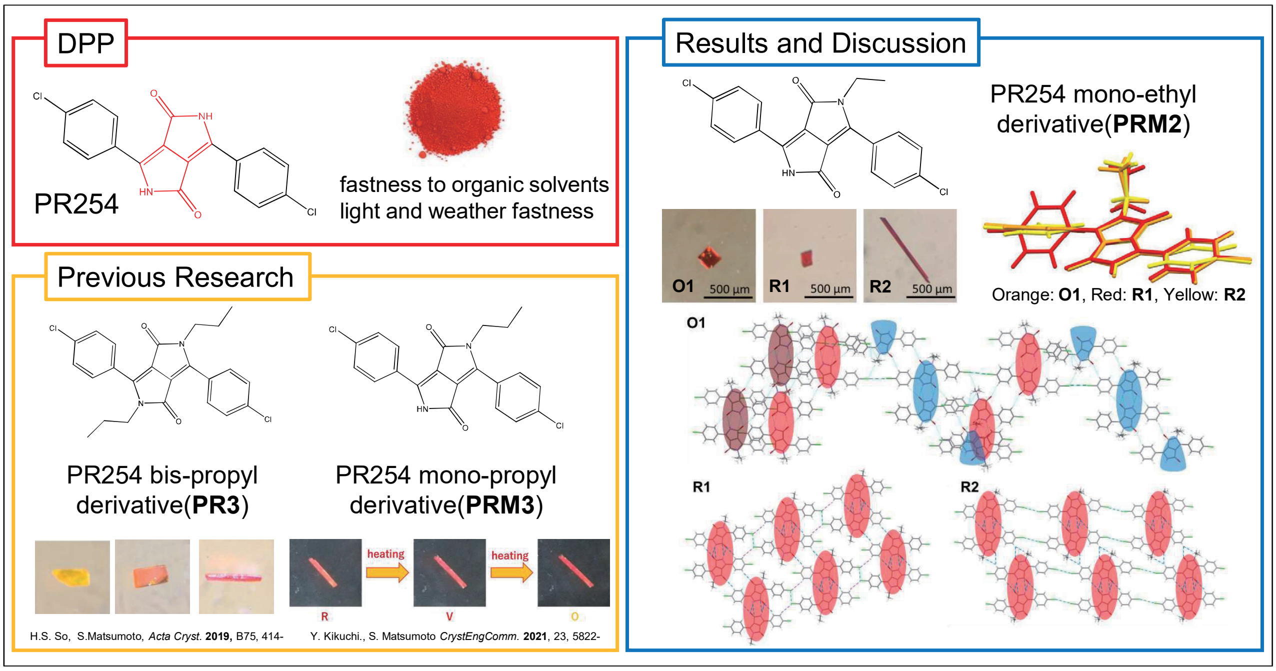
Abstract (100-200word, 16 point)

Pigment Red 254 (PR254), a chlorinated diketopyrrolopyrrole, is a vivid red pigment. This is widely used in industrial paint applications due to its excellent fastness to organic solvents, and outstanding light and weather fastness . Crystal polymorphs is very important in dye application to organic pigments as well as optoelectronic materials, because different molecular conformations and/or molecular arrangements may result in different solid-state properties.

In previous research, three crystal polymorphs were found from a derivative of PR254 in which propyl groups were introduced into both amino groups and have been introduced into one amino group, for each.

In this study, we synthesized chlorinated diketopyrrolopyrrole derivative with an ethyl group on one amino group and investigated its polymorph occurrence. As a result of crystallization, one orange crystal and two differently-shaped red crystals were obtained. Single Crystal X-ray analysis for the obtained crystalline solids revealed that one orange crystal (O1) is the monoclinic crystal system and space group $P2_1/c$, two red crystals (R1, R2) are the triclinic crystal system and space group $P\bar{1}$. They are polymorphs with different molecular conformation and molecular arrangements.



