

# allotroppe

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Volume 2 Issue 3 July-September 2025



Crafting Molecules, Shaping  
Minds: The Journey of Dr C.  
V. Ramana

Chloride-Resistant Iron  
Hydrogen Phosphite  
Catalyst for Sustainable  
Seawater Electrolysis

Catalyzing India's Rise as a  
Research and Innovation  
Powerhouse

Symposium on "Emerging  
Trends in Molecules and  
Materials (ETMM)"

## CHT-KIT SAFEGUARDING INDIA'S **TODDY** TRADITION FROM TOXIC ADULTERATION



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This issue of our magazine celebrates how science, when pursued with rigour and purpose, transforms lives and society. Much like molecules constructed from precise atoms, CSIR-NCL builds solutions with discipline, creativity and tangible impact. ***Our cover story features the CHT-KIT, a user-friendly, field-ready tool developed to detect chloral hydrate adulteration in toddy.*** Beyond its chemical ingenuity, the kit safeguards public health, preserves livelihoods and protects India's centuries-old toddy tradition - a powerful example of science serving society directly.

Our "Curious Minds" section features ***Dr C. V. Ramana***, Chief Scientist and Head of the Organic Chemistry Division, whose journey embodies precision, discipline and mentorship at the highest level. His work in total synthesis, catalysis and drug discovery highlights how fundamental research can underpin societal benefit while nurturing scientific talent. This issue also highlights path-breaking research, technology licensing, MoUs, training programs, lectures, outreach initiatives and student engagements - illustrating the multifaceted roles of CSIR-NCL as a hub of knowledge, innovation and societal impact.

In alignment with our theme, ***Allotropes of Science***, this issue underscores the dual role of NCL as both a cradle of meticulous scientific inquiry and a driver of tangible societal transformation. Just as molecules derive function from precise atomic arrangements, the laboratory constructs solutions that integrate discipline, creativity and practical relevance. From protecting India's toddy tradition to advancing the synthesis of complex molecules, NCL scientists exemplify how rigour in research translates into meaningful change.

As you turn the pages, you will see science in action - delivering impact, fostering talent and safeguarding traditions.

***May this read be both informative and inspiring.***

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# INVITATION FOR ARTICLES

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We invite your contributions for Allotrope in the following capacities:

## ***Research stories***

Explain your research/ ongoing experiment in a simplified manner.

## ***Science articles***

Describe a contemporary science topic, a scientific concept, technology, or a scientist of interest.

## ***Individual experiences***

Write about your personal field research/ travel experiences, conferences, paper/ poster presentations, PhD journey, or others. Senior scientists and staff members are invited to share their work experiences and insights.

## ***Visual narrations***

Showcase your research or technology with the help of a schematic or a graphic. Photographs related to NCL are also welcome.

The word limit for writing stories and articles is 500 words.

Kindly send your entries to: [allotrope.ncl@csir.res.in](mailto:allotrope.ncl@csir.res.in)

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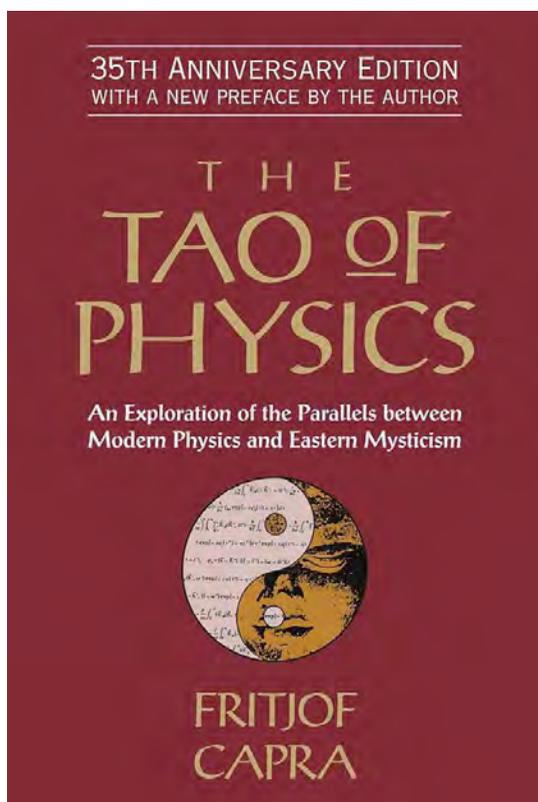
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## SAFEGUARDING INDIA'S

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### TRADITION FROM TOXIC ADULTERATION

“How a user-friendly colour-based test developed at CSIR-NCL is transforming public-health enforcement, preserving livelihoods and safeguarding India's toddy tradition.”

