UGC Approved Indexed Peer Reviewed Journal

ISSN: 2320-6586 (Online)

IILM UNIVERSITY

Technologies for Sustainable Development Goals 2025 (TECH4SDG-2025)

School of Computer Science & Engineering

IILM University Greater Noida

Presents

1st National Conference

on

Technologies for Sustainable Development Goals 2025 (TECH4SDG-2025)

3rd March 2025

Technically Co-Sponsored by IEEE UP SECTION (INDIA)

Venue:

IILM University, Greater Noida

Plot No.18,16, Knowledge Park II, Greater Noida, Uttar Pradesh 201306

Procedings Published at

International Journal of Research in Modern Engineering and Emerging Technology

Vol. 13, Sp. Issue 1, April 2025

Doi: https://doi.org/10.63345/ijrmeet.org.v13.si1.1301

Editor-in-Chief

Dr. Mylavarapu Seetharama Prasad

www.ijrmeet.org

ISSN: (Online) 2320-6586

INTERNATIONAL JOURNAL OF RESEARCH IN MODERN ENGINEERING & EMERGING TECHNOLOGY

(IJRMEET)

I.F. (wef. 2023: 6.004)

Vol. 13, Sp. Issue 1, April: 2025

No part of this Journal may be reproduced in any form, by Photostat, Microfilm, Xerography, or any other means, or incorporated into any information retrieval System, electronic or mechanical, without the written permission of the Author, Editor-in-Chief and the Publisher of this Journal.

Copyright © 2025
Inc. All Rights Reserved

Published By
Resagate Global
KDP Grand Savanna, R. N. Ext.,
Ghaziabad- 201017, Uttar Pradesh, India

Powered By
Editor-in-Chief
IJRMEET
www.ijrmeet.org

INTERNATIONAL JOURNAL OF RESEARCH IN MODERN ENGINEERING & EMERGING TECHNOLOGY (IJRMEET)

Dear Author / Researcher,

On behalf of the *International Journal of Research in Modern Engineering & Emerging Technology (IJRMEET)*, I extend my heartfelt gratitude to all the authors and research scholars for choosing our platform to publish their valuable research contributions.

IJRMEET, a Refereed, Peer Reviewed, Indexed, and Monthly Journal in Electronic format, has been consistently dedicated since April 2013 to advancing scholarly work in the domains of Modern Engineering and Emerging Technologies. Your innovative and quality research is at the core of our mission to promote academic excellence and practical solutions in the ever-evolving field of engineering and technology.

We believe that publication should be based purely on the merit, originality, and relevance of the research, not on financial considerations. We ensure that every manuscript undergoes a thorough review process to maintain the integrity, reliability, and scholarly value of each published work.

Our journal aims not only to disseminate high-quality research globally but also to highlight critical engineering problems and their practical resolutions. I encourage researchers, academicians, faculty members, and industry professionals to continue contributing to IJRMEET and to inspire their peers and students to join us in this academic pursuit.

We sincerely thank our respected Editors, Reviewers, Technical Advisors, Authors, Web Developers, Subscribers, Supporters, and the extended academic community whose efforts and encouragement make each issue of IJRMEET a successful endeavor.

With warm regards,

Dr. Mylavarapu Seetharama Prasad

Editor-in-Chief, IJRMEET
Email: editor@ijrmeet.org
Website: www.ijrmeet.org

IILM UNIVERSITY

Technologies for Sustainable Development Goals 2025 (TECH4SDG-2025)

School of Computer Science & Engineering

IILM University Greater Noida

Presents

1st National Conference

on

Technologies for Sustainable Development Goals 2025 (TECH4SDG-2025)

3rd March 2025

Technically Co-Sponsored by IEEE UP SECTION (INDIA)

Venue:

IILM University, Greater Noida

Plot No.18,16, Knowledge Park II, Greater Noida, Uttar Pradesh 201306

IILM UNIVERSITY

ORGANIZING COMMITTEE

CHIEF PATRON

Prof. (Dr.) Taruna Gautam, Vice Chancellor, IILM University, Greater Noida

PATRON

Prof.(Dr.) Rajeev Tiwari, Dean - School of Computer Science & Engineering, IILM University, Greater Noida

GENERAL CHAIRS

Prof. (Dr.) Harshal Patil, Professor & Head-Computing & Security,
School of Computer Science & Engineering, IILM University, Greater Noida

Dr. Jasminder Kaur Sandhu, Associate Professor & Head-Machine Learning & Data Science,
School of Computer Science & Engineering, IILM University, Greater Noida

PROGRAM AND ORGANIZING CHAIRS

Dr. Lalit Kumar, Associate Professor & Head-Computing Applications,
School of Computer Science & Engineering, IILM University, Greater Noida

CONVENERS

Dr. Lalit Kumar, Associate Professor& Head- Head-Computing Applications,
School of Computer Science & Engineering, IILM University, Greater Noida

Dr. Deependra Rastogi, Assistant Professor & Head-Labs,
School of Computer Science & Engineering, IILM University, Greater Noida

ORGANIZING SECRETARY

Dr. Sumit Singh Dhanda, Associate Professor, School of Computer Science & Engineering, IILM University, Greater Noida

Ms. Suman Avdhesh Yadav, Assistant Professor, School of Computer Science & Engineering, IILM University, Greater Noida

Mr. Shantanu Bindewari, Assistant Professor, School of Computer Science & Engineering, IILM University, Greater Noida

TECHNICAL PROGRAM COMMITTEE CHAIRS

Prof. Pardeep Singh, Galgotias University, Uttar Pradesh

Dr. Sunil Nain, UIET, Kurukshetra University, Kurukshetra

Dr. Sandeep Punia, CHRIST (Deemed to be University), Bengaluru

Prof. (Dr.) Rajiv Agarwal, LIET Greater Noida, India

Dr. Sandeep Verma, NIT Jalandhar, India

Dr. Sourabh Jain, IIIT Sonepat, India

Dr. Vandana Sharma, Christ University Delhi NCR, India

Prof. (Dr.) Brijmohan Singh, Quantum University, India

Prof. Balamurugan Balusamy, Shiv Nadar University, India
Dr. Shashikant Patil, Atlas SkillTech University Mumbai, India
Dr. Abhimanyu Nain, Guru Jambheshwar University, Hisar, Haryana
Dr. Ajay Punia, Guru Jambheshwar University, Hisar, Haryana
Prof. Sanjay Jain, Amity University Rajasthan, Jaipur
Prof. Ashwani Yadav, Amity University Rajasthan
Dr. Amit Kumar, Galgotias University, Greater Noida
Dr. Jitendra Rajpurohit, Symbiosis University, Pune
Dr. Pankaj Agarwal, Jindal Steels Ltd.
Prof. Sanjay Yadav, Alliance University, Bengaluru