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Blockchain-Driven Carbon-Neutral Sustainable Supply Chains in India

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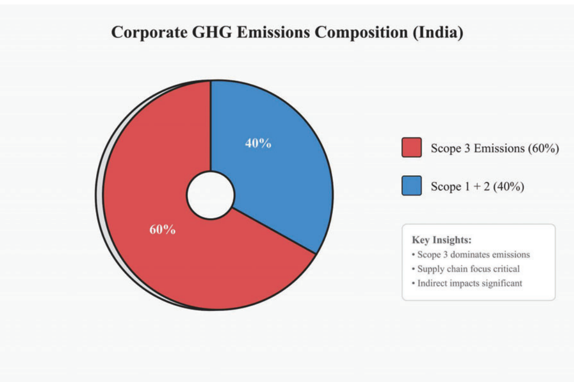
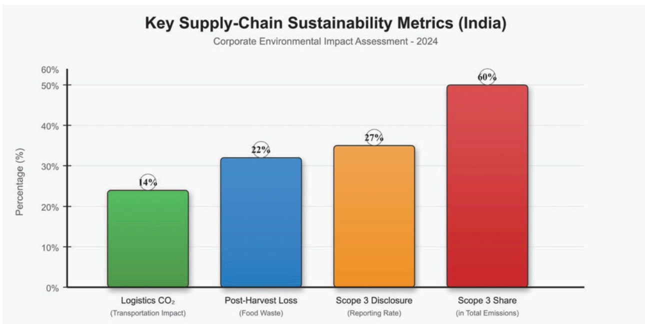
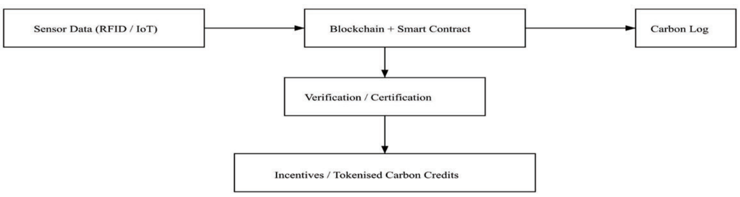
Abstract:
Recent industry pilots in India demonstrate that blockchain technology can significantly accelerate the transition to carbon-neutral sustainable supply chains. In agriculture, integration of blockchain with IoT platforms (e.g., APEDA–IBM Food Trust) has enabled real-time traceability of produce and reduced post-harvest losses by almost 30 %. In cold-chain pharmaceutical networks, blockchain deployment by Zeel Logistics has led to 15–18 % reductions in transport-related CO_2 emissions by eliminating delays and improving route transparency. Similarly, a pilot implemented by Tata Steel in Jharkhand achieved a 10–12 % cut in embedded supply-chain emissions by using smart contracts and tamper-proof carbon data capture. These findings reveal that blockchain not only improves traceability and transparency, but also enables verified low-carbon product certification and incentive mechanisms via tokenised carbon credits. With supply-chain emissions contributing approximately 60 % of total corporate CO_2 emissions in India, blockchain integration emerges as a practical and impactful pathway towards carbon-neutral and nature-positive logistics systems.
To further scale these benefits, it is recommended that India adopt national blockchain carbon registries, introduce standardised emission disclosure requirements for suppliers, and provide incentives for MSMEs to onboard digital traceability platforms.







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Pseudo-Multimodal Contrastive Learning for Acute Coronary Syndrome Diagnosis using 12-Lead Electrocardiograms

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Abstract

12-lead electrocardiograms (ECGs) are a primary non-invasive tool for diagnosing acute coronary syndrome (ACS), but their interpretation requires expert knowledge.

Conventional AI approaches often process ECGs as 1D time-series signals, overlooking spatial and structural information that cardiologists visually interpret from ECG waveforms.

To address this gap, we propose a pseudo-multimodal contrastive learning framework that treats the raw 1D ECG waveform and 2D Gramian Angular Difference Field (GADF) transformation image as complementary modalities. Although both originate from the same signal, they differ in representation format and feature distribution, enabling cross-modal alignment during self-supervised pretraining.

Using a real-world 12-lead ECG dataset provided by Yokohama City University, our method learns modality-invariant representations by aligning 1D and 2D embeddings of the same cardiac event, thereby enhancing generalization for downstream tasks. Experimental results demonstrate improved ACS classification performance, particularly for minority classes such as inferior myocardial infarction, compared with unimodal and conventional contrastive learning baselines. This approach bridges the gap between signal-based and image-based ECG analysis, offering a promising direction for clinically relevant AI-assisted diagnosis.