For centuries, toddy - naturally fermented from palm sap, has been part of the cultural and social life of several Indian states. Containing about 5-6% ethyl alcohol with a host of benign natural compounds, it has long served as an affordable beverage for economically vulnerable communities. In India, it is sold through government-regulated toddy shops and remains intertwined with local livelihoods.

But in recent years, this everyday drink has become central to a growing public-health emergency. Reports of mass poisonings, hospitalisations, kidney failure and deaths have surfaced from regions where toddy consumption is widespread. Behind these tragedies lies a disturbing trend:

adulteration with strong sedatives such as chloral hydrate, alprazolam and diazepam to artificially simulate intoxication. In some belts, authorities estimate that up to 95% of commercially sold toddy may be adulterated.<sup>1</sup>

Among these chemicals, **chloral hydrate** stands out as especially dangerous. A Maharashtra state-level committee, including excise officials, toddy suppliers, NCL scientists and policy experts, found evidence that chloral hydrate was being added illegally, sometimes approaching **one gram per litre**. Even more alarming was the possibility of synthetic toddy, created entirely from chemicals, entering the market.

Yet for years, enforcement officials had no practical, scientifically validated method to check adulteration on the spot. Existing procedures required carrying laboratory chemicals and glassware into the field or sending samples to forensic labs after halting fermentation with copper sulphate. Both options were slow, impractical and vulnerable to legal challenge. Officers, often non-chemists, struggled to perform tests reliably. The need for an accurate, portable, scientifically validated, tamper-proof field test was unmistakable. But until recently, no such tool existed.

This widening gap between a dangerous public-health threat and the lack of a rapid detection tool is where **CSIR-National Chemical Laboratory (NCL)** stepped in. Their response is a practical scientific innovation that promises immediate, ground-level impact: the **CHT-KIT**, a user-friendly, on-the-spot detection system for chloral hydrate adulteration in toddy.

### Chloral Hydrate: A Hidden Danger

Inside the body, chloral hydrate is rapidly converted by alcohol dehydrogenase into trichloroethanol, a potent central nervous system depressant and smaller amounts of trichloroacetic acid, a corrosive compound. Even small quantities can cause rashes, vomiting, gastric discomfort, acute peptic ulcers, and multi-organ failure affecting the kidneys, liver, and heart. Around 2 grams can induce severe toxicity. Repeated exposure carries carcinogenic risk.

### The Breakthrough at CSIR-NCL

Recognising the scale of the crisis, researchers at CSIR-NCL embarked on a systematic scientific investigation. Led by **Dr Narshinha P. Argade** and **Dr Asish K. Bhattacharya**, the team studied adulteration patterns, tested hundreds of combinations of reagents, analysed sensitivity thresholds and refined a method that could withstand variability in natural toddy composition.



The result was a user-friendly colour-based diagnostic tool - the **Chloral Hydrate Test Kit (CHT-KIT)** - designed specifically for non-chemist field officers to use in remote or high-intensity enforcement zones.

### How the CHT-KIT Works

The strength of the CHT-KIT lies in its simplicity:

- It contains pre-measured reagents sealed in a user-friendly format.
- Only **0.50 mL** of toddy is needed.
- If chloral hydrate is present, the solution **turns pink within seconds**.
- The kit can detect concentrations as low as **10 mg/L**, far below dangerous levels.
- If no pink colour appears, the sample is free of chloral hydrate.

No weighing, no heating, no specialised apparatus - just a few seconds, a few drops and a clear answer. This innovation represents not only chemical ingenuity but a deep understanding of real-world enforcement: portability, speed, clarity of results and legal defensibility.

### Validation and Government Adoption

Scientific credibility was essential. The kit underwent independent evaluation by the **Forensic Science Laboratory (FSL), Government of Maharashtra**, which formally approved its authenticity, sensitivity and reliability. Following this, CSIR-NCL provided a live demonstration of the CHT-KIT to more than **15 excise officers**, using toddy samples procured by the officers themselves. The demonstration served two purposes: it confirmed adulteration in some samples and proved that officers could perform the test easily and without laboratory support.

A subsequent demonstration to the **Excise Commissioner of Maharashtra** accelerated the next step: the state issued a **Government Resolution (GR)** and an **Office Memorandum (OM)** mandating immediate deployment of the CHT-KIT for routine enforcement.

For the first time, officers had an on-the-spot tool to detect one of the most dangerous toddy adulterants.

### Technology Transfer and Commercialisation

Recognising the societal significance of the innovation, CSIR-NCL has officially licensed the know-how to a new start-up - *Authentic Chemicals and Research Centre (ACRC-TEM)* located in Tembhurni-MIDC, Solapur. Through a technology transfer agreement, ACRC-TEM obtained the rights to manufacture and supply the kit to excise departments in Maharashtra and across India.



Chloral Hydrate Test Kit

The first purchase order from the Maharashtra Excise Department marks a transformative moment: a laboratory breakthrough entering real-world enforcement.