INDUSTRIAL AND ENTREPRENEUR CHAIRS

Mr. Vaibhav Sharma, IILM University, Greater Noida, India

FINANCE COMMITTEE

Mr. Abhinav Raghav, IILM University, Greater Noida, India
Mr. Vikas Tiwari, IILM University, Greater Noida, India

REGISTRATION COMMITTEE

Dr. Anand Singh, IILM University, Greater Noida, India
Ms. Apoorva Jain, IILM University, Greater Noida, India

WEB ADMINISTRATORS

Mr. Shantanu Bindewari, IILM University, Greater Noida
Mr. Shiva Nath, IILM University, Greater Noida

WOMEN@TECH4SDG

Dr. Gunjan Mittal Roy, IILM University, Greater Noida, India
Dr. Kirti Shukla, IILM University, Greater Noida, India
Dr. Apoorva Jain, IILM University, Greater Noida, India
Ms. Heena Khera, IILM University, Greater Noida, India
Ms. Reeta Mishra, IILM University, Greater Noida, India
Dr. Divya Prakash, Shobhit University Gangoh
Dr. Pushpa Singh, IILM University, Greater Noida, India
Dr. Preeti Narooka, Manipal University Jaipur, Rajasthan
Dr. Daksha Baroda, IILM University, Greater Noida, India




JILM UNIVERSITY
1st IEEE National Conference

राष्ट्रीय सौर ऊर्जा संस्थान
(नवीन एवं नवीकरणीय ऊर्जा मंत्रालय, भारत सरकार का स्वायत्त संस्थान)
National Institute of Solar Energy
(An Autonomous Institute of Ministry of New and Renewable Energy, Govt. of India)
गुरुग्राम - फरीदाबाद रोड, ग्वाल पहाड़ी, गुरुग्राम - 122 003, हरियाणा, भारत
Gurugram - Faridabad Road, Gwal Pahari, Gurugram -122 003, Haryana, India

डॉ. मोहम्मद रिहान / Dr. Mohammad Rihan
महानिदेशक / Director General



MESSAGE

I am happy to know about Tech4SDG-2025, a distinguished national conference that aims to explore and highlight the transformative power of technology in achieving the United Nations Sustainable Development Goals (SDGs). This event serves as a critical platform for fostering collaboration among experts, innovators, and leaders who are dedicated to creating solutions that drive sustainable change.

As we face global challenges ranging from environmental sustainability to social equity, it is clear that technological advancements will play a pivotal role in shaping our collective future. Tech4SDG-2025 presents a unique opportunity to examine how cutting-edge technologies can contribute to solving the most pressing issues of our time, from climate change to poverty alleviation.

I look forward to the engaging discussions and innovative ideas that will emerge from this conference. I believe that by working together, we can harness the potential of technology to drive meaningful progress towards a sustainable and equitable world.

I extend my best wishes to all the participants and organizers of Tech4SDG-2025.

27.02.25

(Dr. Mohammad Rihan)

Dated: 27th February, 2025
Place: Gurugram

दूरभाष / Tel. No. : 0124-285 3000, 3056
ईमेल / Email : dgnise.mnre@nise.res.in, mohdrihan@nise.res.in, वेबसाइट/ Website : www.nise.res.in

INTERNATIONAL JOURNAL OF RESEARCH IN MODERN ENGINEERING & EMERGING TECHNOLOGY (IJRMEET)

Authors' Guidelines

Resagate Global welcomes submissions in all areas related to Management, Pharmacy, Engineering, Education, Humanities, Social Science, etc. Manuscript for all discipline must be in English prepared on a standard A4 size paper setting. It must be prepared in 12-point Times New Roman and must follow the following criteria for all discipline.

1. Each manuscript requires an abstract with a length of 15 – 20 lines in 12 point font Times New Roman and Italic font followed by 5 – 7 keywords.
2. Type-written manuscripts in MS Word (.doc) format should be submitted by E-mail to editor@ijrmeet.org
3. Research Papers/Review Articles will be published in the Journal after peer-reviewed process.
4. Leave 1 inch margin for each – top, bottom, left and right.
5. List of references must be present.
6. Papers without references will not be reviewed.
7. Section headers will be bold faced sentence case whereas sub-section header will be in normal style, both indented at 0.5 inch. Line space is 1.5 for entire article.
8. Once the paper is accepted, the authors will be required to send the signed copy of Copyright Form through E-mail to editor@ijrmeet.org
9. It is mandatory for all the authors to sign the Copyright Transfer Form.
10. It will be take more then 2-3 weeks to 1 month to publish after submitting.
11. Research paper should contain with abstract (including 200-300 words) & including minimum 1500 words and you must follow all the steps (Design) of research.
12. The decision of Reviewers will be final and canvassing in any form will be disqualification of authors in future issues.
13. In article minimum 1500 words must required.
14. Page layout must be created only A4 size only.
15. PDF file is not accepted.

INDEX

S. No.	Particulars	Page No.
1	A Comparative Study On Load Balancing Algorithms And Its Types **Methily Johri & Aditri Ashish**	1–10
2	Optimizing Supply Chain Management with Ethereum 2.0: Innovations in Blockchain Technology **Ayush Gupta & Dr. Ambuj Kumar Agarwal**	11–17
3	Smart Surveillance: "A Real-Time Crowd Analysis System for Density and Anomaly Detection" **Komal Sharma, Dr. Pankaj Kumar Varshney, Aditi Aggarwal & Gaurav Kumar**	17–22
4	AI-Driven Network Optimization: Matching Policyholders to Cost-Effective Providers Using Business Intelligence **Ruchi Mangharamani & Prof. (Dr) Sangeet Vashishtha**	23–29
5	The Future of UX: Designing for Emerging Technologies (AI, AR, VR, Voice UI) **Ojas Gupta & Prof.(Dr.) Arpit Jain**	30–37
6	Enhancing Liquidity Stress Testing: Best Practices for Modern Banking Risks **Padmini Bulani & Dr Abhishek Jain**	38–45
7	AI-Powered Investment Strategies: Optimizing Risk and Returns in Modern Banking **Aditya Mehra & Dr. Shakeb Khan**	46–53
8	Scaling Customer Journey Optimization in a Multi-Tenant Distributed System	54–61