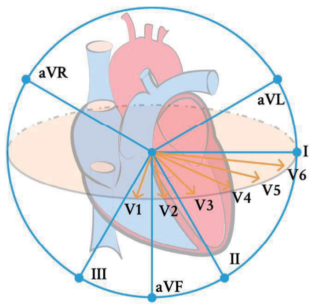
Introduction

12-lead Electrocardiograms(ECG)

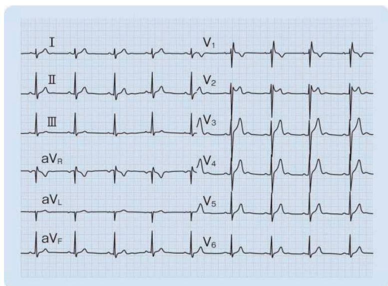
- A non-invasive examination that records the heart's electrical activity from 12 perspectives.
- ECG waveforms are modified by different pathological conditions, and accurate diagnosis requires specialized clinical expertise.

Issue

The gap between AI's 1D signal processing and physicians' overall visual assessment limits diagnostic accuracy and clinical applicability.



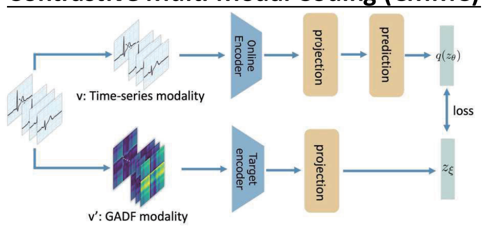
Observation direction of each lead



Example of 12-lead ECG

Proposed Method

Contrastive Multi Modal Coding (CMMC)



- ■ Pseudo multi modal input
  - 1D time-series ECG data & its 2D GADF transformation image
- ■ BYOL architecture
  - Only use positive pair for training

Experiment & Result

Experiment

■ **procedure**

1. Self-Supervised Pretraining
2. Downstream Evaluation

■ **Comparison method**

- CMLC (only use 1D waveform data)

Using 2 different leads from the same patient

- CMMC

Using 1D waveform and 2D GADF image of the same lead

- CMMC + CMLC

Extends the CMMC framework by adding an additional branch for CMLC

Result

	Accuracy	macro-f1
CMLC	0.656	0.496
CMMC	0.689	0.519
CMMC+CMLC	**0.722**	**0.539**

- ➢ Compared with conventional unimodal methods (CMLC), using pseudo multi modal input proved more effective.
- ➢ Combing spatial and modality invariance further improved classification accuracy.

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Carbon Neutrality and Financial Market Incentives

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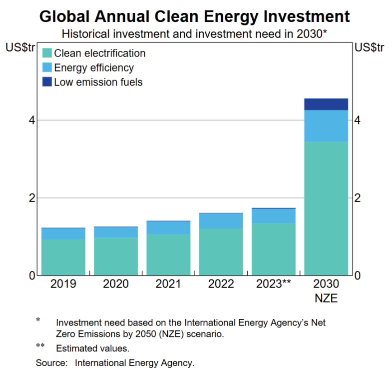
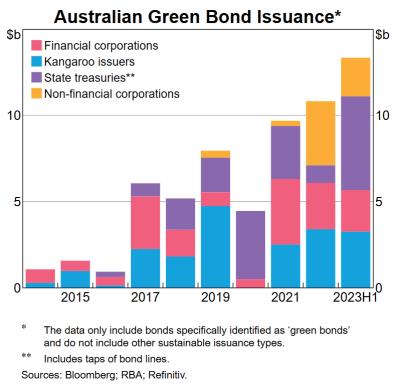
Abstract

Achieving carbon neutrality requires a fundamental shift in energy sources, especially for countries that heavily rely on mining. While some argue that major greenhouse gas–emitting industries should be used to finance the transition to alternative energy sources, this transition faces significant challenges, including substantial upfront investments that may not yield returns comparable to traditional extractive industries. Financial markets have supported initiatives to create financial instruments such as carbon bonds, offering pathways for companies to offset the impact of their emissions. However, this approach limits their transformative potential, as the strategy focuses on treatment rather than addressing the root cause. To accelerate progress, we believe that financial markets must evolve toward promoting more proactive investment in sustainable infrastructure, clean technologies, and low-carbon innovation. A key step in this process is to strengthen the Australian Sustainable Finance Taxonomy to create greater incentives, thereby unlocking capital flows toward carbon-neutral solutions.