### Beyond Public Health: Protecting Tradition and Livelihoods

Adulteration threatens not just consumers but also the livelihoods of honest toddy tappers. To distinguish authentic toddy from adulterated variants, CSIR-NCL recommends branding naturally fermented toddy as “*Alneera*.”

The CHT-KIT enables verification of authenticity, helping rebuild public trust and support evidence-based regulation. By distinguishing genuine toddy from adulterated or synthetic versions, the kit safeguards tappers and small vendors from reputational damage, protecting an age-old cultural tradition.

### Why the CHT-KIT Matters

The adulteration crisis is not simply about spurious drinks; it threatens public health, vulnerable communities and an age-old tradition. A tool like the CHT-KIT empowers the state and protects society in multiple ways:

- **Public Health:** Rapid detection prevents toxic toddy from reaching consumers.
- **Deterrence:** On-the-spot testing discourages illegal adulteration.
- **Efficiency:** Field officers can conduct reliable tests without laboratory delays.
- **Cultural Preservation:** Helps protect traditional producers and rebuild confidence in authentic toddy.
- **Science-Policy Synergy:** Demonstrates how research can directly solve societal problems.



CHT-KIT Knowhow Transfer to ACRC-TEM: Dr Ashish Lele (Director, CSIR-NCL) with Dr Narshinha P. Argade and Dr Asish Bhattacharya.

### The Challenges Ahead

For long-term impact, state-wide deployment, consistent officer training and clear legal procedures for positive tests are essential. Continuous monitoring will be needed to detect emerging adulterants and public awareness campaigns can educate communities about risks and safe consumption. Regulations must continue to support legitimate producers, ensuring enforcement strengthens rather than threatens traditional livelihoods.

### A Blueprint for the Future

The CHT-KIT story is more than one of chemical reagents and field tests. It is an example of how science, policy and community welfare can converge to solve a pressing real-world problem. It demonstrates that scientific innovation, when aligned with public need, can safeguard lives and traditions alike.

As Maharashtra rolls out large-scale deployment, the coming months will be crucial. If implemented effectively, the CHT-KIT could become a national model - replicated across states, adapted for other beverages and expanded to detect additional harmful substances. In doing so, it may help reaffirm what toddy was always meant to be: *a natural nutritious, culturally cherished drink rather than a disguised poison*. The CHT-KIT ensures that this heritage beverage can remain what it was always meant to be - *safe, authentic and timeless*.

1. Adulterated toddy has turned into a health emergency in Telangana. (2025, July 11). *The Economic Times*. <https://economictimes.indiatimes.com/articleshow/122381174.cms>



CRAFTING MOLECULES,  
SHAPING MINDS:  
THE JOURNEY OF  
**DR C. V. RAMANA**

*Curiosity is the spark that ignites discovery. At the heart of our work are brilliant minds driven by knowledge and a deep desire to understand, innovate, and transform the world through research and innovation. These are the explorers of the unseen - the ones who see possibility in every molecule and progress in every reaction.*

Before the sun washes Pune in gold, **Dr Chepuri Venkata Ramana** has already walked several kilometers, played a brisk game of tennis and mentally mapped out his day. By the time he enters the Organic Chemistry Division of the **CSIR-National Chemical Laboratory (NCL), Pune**, he is not just prepared - he is ahead.

*“Perfection and being at the front - that's my ambition. Awards or recognition are secondary.”* he says simply, a philosophy that has guided both his life and his laboratory.

With around 160 publications, 20 patents and thousands of citations to his name, Dr Ramana's scientific resume reads like that of a chemist carved for the top echelons of his discipline. He is the Head and Chief Scientist in NCL's Organic Chemistry Division and among India's most respected researchers in **total synthesis, catalytic methods and complex molecule construction**.

While many chase the limelight or impact factors, he prefers a different measure of success:

*“I would like to be regarded as one of India's good, over the best, organic chemists - someone who did original work, trained people well and strengthened the scientific ecosystem.”* For a scientist who has mastered the synthesis of complex natural products, designed elegant catalytic reactions and mentored a generation of chemists, the humility is disarming. Yet it is this grounded, craftsman-like approach that defines his career.

#### **From Addanki to the World**

Born in the small village of **Addanki, Prakasam District, Andhra Pradesh**, Dr Ramana was the eldest of three siblings and the first in his family to cross the threshold of higher education. Early academic achievements - including a perfect score in mathematics in school - hinted at the meticulous, disciplined mind he would become.



He completed his graduation at VRS & YRN College, Chirala and his post-graduation in Chemistry from Andhra University, Waltair, where his academic seriousness sharpened. However, the formative stones of his scientific personality were laid during his PhD at the University of Hyderabad under the guidance of **Professor M. Nagarajan**. Working on cyclopropanated sugars, he learned two critical lessons: *how to be independent and how to remain silent in challenging situations*. These principles became the bedrock of his own mentoring approach - *demanding, disciplined and built on self-reliance*.