S. No.	Particulars	Page No.
	Sumit Kumar Agrawal & Prof. (Dr) MSR Prasad	
9	Object Detection Using Convolutional Neural Networks: Advances, Techniques, and Applications **Bharath Thandalam Rajasekaran, Saravanan Thirumazhisai Prabhagaran & Prof. (Dr) Punit Goel**	62–69
10	AI-Augmented Intrusion Detection Systems for High-Speed Optical Networks **Sattvik Sharma & Prof.(Dr) Avneesh Kumar**	70–77
11	Generative AI in Data Security: Opportunities and Challenges **Vybhavreddy Kammireddy Changalreddy, Piyush Bipinkumar Desai & Prof (Dr) Ajay Shriram Kushwaha**	78–86
12	Integrating Salesforce with Cloud-Based Data Warehousing for Unified Analytics **Nidhi Shashikumar & Dr S P Singh**	87–94
13	AI-Powered Cybersecurity: A Unified Approach to Protecting Enterprise, Cloud, and SaaS Applications **Varun Grover, Khushmeet Singh & Er. Siddharth**	95–103
14	Sales and Order Analysis Using Excel-Based Dashboard: A Case Study on Vrinda Store **Mohd Ammar Khan & Harun Faridi**	104–106
15	ChatMania: A Realtime Chat Application **Dr. Kirti Shukla & Anshika**	107–110

S. No.	Particulars	Page No.
16	Digital Surveillance and Domestic Abuse: A Legal Vacuum in Indian Marital Relationships **Vishal Nehra & Dr. Rakesh Kumar**	110–116
17	The Role of Emotional Appeal in Online Advertisements Targeting Working Women in Delhi-NCR **Mona Mishra & Dr. Praveen Mittal**	116–120
18	AI-Driven Data Governance Strategies for Enhanced Cloud Security in Enterprises **Chandana Pandey & Dr Gauri Shanker Kushwaha**	121–123
19	Evolution of Social Media Advertising and Consumer Behavior **Mr. Pramod Rana & Prof (Dr) Punit Goel**	124–129
20	Sustainability Accounting Practices in Indian Manufacturing Firms **Mrs. Sonal Jain & Dr. Ajit Singh**	129–134
21	Fundamental Rights vs. Reasonable Restrictions: A Study of Evolving Judicial Balances **Mrs. Anshika Agarwal & Dr. Vijay Kumar Singh**	134–139
22	सतत शिक्षा के लिए हिंदी साहित्य की भूमिका: सतत विकास लक्ष्य-4 (गुणवत्तापूर्ण शिक्षा) का सांस्कृतिक विश्लेषण **श्रीमती रेणु गुप्ता, डॉ. बृजलता शर्मा**	140–144
23	Mind–Gut Synergy in Chronic Lifestyle Conditions: Evaluating Psychotherapy-Driven Behavioral Change and Microbiota-Mediated Metabolic Repair **Krithika. V, Dr. Sarbesh Kumar Singh**	145–151

S. No.	Particulars	Page No.
24	प्राचीन शिक्षा प्रणाली से आधुनिक AI आधारित शिक्षा की ओर संक्रमण **गौरव जोशी, डॉ सारिका गोयल**	152–159
25	पर्वतीय क्षेत्रों में शिक्षा के डिजिटलीकरण की चुनौतियाँ एवं संभावनाएँ **राकेश उनियाल, डॉ. मीनाक्षी हर्राव वर्मा**	160–168
26	Women Leadership and Democratic Participation in India: Challenges and Opportunities in Parliamentary Politics **Renu Yadav, Dr. P.P.S. Rana**	169–176
27	Evaluating GST Effects on Competitiveness and Industrial Development **Aman Goel, Dr. Pooja Yadav**	177–183
28	एस०आर० हरनोट के कथा साहित्य में लोक संस्कृति, पर्यावरण चेतना और सामाजिक परिवर्तन का अध्ययन **सीमा देवी, डॉ० अरविन्द्र कौर चुंबर**	184–189
29	Balancing National Security and Human Rights in Modern India **Shalu Jain, Dr. Vijay Kumar**	190–197
30	Economic Performance Drivers and Fiscal Resilience in Indian Airports **Lalit Kumar Sharma, Dr. Pooja Yadav**	198–203
31	Educational Governance and AI Learning Outcomes in Government Elementary Schools **Dr. Shubhra Chaturvedi**	203–210
32	Artificial Intelligence and the Future of Teacher Roles in India Classroom **Neeru Verma**	211–220
33	Research Culture Among Undergraduate Students in Indian Universities **Dr. Dhanashri Rajshri Ravindra Jadhav**	221–229

S. No.	Particulars	Page No.
34	Awareness of Human Papillomavirus Vaccination Among Adolescent Girls and Their Parents **Dr. Chintamani Venu Madhav Naresh Kumar**	230–234
35	Graduate Employability and Skill Gaps in State Universities **Narender Panghal**	235–242
36	Political Funding Transparency in Indian Election **Dr. Anand Kumar Dwivedi**	243–252
37	AI-Powered Platforms for Data Analytics and Audience Development **Sachin Sangal**	253–258
38	Engineering Leadership Models in AI Startups: Balancing Innovation and Operational Efficiency **Dr. Kalpesh Rasiklal Rakholia**	259–269
39	Challenges in Integrating CWSN in Regular Classrooms **Anil Kumar**	270–280
40	An Artificial Intelligence-Based Legal Compliance Framework for Real-Time Environmental Governance to Advance SDGs 9, 12, 13, and 16 **Dr. Jyoti Janardhan Reddy**	281–288
41	Impact of Source Segregation and Waste Characterization on the Efficiency of Material Recovery Facilities **Varinder Vikram Singh, Dr. Pankaj Kumar Bharti**	289–296
42	Significance of Emotional Intelligence of schedule caste students in relation to Self-concept at secondary level **Mrs. Varsha Asher Wasker, Dr. Kuldeep Singh Tomar**	297–305
43	औपनिवेशिक भारत में स्थानीय बाजारों के सामाजिक परिवर्तन का ऐतिहासिक अध्ययन **Pankaj Tamta**	306–310