Eligible Green Expenditure	Description	Allocations in 2022–23, 2023–24 ($m)
CEFC Renewable Energy Investments	Financing investments that add value and develop capability in renewables and low-emission technologies	422.1
Rewiring the Nation	Low-cost financing to upgrade Australia's electricity grid and enable the renewable energy transition	5.0
Regional Hydrogen Hubs	Supporting green hydrogen industrial hubs	35.5
Community Batteries	Deploying community batteries across Australia	13.7
Advancing Renewables Program	Financing R&D projects for renewable energy technology	305.6
Household Energy Upgrades Fund™	Low interest loans for energy saving home upgrades	5.0
Electric Trains in the Infrastructure Investment Program	Financing the construction of core electric rail transport infrastructure	3,365.9
Driving the Nation Fund	Supporting electric vehicle charging infrastructure	37.3
International Climate Finance Projects	Supporting climate mitigation and adaptation in Indo-Pacific countries	232.9
Urban Rivers and Catchments Program	Addressing natural resource management problems in urban waterways	1.6
Saving Koalas Fund	Supporting the recovery of Australia's unique plants, animals and ecological communities	24.8
Reef 2050	Investing to protect the health and resilience of the Great Barrier Reef	88.2
Murray–Darling Basin Plan	Recovering environmental water for the Murray–Darling Basin	871.6

- Achieving carbon neutrality requires a **fundamental shift in energy sources**, especially for mining-dependent countries.
- Some propose using revenues from **high-emission industries** to finance the energy transition.
- Major challenges include **high upfront costs** and **lower returns** compared to traditional extractive industries.
- Financial markets have developed **carbon bonds** to offset emissions, but this approach is limited as it **treats symptoms rather than root causes**.
- To accelerate progress, financial markets should **promote proactive investment** in sustainable infrastructure, clean technologies, and low-carbon innovation.

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

Stabilisation of Cu^{2+} by using amine ligands in direct synthesis of Cu/SBA-15 mesoporous catalysts

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Abstract

Mesoporous silica is a porous solid made of silicon dioxide with regular pores ranging from 2 to 50 nm in diameter. It has a high specific surface area due to its numerous pores. By loading metal onto it, a highly active catalyst can be obtained. In addition, since only a small amount of metal is required, it can be produced at low cost. Synthesis methods include impregnation and direct synthesis.

However, impregnation has the issue of poor metal dispersion. Direct synthesis also has issues, such as weak interaction between metal and silica under acidic conditions and reduced dispersion due to the formation of copper hydroxide under basic conditions. In the direct synthesis method, copper can be stabilized by forming complexes with ligands such as amines.

In this study, we are investigating the effects of changing the position of copper complexes relative to micelles by using amines with different hydrophobicity.

Table.1 Ligand amines

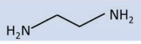
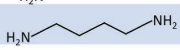
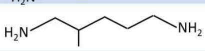
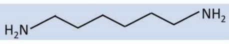
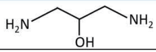
sample	Amine		Log Pow [-]
NO.1	Ethylenediamine		-2.04
NO.2	1,3-Diaminopropane		-1.42
NO.3	1,4-Diaminobutane		-0.72
NO.4	2-Methyl-1,5-diaminopentane		-0.14
NO.5	Hexamethylene diamine		0.04
NO.6	1,3-Diamino-2-propanol		-1.95

Table.1 shows the amines used in the experiment.
The water-octanol partition coefficient values are also shown as an indicator of hydrophobicity.

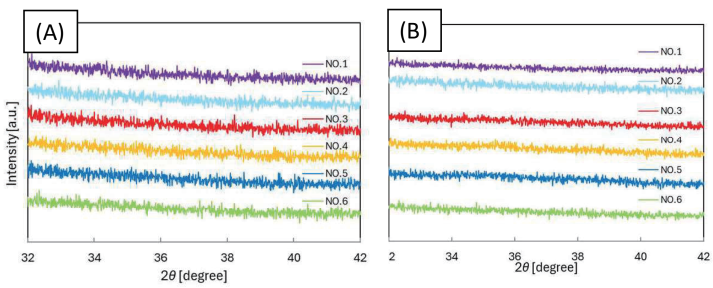


Fig.1 High angle XRD of(A)2% (B)10% loading samples

Figure 1 shows the XRD at high angles.
No peaks related to copper oxide were observed for either 2% or 10% copper content.
This result indicates that the copper is well dispersed without agglomeration.