### The Swiss Refinement

Dr Ramana's postdoctoral journey took him to the Organic Chemistry Laboratory at ETH Zurich under Professor Andrea Vasella (1998-2001), which truly refined his scientific rigour. Working on glycosidase inhibitors, he encountered a culture where precision was non-negotiable. *"It took me a month to prepare two slides,"* he recalls, laughing, yet with the gravity of someone who truly learned the lesson. These experiences - the long meetings, the uncompromising critique, the disciplined execution - now define his own laboratory culture. Later, he further expanded his expertise in catalysis and mechanistic reasoning as a Visiting Professor at CaSuS, Georg-August-University, Göttingen, Germany.

### At NCL: Discipline Meets Ambition

In 2001, Dr Ramana returned to India and joined **CSIR-NCL, Pune**, a step that would define his professional life. Here, he built a research group focused on *"small molecules synthesis by employing transition metal complexes and developing new catalytic methods"* and **total synthesis of natural products** - one of the most demanding areas in organic chemistry.

“

*When Dr Ramana's application arrived at NCL in 2001, we didn't hesitate to offer him a Scientist C position - confident that his strength in carbohydrate chemistry would continue to flourish here even after senior retirements. He was sincere, focused, hardworking and truly innovative. Together, we published seminal work on the total synthesis of chiral natural products from carbohydrate precursors - including the stereochemical elucidation of multiplolide and the synthesis of all possible eupomatilone isomers.*

*Ramana also expanded our toolkit in organometallic methodology, contributing to new synthetic methods that have found application in complex synthesis and cancer research. Beyond his science, he is a shy, composed yet approachable mentor - a man of few words but deep insight. Students and peers alike respected his calm presence, his voracious appetite for current literature and his relentless pursuit of chemistry.*

”

*- Dr Gurjar, Former Head, Organic Chemistry Division, CSIR-NCL*

While early in his career, his ambitions may have aligned with metrics, such as the number of papers and large teams, time brought clarity. *"After the initial recognition, you see the value is limited. What matters is whether your research touches society and whether your students become capable, independent scientists."*

This guiding principle now underpins his work across process chemistry, drug discovery pathways and translational research, allowing his team to address real-world problems beyond academic publication lists.



Dr Ramana in front of the sculpture featuring a novel sundial version of the periodic table at the Slovak University of Technology in Bratislava (Jan 2011).

### Total Synthesis & Philosophy of Excellence

Total synthesis - building complex molecules atom by atom - is unforgiving, leaving no room for error. Bond angles misdrawn, spectra misread, or mechanistic missteps can derail months of effort. Dr Ramana's choice of this path mirrors his personality: methodical, uncompromising, patient and exacting. *"It is not enough to make a molecule,"* he says, *"It must be perfect."* This drive for intentional excellence permeates his work and his lab.

His contributions have been recognised with prestigious awards, including the CSIR Young Scientist Award (2003), NCL Scientist of the Year Award (2009), CRSI Bronze Medal (2013), and the Prof. D.K. Banerjee Memorial Lecture Award (2011). In 2017, he received one of India's highest honours in the field of chemical sciences, the C.N.R. Rao National Prize, for his work on natural product synthesis. He is also a Fellow of the Indian Academy of Sciences - yet to him, these are markers of recognition, not objectives. He encourages young researchers to work hard, remain updated and cultivate discipline. *"It's not the problems that make you; it's your attitude,"* he emphasises.

### Mentorship with Purpose

Dr Ramana's approach to mentorship combines toughness with empathy - students quip he can be a "terror," but one whose guidance forges resilient, competent scientists. He often encourages students from underprivileged backgrounds, valuing their appreciation for resources and focus.

### Transition Metal Catalysis in Total Synthesis

C. V. Ramana

Organic Chemistry Division



An illustration of transition metal catalysis in total synthesis.

*"They know how to fight small battles,"* he notes. *"A Ph.D. can change not only their life but the life of their entire family."* Many of his former students now lead teams in academia and industry, a testament to his influence as a mentor whose greatest pride is not in awards, but in the people he trains and the culture of disciplined, precise, and independent thinking he fosters.

## Leadership, Collaboration and Broader Impact

Beyond individual mentorship, Dr Ramana has shaped division-wide excellence at NCL. He ensures the Organic Chemistry Division always has funding, a practical but crucial contribution that keeps researchers productive and focused. His leadership philosophy is clear: enable, empower and allow talent to flourish.

His work in the Open Source Drug Discovery (OSDD) program exemplifies this ethos. By coordinating multi-institutional teams and launching the OSDD-Young Researcher Program, he has provided hands-on training to undergraduate students from remote colleges in the areas of chemical synthesis and drug discovery.