S. No.	Particulars	Page No.
44	Teachers' Readiness to Integrate Generative AI into Lesson Planning and Classroom Instruction **Prema Bharti**	311–316
45	Battery Usage Optimization Techniques for AI-Heavy Mobile Apps **Dr. Akankasha Kathuria**	317–321
46	Gender, Technology, and Changing Family Structures in Urban India: A Socio-cultural Analysis **Prof. Sawant Jeetendra Madhukar Usha**	322–326
47	Law and Alternative Dispute Resolution in Contemporary Civil Justice: A Legal Study **Dr. Pooja Khurana**	327–331
48	English Literature and the Representation of Women in Contemporary Fiction: A Corpus-Based Study of Narrative Agency, 2000–2024 **Dr. Abu Farah Hoque**	332–336
49	Agricultural Impact of Biochar and Reduced Fertilizer on Mustard Soil Health and Yield **Dr. Bibhu Santosh Behera**	337–346
50	Ethical and Privacy Frameworks for AI-Driven Customer Data Analytics in Medical Profession **Dr. Gaurav Singh Tomar**	347–351
51	Influence of Abhyas and Meditation on Attention, Emotional Regulation, and Lifestyle Behaviour among Students **Dr. Rakhee Rajendra Gugale**	352–357
52	Platform Culture and Fragmented Selfhood in Contemporary English Literature **Dr. Akanksha Singh**	358–362
53	Digital Health Literacy and Health Information Inequality in Rural India: A Multidimensional Assessment	363–368

S. No.	Particulars	Page No.
	Ranjana Jadaun	
54	स्मार्ट विनिर्माण और उद्योग 5.0 में कृत्रिम बुद्धिमत्ता, मानव-केंद्रित तकनीक और सतत विकास का अंतःविषयक अध्ययन **Dr. Ghamendra Kumar Sahu**	369–375
55	Contribution of Yoga-Based Breathing Techniques to Daily Stress Management **Dr. Sweta Kumari**	376–387
56	Algorithmic Silence and Unspoken Meaning in Contemporary English Fiction **Dr. Jyoti Devi**	388–396
57	Cost-Benefit Analysis of Custom Image Analysis Tools in Oncology Research **Sumit Malhotra**	397–405
58	उच्च शिक्षा में सूक्ष्म अधिगम तकनीकों का शैक्षिक प्रभाव **Ram Singh**	406–412
59	Optimising Laboratory Workflows with Low-Code/No-Code Software Solutions **Dr. Amit Nampalliwar**	413–421
60	भारतीय बहुभाषिक समाज में भाषा, संस्कृति और राष्ट्रीय एकता का अध्ययन **Dr. Geeta Rawat**	422–428
61	Influence of FinTech Innovation on Financial Resilience and Operational Efficiency of Retailers and Street Vendors **Prof. Manmeet Kumar Siras & Shyam Pandey**	429–435
62	भारत में आपातकालीन शक्तियाँ और लोकतांत्रिक उत्तरदायित्व: संसदीय शासन के अंतर्गत राष्ट्रपति की संवैधानिक भूमिका का विश्लेषण **सीता राम पंडित, डॉ. पी. पी. राणा**	436–441
63	Mechanical Design Improvements for Faster Thermal Dissipation in High-Capacity Batteries	442–450

S. No.	Particulars	Page No.
	Dharmendra Tiwari	
64	English Literature and the Changing Patterns of Communication among Young Adults **Ravindra Hanmantrao Sagar**	451–459
65	An Explainable AI Framework for Transparent and Reliable Medical Diagnosis **Dr. Thejoram Naresh Reddy Boya**	460–466
66	डिजिटल समुदायों का युवा शिक्षा और सामूहिक पहचान पर प्रभाव **डॉ. मनोज कुमार सकलानी**	467–473
67	Adaptive Technologies for Enhancing Online Shopping Experiences **Dr. Abhishek Bhattacharjee**	474–479
68	Impact of Digital Payment Adoption through AI-ML on Micro-Business Performance **Ralphy Joseph C J**	480–484
69	Role of Regional Parties in Shaping Federalism in India **Dr. Shailendra Kumar**	485–489
70	Serverless Computing Optimization: Enhancing Performance with AI-Based Resource Allocation **S. Venkatasubramanian**	490–495
71	Student Satisfaction in Autonomous vs. Affiliated Colleges **Dr. Mohit Dixit**	496–500
72	Psychological and Social Isolation and Its Effect on Urban Elderly **Mredula P., Dr Sarita Gupta**	501–507
73	The Role of Folk Literature in Promoting Community Health Awareness in Rural India: A Study from the Perspective of English Literature	508–512

S. No.	Particulars	Page No.
	Dr. Revant Gautam	
74	Exam Stress Clinical Psychology Mechanisms Among Rural Students **Dr. Avinash D. Karambhe**	513–517
75	उभरती हिंद-प्रशांत सुरक्षा संरचना में भू-राजनीतिक प्रतिस्पर्धा और रणनीतिक प्रतिरोध **Dr. Girish Chandra Pachauli**	518–522
76	Sustainable Edible Coatings for Reducing Oxidative Deterioration in Fresh Fruits **Amar Jensi Solanki**	523–528
77	Impact of GST Implementation on Legal Disputes in Small Businesses **Dr. Nikhat Khan**	529–534
78	Innovations in Healthcare Product Management Through AI and Machine Learning **Dr. Navdeep Singh**	535–538
79	Psychological Effects of Music and Memory Recall in Elderly Patients **Lindamulage Mithun Dilantha Deva Adithiya**	539–544
80	Comparative Study of Formative Assessment in Government vs. Private Schools **Dr. Roopali Chandra**	545–549
81	Educational Learning Needs of Orphaned Children in Institutional Homes **Ajitha. P. M**	550–554
82	Behavioral Differences in Joint vs. Nuclear Family Children **Rajeevan Edadan Puthiya Veetil**	555–559
83	Leveraging Data Architecture to Enhance Business Intelligence in Retail and Finance **Dr. Priyanka Gosain**	560–563