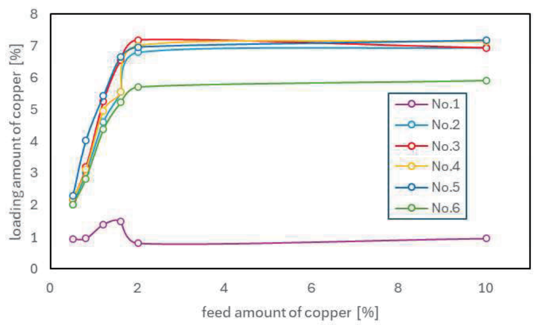


Fig.2 Copper content ratio

Figure 2 shows the feed amount on the horizontal axis and the catalyst loading on the vertical axis. Sample No. 1 had a loading of less than 2% at the highest. The other samples showed an increase in proportion to the feed amount up to 2%, But it did not increase beyond that point. Sample No. 6 had the second smallest loading after Sample No. 1 compared to the other samples.

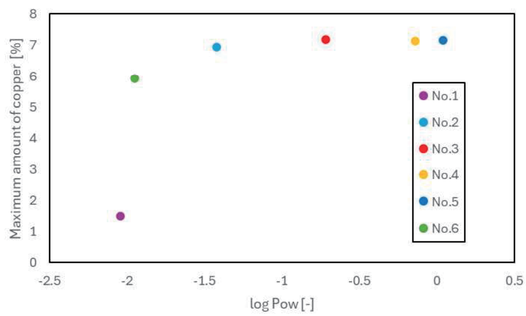


Fig.3 Association with hydrophobicity

Figure 3 shows that the copper loading decreases rapidly as the hydrophobicity decreases.

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YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

Evaluation of interactions between solutes and solid-liquid interfaces by HPLC and HSP

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In separation operations using solid-liquid interfaces such as adsorption, it is important to evaluate the interaction between the solid-liquid interface and the solute. However, in actual systems, quantitative evaluation is difficult due to the complexity of phenomena such as multi-component systems. Hansen's solubility parameters (HSP) can be considered as a method for quantifying the interaction between solutes and solid-liquid interfaces, but the method for determining HSP at solid-liquid interfaces has not been established. On the other hand, retention time in liquid chromatography (HPLC) can be used as a method for experimentally evaluating the interaction between solute and solid-liquid interface. In this study, we used porous silica fillers modified with various alkyl groups and investigated the relationship between retention time and HSP distance at the solid-liquid interface for approximately 20 combinations of mobile phases and solutes using HPLC.

The results show that substances with smaller HSP distances from the stationary phase tend to have larger retention coefficients, as shown in Figure 2. Furthermore, Figure 3 shows that substances with a larger HSP distance from the mobile phase tended to have a larger retention coefficient, indicating that there is a certain correlation between the HSP distance and the retention coefficient.

Objective

Clarifying the relationship
between HSP and HSP distance.

Hansen Solubility Parameters(HSP)

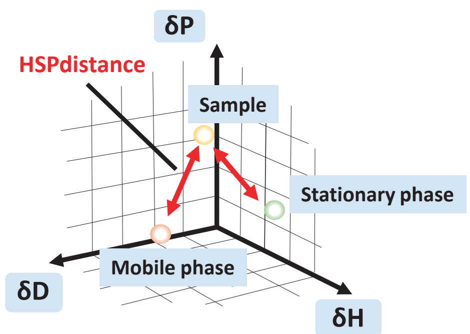

Fig.1 Image of HSP value

Experiment

・Measure the retention time of samples using HPLC and calculate the retention coefficient.

・Plot the relationship between the HSP distance between the sample and the stationary phase/mobile phase and the retention coefficient.

conditions

Mobile phase : MeOH : H_2O = 60 : 40
Stationary phase : Silica modified with trichlorooctadecylsilane(C18)
Sample : Approximately 20 types of organic solvents

Result

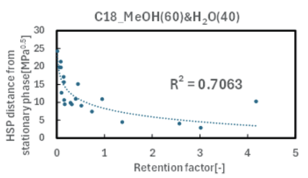

Fig.2 Relationship between HSP distance from stationary phase and relation factor

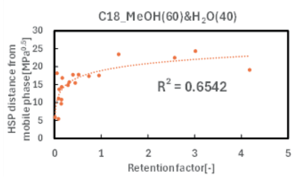

Fig.3 Relationship between HSP distance from mobile phase and relation factor

There is a certain correlation between HSP distance and retention coefficient.