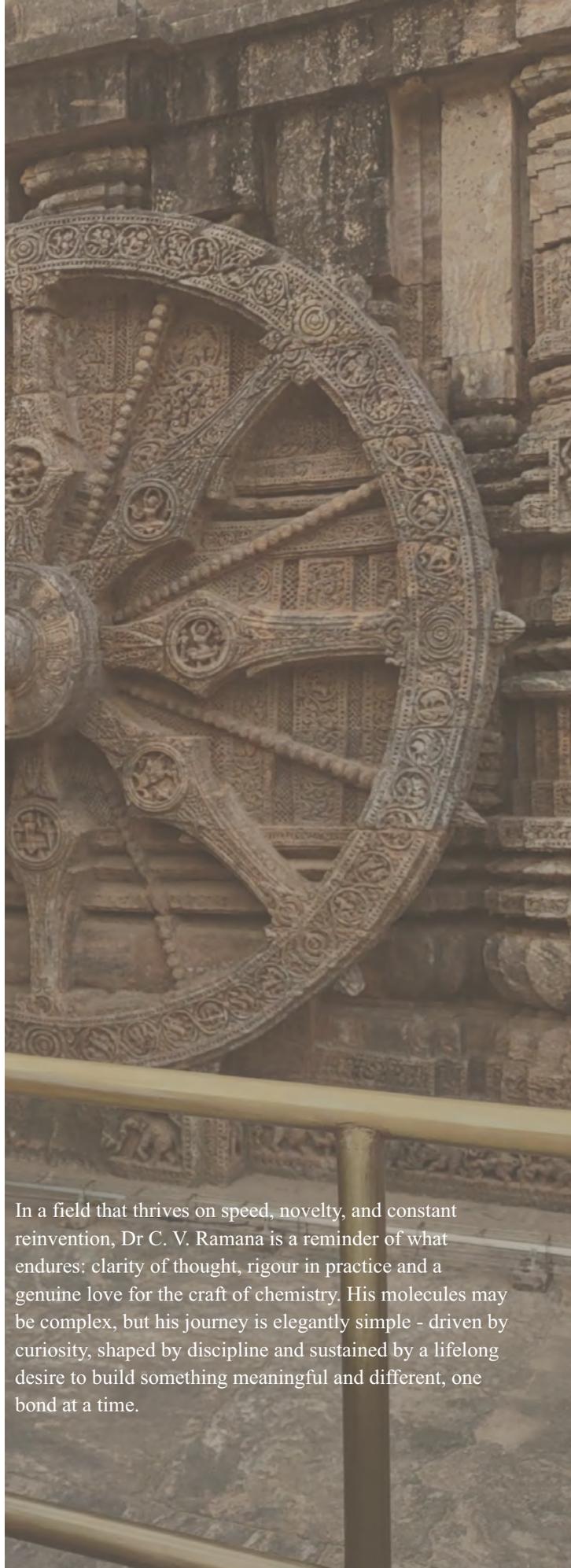
Internationally, his collaboration with Professor Alex Degtarev at Tufts University led to the development of NCL-240, a small molecule antagonist of PIP3 signalling with anti-cancer potential, resulting in patents and publications. During the COVID-19 pandemic, when labs were largely inaccessible, Ramana coordinated the synthesis of repurposed drug candidates, demonstrating adaptability, leadership and calm under unprecedented pressure.

### A Legacy Written in Molecules and Mindsets

Outside the lab, Dr Ramana's life mirrors his professional demeanour: simple, disciplined and focused. He maintains physical fitness through walking and tennis, embodying the idea that mind and body are inseparable. When asked about hobbies, his answer is refreshingly blunt: *"No books. No movies. No music. No painting. Only organic chemistry."*

To understand Dr C. V. Ramana is to understand total synthesis itself: meticulous, demanding, courageous and exacting. Science is not about genius alone; it is about hours of disciplined work. *"Fifty percent of research fails,"* he says. *"One successful chapter of a thesis takes a year - but students spend three years failing."* Discipline, resilience and attention to detail are non-negotiable. This is the same mindset that guides his daily routine: early mornings and long lab hours, and unrelenting hard work.

Ask him what he wants to achieve next, and he shrugs lightly. Maybe farming. Maybe industry. The future is flexible. But one thing remains certain: wherever he goes, he will stay the same man - disciplined, direct, profoundly human and forever in pursuit of perfection.



In a field that thrives on speed, novelty, and constant reinvention, Dr C. V. Ramana is a reminder of what endures: clarity of thought, rigour in practice and a genuine love for the craft of chemistry. His molecules may be complex, but his journey is elegantly simple - driven by curiosity, shaped by discipline and sustained by a lifelong desire to build something meaningful and different, one bond at a time.