S. No.	Particulars	Page No.
84	Effect of Pelvic Floor Exercises on Women's Health and Functional Recovery **Dr. Kapila Jain**	564–569
85	Acceptance of AI-Assisted Drug Information Systems by Pharmacists **Dr. Tarun Sahani**	570–574
86	Jane Austen's Portrayal of Marriage and Society in English Literature **Serjana Thapa**	575–581
87	Employability Skill Gaps in Engineering Graduates (2013–2016) **Dr. A. H. Khan**	582–586
88	Aggressive Behavior, Family Conflict and Social Adjustment Among Students in Rural Kerala: A Comparative Study **Vinod Babu, Prof . Dr. S. Chandrachud**	587-592
89	Impact of Digital Documentation on Logistics Management Efficiency **S. Lakshmi Narasimma**	593–599
90	Generative AI Models for Product Design Innovation: Applications in Automotive and Last-Mile Delivery **Dr. Bimal Kumar Kalita**	600–603
91	Prevalence of Low Back Pain Among Women Attending General Outpatient Departments **Dr. Trushna Tembhekar**	604–609
92	Women's Reservation and Performance in Local Bodies **Rashmi Shukla**	610–613

S. No.	Particulars	Page No.
93	Ayurvedic Approaches to Menopausal Health and Rajonivritti **Dr. Ashwini R. Metangale**	614–619
94	Effect of Core Strengthening Exercises on Physical Function in Women **Prof. (Dr.) Vrushalee Dodke**	620–625
95	Relationship Between Physical Activity and Joint Health Among Young Adults **Dr. Priti S. Arikar**	626–632
96	Assessment of Screen Time and Sleep Quality Among School-Age Children **Dr. Sayali Jichkar**	633–638
97	Cellular Responses of Yeast to Different Sugar Concentrations in Biology **Aarthi B Pradhan**	639–644
98	Political Funding Transparency in Indian Elections **Dr. Kanta Verma**	645–648
99	Gender Identity and Expression in College Students **Dr. Babhuti Kashyap**	649–653
100	A Study of the Corrosion Inhibition Properties of Glycine and Alanine on Metal Surfaces **Pinky**	654–659
101	The Impact of British Rule on the Indian Education System **Dr. Nageshwar Joolu**	660–664

S. No.	Particulars	Page No.
102	Merchandising Optimization Techniques for Users in Online Marketplaces **Dr. Munish Kumar Sharma**	665–668
103	Incorporating Voice Navigation and Control in Web Accessibility **Venkata Sumanth Appari**	669–673
104	Relationship Between Posture and Common Musculoskeletal Problems Among Adults **Dr. Rupali Vaibhav Selukar**	674–677
105	Influence of Household Water Sources on Basic Microbial Diversity **Dr. Kunjlata Lal**	678–681

International Journal of Research in Modern Engineering and Emerging Technology (IJRMEET)

Vol. 13, Sp. Issue: 01, April: 2025
(IJRMEET) ISSN (o): 2320-6586

Cellular Responses of Yeast to Different Sugar Concentrations in Biology

Aarthi B Pradhan

Assistant Professor

Naran Lala College of Professional And Applied Sciences, Navsari,

affiliated to Veer Narmad South Gujarat University, Surat, PIN - 396450

ORCID ID https://orcid.org/0009-0007-4925-9813

Abstract : Sugar concentration influences yeast growth through its combined effects on nutrient availability, metabolic regulation, and extracellular osmotic pressure. This paper examines these relationships in Saccharomyces cerevisiae using a controlled experimental framework with biomass accumulation and membrane integrity as complementary endpoints. The numerical dataset is simulated, and its results require replacement with experimental measurements before submission as empirical research. Five initial glucose concentrations—0.1%, 0.5%, 2%, 5%, and 20% weight per volume—are compared over 24 hours, with four independent cultures per treatment. Temperature, medium composition, initial biomass, working volume, and shaking conditions are standardized. In the simulated dataset, final dry biomass increases from 0.230 ± 0.026 g L^{-1} at 0.1% glucose to 1.810 ± 0.088 g L^{-1} at 5% glucose, before decreasing to 1.200 ± 0.077 g L^{-1} at 20% glucose. One-way analysis of variance identifies differences among treatment means, $F(4,15) = 296.56$, $p < 0.001$. The membrane-intact cell fraction decreases from 98.0% at 0.1% glucose to 84.0% at 20% glucose. These values demonstrate a consistent analytical approach to a concentration-dependent response. Published evidence supports interpreting glucose as both a metabolic substrate and a potential osmotic challenge, although physiological endpoints alone cannot establish activation of specific signaling pathways.

Keywords: Saccharomyces cerevisiae, glucose concentration, osmotic stress, biomass, membrane integrity, cellular adaptation

Introduction

Saccharomyces cerevisiae is widely used to investigate eukaryotic cell growth, metabolism, and environmental adaptation. Its ability to utilize sugars connects fundamental cell biology with applications in baking, brewing, and biotechnology. However, the relationship between sugar availability and cellular performance is not necessarily linear. Increasing sugar concentration changes both the amount of available carbon and the physical environment surrounding the cell.

Glucose also functions as a regulatory signal. Yeast adjusts transporter expression and metabolic activity according to extracellular glucose availability. Consequently, two cultures receiving different glucose concentrations can differ in nutrient uptake and regulatory state even when other environmental conditions are identical. Özcan and Johnston (1999) describe the regulation of yeast hexose transporters and their relationship to glucose availability. PubMed

At sufficiently high concentrations, extracellular solutes reduce water availability and impose an osmotic challenge. Yeast responds through coordinated physiological adjustments, including changes in glycerol metabolism and stress signaling. These responses support adaptation but can alter growth and cell-cycle progression. Hohmann (2002) provides a comprehensive account of yeast osmoadaptation. pubmed.ncbi.nlm.nih.gov

An investigation of sugar concentration therefore requires more than a measurement of culture turbidity. Biomass accumulation describes population-level production, while membrane integrity provides information about cellular condition. Together, these endpoints permit a more careful assessment than either measurement alone.

The present paper focuses specifically on glucose concentration rather than comparisons between different sugars. This distinction avoids combining concentration effects with differences in transport or substrate utilization.