YNU Symposium2025
September 3 -4, 2025, Yokohama, Japan

Innovating Technology for a Sustainable Future

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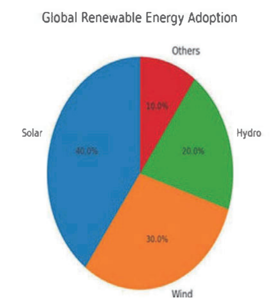
E-mail: sneelulatha2005@gmail.com

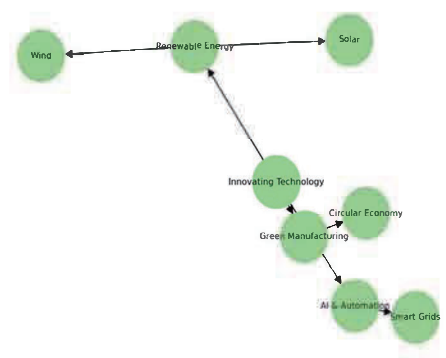
Abstract :

Innovating technology for a sustainable future requires a blend of creativity, responsibility, and forward-thinking solutions that address pressing global challenges. Emerging technologies such as artificial intelligence, renewable energy systems, green manufacturing, and circular economy models are shaping a pathway toward reduced carbon footprints and efficient resource management. By integrating digital innovation with sustainable practices, industries can optimize energy usage, minimize waste, and create resilient infrastructures. Moreover, collaboration between governments, research institutions, and private sectors ensures that technological advancements are accessible and scalable across communities worldwide. This paradigm shift toward sustainability not only mitigates climate change but also fosters economic growth, equity, and social well-being. Ultimately, innovation becomes the driving force in transforming technological progress into environmentally responsible development, ensuring a healthier planet for future generations

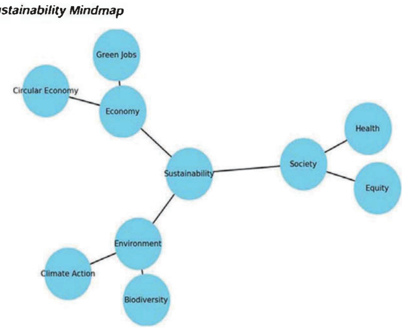
Global Renewable Energy Adoption



Sustainable Technology Flow Diagram



Sustainability Mindmap



Pre-Symposium Events

August 27th (Wed), 29th (Fri) and September 1st (Mon)

Themed Lecture, Yokohama Tour, Laboratory Visiting at the YNU Campus

August 28th (Thu)

Industrial Tour Day 1

Toshiba Energy System & Solutions Corporation
https://www.global.toshiba/ww/company/energy.html

FUJIFILM Business Innovation Corp.
https://www.fujifilm.com/fbglobal/eng

SANWA SEKISAN CORPORATION
https://sanseki-inc.com/

Ricoh Company, Ltd.
https://rpc.ricoh.com/en/

August 30th (Sat)

Cultural Tour

The visiting places vary depending on the group.

September 2nd (Tue)

Industrial Tour Day 2

JFE Engineering Corporation
https://www.jfe-eng.co.jp/en/

Sumitomo Heavy Industries, Ltd.
https://www.shi.co.jp/english/index.html

OKAMURA CORPORATION
https://www.okamura.com/

FANCL
https://www.fancl.jp/en/index.html

Participants from India & Australia

India

IIT-Kanpur	**3 Students**
VIT	**Dr. K. Govardhan & 3 Students**
Anna University	**3 Students**
Panjab University	**5 Students**

Australia

Griffith University	**Dr. Mirela Malin & 3 Students**
the University of Newcastle	**1 Student**

Campus Information (Access & Map)

How to reach YNU from Yokohama Station

https://www.ynu.ac.jp/english/about/access/access/

By Train

To the Main Entrance

The Nearest Station:

[Yokohama Municipal Subway]