## CHLORIDE-RESISTANT IRON HYDROGEN PHOSPHITE CATALYST FOR SUSTAINABLE SEAWATER ELECTROLYSIS

The global pursuit of sustainable hydrogen production has placed seawater electrolysis at the forefront of research in renewable energy technologies. While seawater is an abundant and widely available feedstock, its practical utilization is hindered by its high chloride content, which promotes corrosion at the anode and limits the operational lifespan of electrodes. This presents a significant challenge, particularly in the oxygen evolution reaction (OER), where competing chlorine evolution can reduce efficiency and degrade catalytic materials.

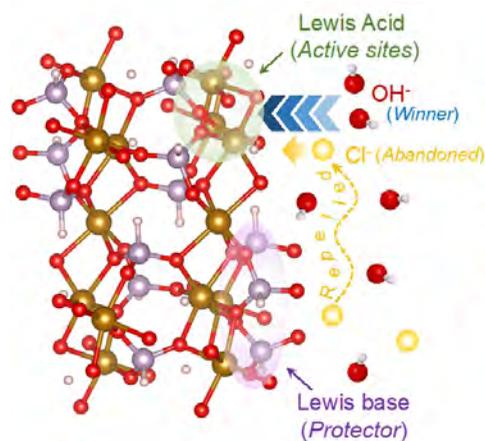
To address this issue, Dr Poulomi Roy and her team at the CSIR-National Chemical Laboratory, have developed a novel ammonium iron hydrogen phosphite (FeHPhi) electrocatalyst that incorporates a trace amount of copper. This material is unique due to its chloride-repelling properties while maintaining high catalytic activity toward water oxidation. The underlying design principle relies on a **frustrated Lewis pair framework**: the  $[\text{HPO}_3]^{2-}$  oxoanion functions as a Lewis base to hinder chloride ion adsorption at the electrode surface, while the Fe centre acts as a Lewis acid, providing active sites for OER. This combination of structural features ensures that the catalyst remains active

and stable even under highly corrosive seawater conditions.

A frustrated Lewis pair refers to a Lewis acid and a Lewis base positioned close enough to interact chemically, yet structurally prevented from forming a stable adduct, allowing them to remain highly reactive toward external molecules.

Experimental evaluation demonstrates the exceptional electrocatalytic performance of the FeHPhi system. In alkaline real seawater, the catalyst achieves a current density of  $500 \text{ mA/cm}^2$  at an overpotential of 344 mV. It also remains stable for over 200 hours of continuous operation, even under potentials where the chlorine evolution reaction dominates ( $>2 \text{ V}$ ). Having such great activity and chloride-repellent ability, the material was further explored in anion exchange membrane electrolyzer using freshwater as well as real seawater. Interestingly, the electrolyzer efficiency and energy consumptions in both cases found to be much comparable underscoring its potential applicability in effective and sustainable seawater electrolysis.

Theoretical studies support the experimental findings, confirming that the frustrated Lewis pair design effectively modulates the adsorption of reactants and prevents chloride



*Iron Hydrogen Phosphite is a structurally engineered, chloride-tolerant catalyst that delivers efficient and durable performance, representing a significant step toward realizing seawater as a practical feedstock for sustainable hydrogen generation.*

poisoning, while facilitating rapid water oxidation at the Fe active sites. By controlling both surface chemistry and electronic properties, this catalyst represents a significant advancement in designing OER-active materials that can withstand harsh saline environments.

While earlier research has explored strategies to improve seawater OER, such as protective coatings and selective membranes, these approaches typically address either catalytic activity or chloride resistance, but not both simultaneously. The present study distinguishes itself by integrating chloride repulsion and catalytic functionality directly within the catalyst's molecular structure, reducing the need for external barriers or additives. Moreover, the frustrated Lewis pair mechanism represents a relatively unexplored conceptual framework for seawater catalysis, offering new opportunities in materials design.

The development of the FeHPhi electrocatalyst represents a significant step toward scalable, durable, and cost-effective

*A frustrated Lewis pair refers to a Lewis acid and a Lewis base positioned close enough to interact chemically, yet structurally prevented from forming a stable adduct, allowing them to remain highly reactive toward external molecules.*

seawater-based hydrogen production. By coupling achloride-repellent framework with strong OER activity, this system provides a promising pathway for overcoming longstanding limitations associated with seawater electrolysis. Moreover, being Fe-based, the catalyst is inherently low-cost, enhancing its potential for efficient hydrogen production. As global interest in green hydrogen grows, innovations such as this may help unlock the vast potential of seawater as a renewable resource for clean energy technologies.