Literature Review

Glucose Sensing and Transport

Özcan, Dover, and Johnston (1998) demonstrated the signaling roles of the glucose sensors Snf3 and Rgt2. Their findings establish that extracellular glucose detection is distinguishable from glucose transport itself. This provides a mechanistic basis for expecting concentration-dependent cellular regulation rather than a response determined solely by substrate quantity. PubMed

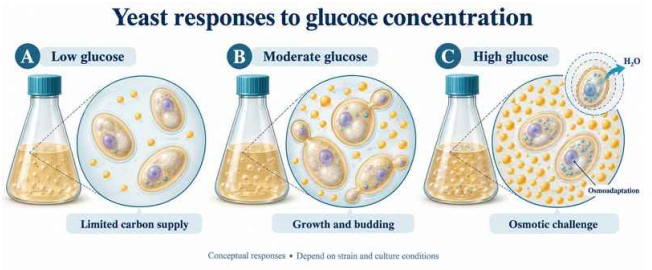
Özcan and Johnston (1999) reviewed the function and regulation of hexose transporters. Different transport systems help yeast respond to changing glucose availability. Their

review supports controlling the inoculum's cultivation history because previous glucose exposure can influence the physiological state of cells entering an experiment. PubMed

Rolland, Winderickx, and Thevelein (2002) describe interconnected glucose-sensing mechanisms that regulate cellular activity. Their work emphasizes that glucose influences gene expression and metabolism through several pathways. A simple growth experiment can reveal a concentration-associated phenotype, but it cannot independently identify which regulatory pathway causes that phenotype. Oxford Academic

Sugar Availability and Metabolic Allocation

De Deken (1966) established the Crabtree effect as an important feature of yeast metabolism. Under suitable conditions, glucose can support fermentation even when oxygen is available. Therefore, supplying additional glucose does not guarantee a proportional increase in biomass production. Carbon may also enter fermentation products rather than new cellular material. Microbiology Society



Pfeiffer and Morley (2014) discuss the evolutionary significance of the Crabtree effect and the coexistence of respiratory and fermentative strategies. Their analysis reinforces the distinction between rapid substrate utilization and efficient conversion into biomass. This distinction matters when comparing cultures with different initial glucose concentrations. frontiersin.org

Osmotic Stress and Cellular Adaptation

Hohmann (2002) explains how yeast responds to increased extracellular osmolarity through changes in signaling, transport, and compatible-solute accumulation. Glycerol is particularly important in osmotic adjustment. Nevertheless, reduced growth in a concentrated glucose solution cannot be attributed specifically to glycerol regulation unless the relevant metabolites or molecular responses are measured. pubmed.ncbi.nlm.nih.gov

O'Rourke, Herskowitz, and O'Shea (2002) review the high-osmolarity glycerol pathway and its contribution to the hyperosmotic response. Their work establishes a biological explanation for adaptive responses while also showing why pathway-specific evidence is needed before claiming pathway activation. sciencedirect.com

Saito and Posas (2012) describe responses including temporary changes in cell-cycle progression, transcription, translation, and glycerol retention. Their synthesis supports investigating both growth and cellular condition, since slower population expansion may accompany adaptation without necessarily indicating extensive cell death. pubmed.ncbi.nlm.nih.gov

Environmental Responses and Growth State

Gasch et al. (2000) demonstrated extensive changes in yeast gene expression following environmental transitions. Their findings show that stress responses are dynamic. Sampling only after 24 hours can miss early responses that diminish as cells adapt. Molecular Biology of the Cell

Brauer et al. (2008) examined relationships among growth rate, cell cycle, stress response, and metabolic activity. Their work supports considering physiological state when interpreting cellular differences. Cultures sampled at the same chronological time may occupy different growth phases and should not automatically be considered physiologically equivalent. Molecular Biology of the Cell

Together, these ten publications support an experiment that standardizes inoculum preparation, separates independent cultures from technical measurements, and distinguishes observed endpoints from inferred mechanisms.

Objectives and Hypotheses

The primary objective is to compare final dry biomass across five initial glucose concentrations. Secondary objectives are to calculate average net specific growth rate and biomass productivity and to describe the membrane-intact cell fraction after 24 hours.

The primary null hypothesis states that mean final biomass is equal across the five treatments. The alternative hypothesis states that at least one treatment mean differs.

A secondary expectation is that the highest glucose concentration may produce lower biomass accumulation or reduced membrane integrity relative to an intermediate concentration. This expectation requires experimental testing and does not establish a universal glucose optimum.

Materials and Methods

Experimental Design and Data Status

The proposed experiment uses a completely randomized design with five treatments and four independently inoculated culture flasks per treatment. The total experimental sample comprises 20 cultures.

All numerical outcomes reported below are simulated. The dataset supports reproducible calculations but does not document a completed experiment.

Each culture flask is one experimental unit. Repeated optical readings, multiple microscope fields, or individual cells counted within a flask are technical observations and do not increase the number of biological replicates.

Yeast Strain and Inoculum Preparation

The protocol specifies an authenticated, prototrophic S. cerevisiae strain. Strain designation, supplier, and relevant genotype must be reported when the experiment is conducted. Using a prototrophic strain avoids unrecognized growth limitation caused by omitted auxotrophic supplements.

A common preculture is prepared under standardized conditions. Cells are harvested, washed to minimize carryover of glucose and fermentation products, and resuspended before inoculation. Initial biomass is standardized to 0.100 g L^{-1} in every flask.

The same preculture stage and handling time are used across treatments. This reduces differences associated with inoculum age, nutrient history, and prior stress exposure.

Culture Conditions

A defined yeast medium supplies identical nitrogen, mineral, and vitamin concentrations across treatments. Glucose is the only intentionally varied component. Sterile glucose stocks are added to produce final concentrations of 0.1%, 0.5%, 2%, 5%, and 20% weight per volume.

Table 1. Experimental treatment structure

Treatment	Glucose, % w/v	Glucose, g L^{-1}	Independent cultures
G1	0.1	1	4
G2	0.5	5	4
G3	2.0	20	4
G4	5.0	50	4
G5	20.0	200	4

Cultures contain 50 mL medium in identical 250 mL baffled flasks and are incubated at 30°C for 24 hours at 180 rpm. Initial pH is adjusted to 5.0, and an identical buffering system is used throughout.

Flask positions are randomized. Medium blanks are prepared for each glucose concentration. Identical shaking conditions standardize the equipment setting but do not guarantee identical oxygen availability, particularly because concentrated solutions can differ in viscosity.