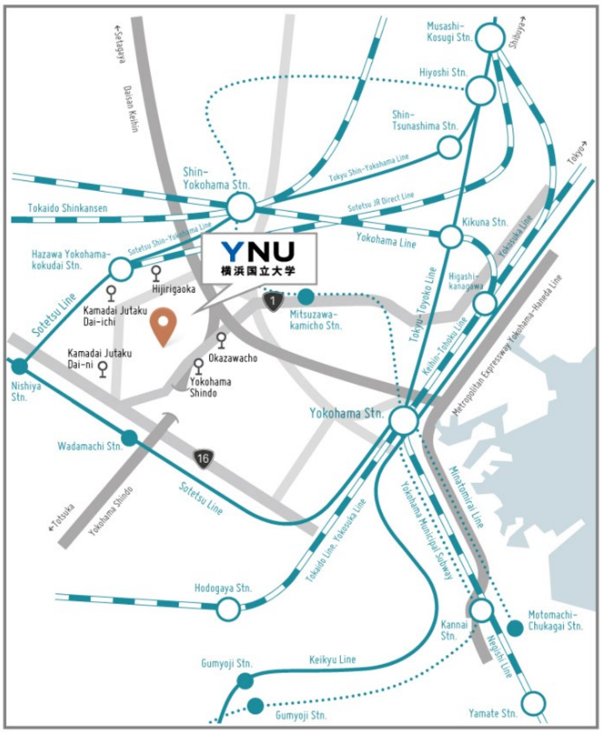
Mitsuzawa-kamicho Station

About a 16 min. walk

Map covering from

Mitsuzawa-kamicho Station

to the Main Entrance

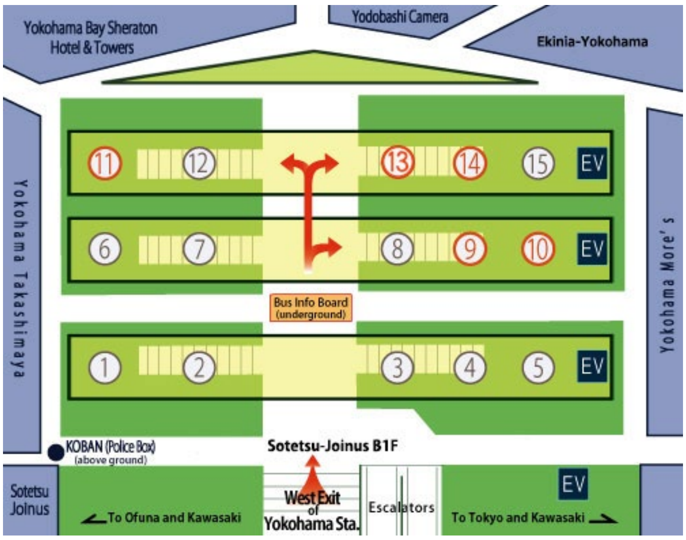


https://www.ynu.ac.jp/english/about/access/train_front/

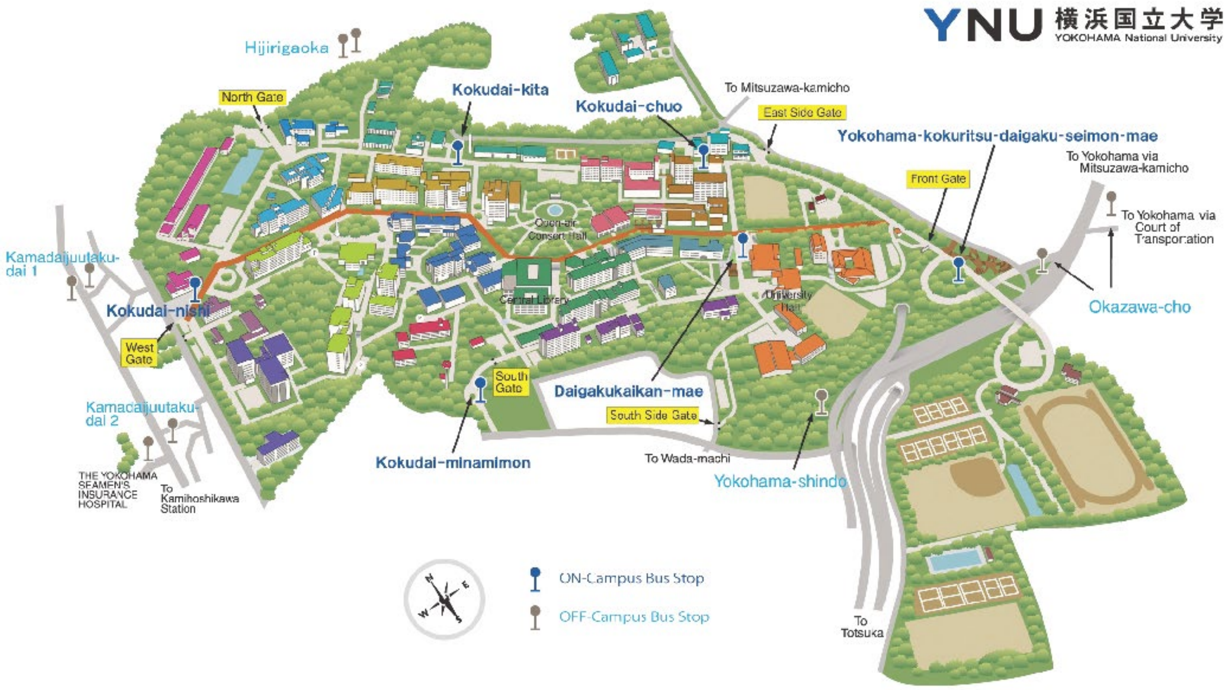
By Bus / Taxi

(The West Exit of Yokohama Station)

It takes 15-20 minutes from the bus terminal at the West Exit of Yokohama Station to YNU.



Campus Map



http://www.ynu.ac.jp/english/access/map_campus.html

Accommodations

YNU Minesawa International Student Dormitory

Address
305-1 Minezawa-cho, Hodogaya-ku,
Yokohama, Kanagawa 240-0061,
JAPAN

Commuting time to YNU
Five minutes on foot

Hotel Yokohama Camelot Japan

Address : 1-11-3 Kitasaiwai, Nishi-ku, Yokohama, Kanagawa 220-0004,
Tel : 045-312-2111
Notes :

- Public transportation / each line Yokohama Station, 5 minutes' walk in the JOINUS underground shopping area (South Exit 12)

- car/Shuto Expressway ~ Yokohama Station West Exit IC ~ 3 minutes from Yokohama West Exit IC Come with Risona Bank and Tenri Building as landmarks

Organizing Committee

Advisory:

Motonari Tanabu, Vice President of YNU & International Strategy Org. Executive Director

Tatsunori Mori, Dean, Grad. Sch. Env. & Info. Sci. (EnvInfoSci)

Yasushi Takemura, Dean Grad. Sch. Eng.

Tomoki Hamagami, Dean, College Sci.＆ Eng.(Eng.)

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Alexandr Akimov, Assoc. Prof. Dept. of Accounting, Finance and Economics, Griffith University

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About the student exchange project

Supporting Fund: Ministry of Education, Culture, Sports, Science and Technology (MEXT)–Japan Society for The Promotion of Science (JSPS) “Inter-University Exchange Project” 2022 Support for Creation of Inter-University Exchanges in the Indo-Pacific Region