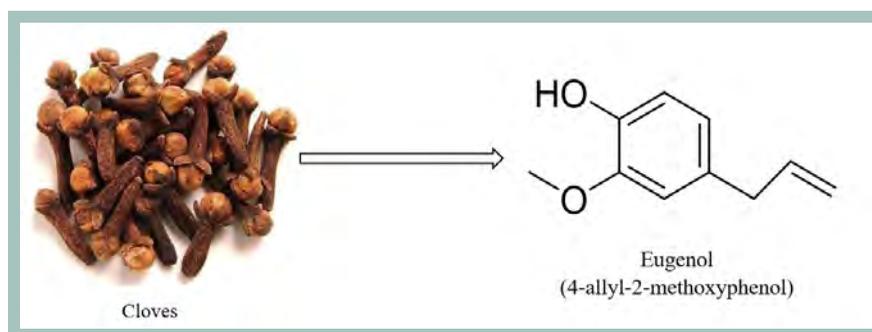
Chandni Das, Nibedita Sinha, Aathira Nair, Santanu Pal, Kavita Joshi\*, Poulomi Roy\*

*Chlorophobic Iron Hydrogen Phosphite as OER-Active Electrocatalyst in Anion Exchange Membrane (Sea) Water Electrolysis*

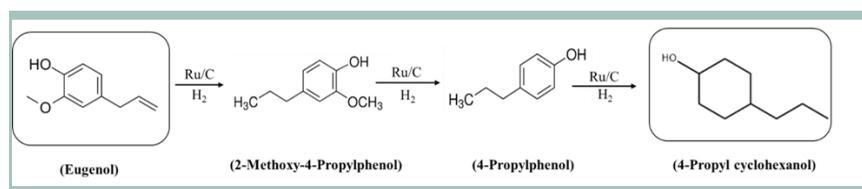
DOI: <https://onlinelibrary.wiley.com/doi/full/10.1002/sml.202505781>

# EUGENOL HYDROGENATION AND KINETIC INSIGHTS INTO RU/C-CATALYSED UPGRADING OF BIO-AROMATICS

Eugenol, the aromatic compound that gives clove oil its distinctive warm scent, is emerging as a promising building block for producing renewable chemicals. Researchers at CSIR-NCL, led by Dr Satyam Naidu Vasireddy have investigated how to selectively transform this bio-derived molecule into valuable industrial products using a ruthenium-on-carbon (Ru/C) catalyst, uncovering detailed kinetic and mechanistic insights that could guide future biorefinery processes.



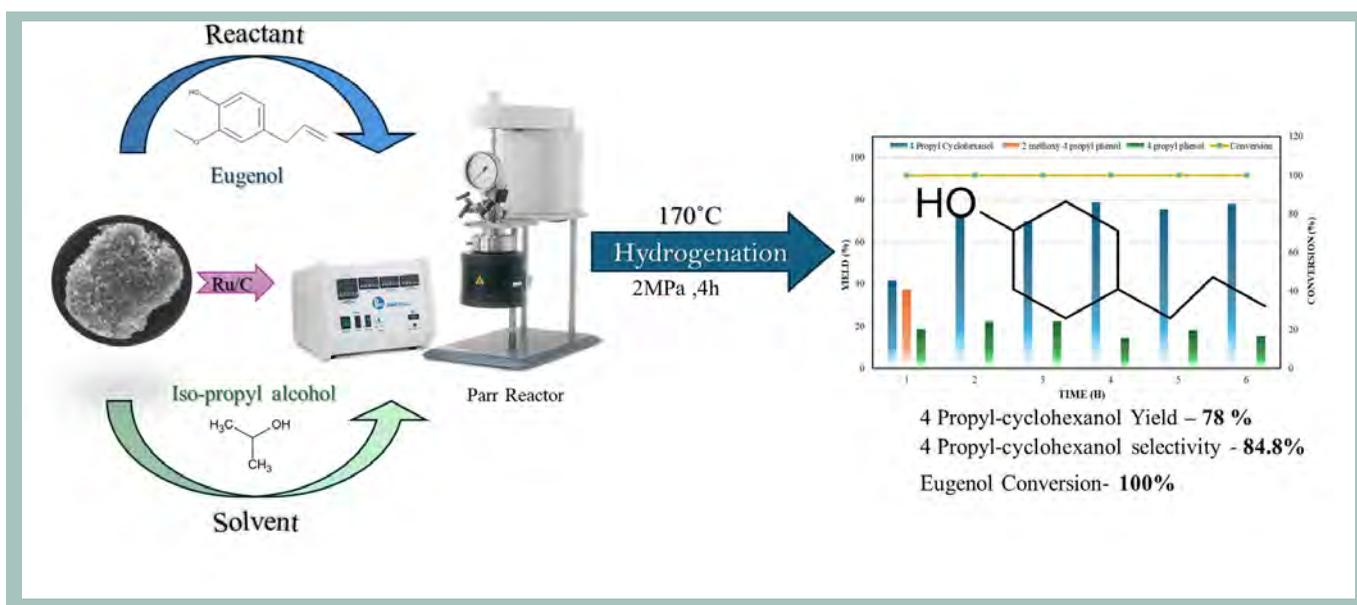
Eugenol is abundant in lignin-rich biomass and features multiple reactive sites: an aromatic ring, an allyl side chain and a methoxy group. These characteristics make it versatile, yet challenging to control during hydrogenation. Depending on the reaction conditions, eugenol can yield partially hydrogenated intermediates or fully saturated compounds, each with different industrial applications, from fragrances to polymer precursors.