Growth Monitoring and Biomass Measurement

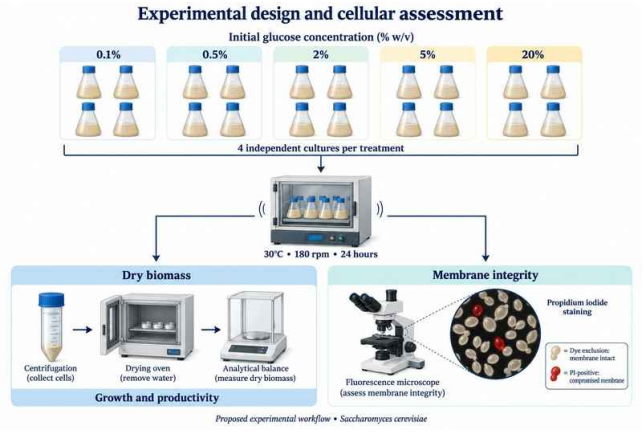
Optical density at 600 nm is recorded at predefined intervals as a supplementary indicator. Samples are diluted into the instrument's validated linear range, and measurements are corrected using the corresponding medium blank.

Dry biomass at 24 hours is the primary endpoint. A known culture volume is centrifuged, and the pellet is washed using a validated procedure that removes extracellular glucose without introducing substantial osmotic injury or cell loss. Biomass is transferred to a preweighed container and dried to constant mass.

Blank-corrected dry mass is divided by the processed culture volume to obtain biomass concentration in g L^{-1}. This direct measurement avoids assuming that one optical-density conversion factor remains valid across all treatments.

Membrane Integrity Assessment

Membrane integrity is assessed at 24 hours using propidium iodide staining and fluorescence microscopy. Samples are processed promptly using a standardized staining period. An unstained control and a killed-cell control establish background fluorescence and positive staining.



At least 200 cells are classified per culture. The membrane-intact fraction is calculated as the percentage excluding propidium iodide. Counts are first summarized separately for each flask and then averaged across the four independent cultures.

Dye exclusion is reported as membrane integrity rather than proof of reproductive viability. Colony formation would provide an additional, distinct endpoint.

Growth Calculations

Average net specific growth rate over 24 hours is calculated as:

$$\mu avg = [\ln(X_{24}) - \ln(X_0)] / 24$$

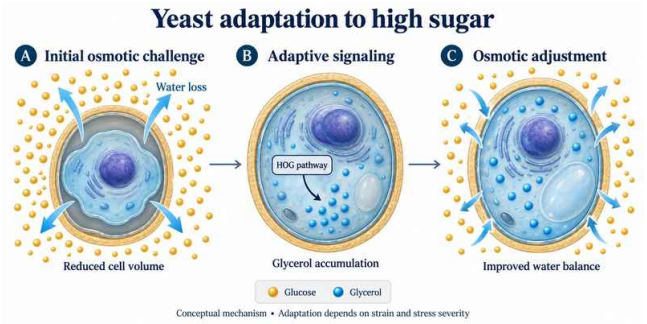
Average biomass productivity is calculated as:

$$P = (X_{24} - X_0) / 24$$

X_0 represents initial biomass, and X_{24} represents final biomass. The rate is a full-period average, not a maximum exponential-phase growth rate.

Statistical Analysis

One-way analysis of variance compares final biomass across glucose treatments. Tukey's procedure controls the familywise error rate for pairwise comparisons at 0.05. Eta squared describes the treatment-associated proportion of variation in the supplied dataset.



Residual patterns and variance differences should be assessed before applying this analysis to experimental observations. Membrane-integrity results are reported descriptively; individual cell counts are not treated as independent biological replicates.

Results

Biomass Accumulation

The simulated endpoint values show increasing biomass from 0.1% through 5% glucose, followed by lower biomass at 20%.

Table 2. Simulated final dry biomass after 24 hours

Glucose, % w/v	Flask 1	Flask 2	Flask 3	Flask 4	Mean ± SD, g L^{-1}
0.1	0.200	0.220	0.240	0.260	0.230 ± 0.026
0.5	0.860	0.910	0.950	1.000	0.930 ± 0.059
2.0	1.360	1.420	1.480	1.540	1.450 ± 0.077
5.0	1.710	1.770	1.850	1.910	1.810 ± 0.088
20.0	1.110	1.170	1.230	1.290	1.200 ± 0.077

Final biomass at 5% glucose is 24.8% higher than at 2% glucose. The 20% treatment has 33.7% lower biomass than the 5% treatment, despite containing four times as much initial glucose.

All final concentrations exceed the standardized initial biomass. Thus, the highest-glucose treatment represents reduced net accumulation relative to an intermediate treatment, rather than complete growth inhibition.

Growth Indicators and Membrane Integrity

The highest calculated average growth rate and productivity occur at 5% glucose.

Table 3. Growth calculations and simulated membrane integrity

Glucose, % w/v	Average growth rate, h^{-1}	Productivity, g L^{-1} h^{-1}	Membrane-intact cells, mean ± SD, %
0.1	0.0347	0.0054	98.0 ± 0.8
0.5	0.0929	0.0346	97.0 ± 0.8
2.0	0.1114	0.0563	96.0 ± 0.8
5.0	0.1207	0.0713	94.0 ± 1.6
20.0	0.1035	0.0458	84.0 ± 3.3

Growth indicators are calculated from treatment mean biomass. Membrane-integrity summaries use four simulated culture percentages per treatment: 98, 97, 99, 98; 97, 96, 98, 97; 96, 95, 97, 96; 94, 92, 96, 94; and 84, 80, 88, 84, respectively.

The membrane-intact fraction at 20% glucose is 10 percentage points lower than at 5%. Nevertheless, most cells remain membrane-intact, illustrating why reduced growth and widespread membrane disruption should not be treated as equivalent outcomes.

Statistical Comparison

ANOVA gives $F(4,15) = 296.56$, $p < 0.001$, with $\eta^2 = 0.988$. The primary null hypothesis is therefore rejected for the simulated dataset.

Tukey-adjusted comparisons distinguish all treatment pairs at the 0.05 level. The largest adjusted p-value is approximately 0.0010. These results describe the mathematical properties of the supplied values and do not constitute evidence from measured cultures.

Discussion

Nutrient Availability and Growth

The increase in biomass across the lower concentrations is compatible with greater carbon availability. However, the small biomass increase at 0.1% glucose does not by itself prove glucose depletion. Residual glucose measurements would be required to establish substrate exhaustion.

Similarly, declining biomass produced per unit of initial glucose cannot be described as a measured biomass yield. True substrate-based yield requires the amount of glucose consumed, rather than the amount initially supplied.