Program Name: “YOKOHAMA International Education Program for Leading Sustainability Transformation towards a Resilient Society with Industry-Government-Academia Network”

Partner Universities: <India> Anna University,
Indian Institute of Technology, Kanpur (IIT-Kanpur),
Panjab University,
Vellore Institute of Technology (VIT)
< Australia > Griffith University,
The University of Newcastle

Program duration: 2022 – 2026 (Japanese fiscal year)

Participating students: Graduate students, Undergraduate students

Number of participating students: Up to 10 students are expected to participate from each university every year. Among the participating students, 1 to 3 students will be supported financially with air tickets between Japan, accommodation in Japan, every year:

Duration of visits: 2 weeks to 1 month (Short term), 1 to 3 months (Middle or long term), 1 semester, etc. The duration will vary by grades or research topics.

Other assistance:

We extend our heartfelt gratitude to all those who played a pivotal role in making this symposium a resounding success. The contributions by the following organizations, in various forms, have been invaluable and greatly appreciated among others.

- Nomura Securities Co., Ltd.
- Toshiba Energy System & Solutions Corporation
- FUJIFILM Business Innovation Corp.
- SANWA SEKISAN CORPORATION
- Ricoh Company, Ltd.
- JFE Engineering Corporation
- Sumitomo Heavy Industries, Ltd.
- OKAMURA CORPORATION
- FANCL
- JASSO (Japan Student Services Organization)
- Alumni Association of Yokohama National University

YOKOHAMA National University

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