Glucose sensing and transporter regulation provide plausible explanations for concentration-dependent cellular adjustment, but those processes were not measured in the numerical dataset. The literature supplies mechanistic context rather than confirmation of a particular pathway. PubMed

Interpretation of the Highest Concentration

The combination of lower biomass and a smaller membrane-intact fraction at 20% glucose is compatible with a less

favorable cellular environment. Increased osmotic pressure is one possible contributor. Published work establishes osmoadaptation as a coordinated process involving signaling and compatible-solute regulation. pubmed.ncbi.nlm.nih.gov

Nevertheless, the present treatment structure changes metabolizable carbon and osmotic conditions simultaneously. Without an independently validated osmotic control, their effects cannot be separated. Ethanol accumulation, nutrient imbalance, oxygen transfer, and pH changes are additional explanations requiring measurement.

Metabolism and Sampling Time

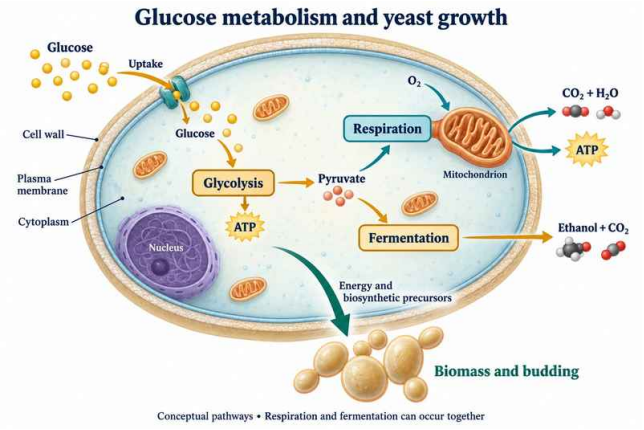
Fermentation can occur alongside respiration in Crabtree-positive yeast. Therefore, lower biomass does not necessarily imply proportionally lower metabolic activity. Ethanol analysis, glucose consumption, and respiratory measurements would help distinguish carbon allocation from generalized cellular impairment. Microbiology Society

The fixed 24-hour endpoint also compares cultures that may occupy different physiological stages. Growth-phase differences could influence both biomass and membrane integrity. Repeated sampling would help distinguish delayed adaptation from persistent impairment, consistent with the dynamic environmental responses described by Gasch et al. and the growth-state relationships examined by Brauer et al. Molecular Biology of the Cell

Limitations and Future Research

The principal limitation is that the numerical results are simulated. Additional limitations include one strain, four independent cultures per treatment, and the absence of direct measurements of osmolality, residual glucose, ethanol, glycerol, and dissolved oxygen.

Future experiments should include a carbon-free control, intermediate concentrations between 5% and 20%, and an appropriate osmotic-control strategy. Molecular measurements would be needed to evaluate HOG-pathway activation. Colony-forming assays would complement membrane staining by assessing reproductive capacity.



Conclusion

Glucose concentration can influence yeast through nutrient supply, metabolic regulation, and osmotic conditions. In the simulated dataset, the highest biomass occurs at 5% glucose, while 20% glucose produces lower accumulation and reduced membrane integrity. These calculations provide a consistent analytical structure, but experimental measurements are required to establish the response, determine its mechanism, and identify the best concentration for a particular strain and cultivation system.

Data Availability

All simulated biomass observations and membrane-integrity percentages are provided above. Statistical results and derived growth indicators must be recalculated when experimental values replace them.

References

1. Brauer, M. J., Huttenhower, C., Airoldi, E. M., Rosenstein, R., Matese, J. C., Gresham, D., Boer, V. M., Troyanskaya, O. G., & Botstein, D. (2008). Coordination of growth rate, cell cycle, stress response, and metabolic activity in yeast. Molecular Biology of the Cell, 19(1), 352–367. DOI: 10.1091/mbc.E07-08-0779.
2. De Deken, R. H. (1966). The Crabtree effect: A regulatory system in yeast. Journal of General Microbiology, 44(2), 149–156. DOI: 10.1099/00221287-44-2-149.
3. Gasch, A. P., Spellman, P. T., Kao, C. M., Carmel-Harel, O., Eisen, M. B., Storz, G., Botstein, D., & Brown, P. O. (2000). Genomic expression programs in the response of yeast cells to environmental changes. Molecular Biology of the Cell, 11(12), 4241–4257. DOI: 10.1091/mbc.11.12.4241.
4. Hohmann, S. (2002). Osmotic stress signaling and osmoadaptation in yeasts. Microbiology and Molecular Biology Reviews, 66(2), 300–372. DOI: 10.1128/MMBR.66.2.300-372.2002.
5. O'Rourke, S. M., Herskowitz, I., & O'Shea, E. K. (2002). Yeast go the whole HOG for the hyperosmotic response. Trends in Genetics, 18(8), 405–412. DOI: 10.1016/S0168-9525(02)02723-3.
6. Özcan, S., Dover, J., & Johnston, M. (1998). Glucose sensing and signaling by two glucose receptors in the yeast Saccharomyces cerevisiae. The EMBO Journal, 17(9), 2566–2573. DOI: 10.1093/emboj/17.9.2566.
7. Özcan, S., & Johnston, M. (1999). Function and regulation of yeast hexose transporters. Microbiology and Molecular Biology Reviews, 63(3), 554–569. DOI: 10.1128/MMBR.63.3.554-569.1999.

8. Pfeiffer, T., & Morley, A. (2014). An evolutionary perspective on the Crabtree effect. Frontiers in Molecular Biosciences, 1, 17. DOI: 10.3389/fmolb.2014.00017.
9. Rolland, F., Winderickx, J., & Thevelein, J. M. (2002). Glucose-sensing and -signalling mechanisms in yeast. FEMS Yeast Research, 2(2), 183–201. DOI: 10.1111/j.1567-1364.2002.tb00084.x.
10. Saito, H., & Posas, F. (2012). Response to hyperosmotic stress. Genetics, 192(2), 289–318. DOI: 10.1534/genetics.112.140863.

Published By
Resagate Global, KDP Grand Savanna, R. N. Ext.,
Ghaziabad- 201017, Uttar Pradesh, India

Copyright © 2025 Inc. All Rights Reserved Contact Us: editor@ijrmeet.org