The research team set out to understand how temperature, hydrogen pressure, reaction time and catalyst loading influence this reaction network and whether mathematical kinetic models could accurately predict these behaviours. The experiments revealed a strong temperature dependence. At lower temperatures, eugenol underwent only partial hydrogenation, forming intermediates such as 4-propylphenol and 2-methoxy-4-propylphenol. Higher temperatures favoured complete hydrogenation, producing 4-propylcyclohexanol as the dominant product. This pattern reflects the higher energy required to saturate the aromatic ring compared with reducing the side-chain functionalities.

*Renewable molecules such as eugenol have immense potential and understanding their reaction pathways is essential for turning lignin-derived biomass into practical industrial chemicals.*

Hydrogen pressure and reaction time further shaped the reaction outcomes. Increased pressure accelerated hydrogenation, enabling full conversion of eugenol with 85% selectivity for the fully hydrogenated alcohol. Longer % Ru/C catalyst was sufficient to achieve complete conversion, with reaction times allowed intermediates to convert fully, shifting the system towards thermodynamic and kinetic equilibrium. Catalyst loading also played a role: a 5 wt higher loadings providing no significant improvement, highlighting the high intrinsic activity of the Ru/C system.



To move beyond empirical observations, the researchers modelled the reaction using the **Langmuir-Hinshelwood-Hougen-Watson (LHHW)** framework, commonly applied to heterogeneous catalytic reactions. Their analysis showed that eugenol and hydrogen compete for the same active sites and that the surface reaction step likely limits the overall rate. The calculated activation energy of 39.33 kJ/mol indicates that hydrogenation on Ru/C proceeds more easily than in similar catalytic systems. Three-dimensional kinetic simulations revealed that the fastest reaction rates occur at high eugenol concentrations with moderate hydrogen pressure, a trend consistent with the LHHW adsorption mechanism. This work provides a clear framework for controlling hydrogenation pathways in lignin-derived molecules - a critical challenge in biomass valorisation. By understanding how to steer reactions towards specific products, researchers can design more efficient, selective and sustainable upgrading processes. With Ru/C proving both active and predictable under varied conditions, this study represents an important step towards converting bio-aromatics into practical industrial chemicals.

*The Langmuir-Hinshelwood-Hougen-Watson (LHHW) kinetic model illustrates how reactions occur on a catalyst surface, taking into account both reactant adsorption and the surface reaction. It demonstrates that reaction rates depend on how strongly molecules bind to the catalyst and how they compete for active sites.*

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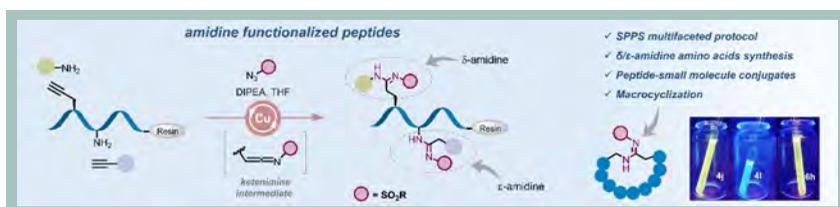
*Kinetics and Mechanistic Insights in the Hydrogenation of Eugenol Using Ru-Based Catalyst*

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# KETENIMINE-ENABLED MULTICOMPONENT STRATEGY FOR ADVANCED AMIDINE FUNCTIONALIZATION OF PEPTIDES

Peptides are powerful biomolecules. Highly specific and tunable, they are at the forefront of therapeutic research, offering targeted strategies for diseases ranging from infections to cancer. Yet their potential is often constrained by a fundamental limitation: peptides are prone to enzymatic breakdown and are restricted by synthesis conditions, making it difficult to fine-tune their structure and function. Among various strategies to improve peptide stability, the incorporation of amidine groups has emerged as a particularly powerful approach. Amidines act as proteolytically stable mimics of peptide bonds, offering enhanced durability while introducing versatile hydrogen-bonding patterns and strong metal-binding capabilities. These features enable shifts in molecular shape, interactions and bioactivity, making amidine incorporation a highly attractive tool in peptide-based drug design.

Addressing the long-standing challenge of efficiently installing amidines on peptides, researchers at CSIR-NCL, Ms Supriya Bodake Mahadev led by Dr Udaya Kiran Marelli, have developed a copper-catalysed multicomponent reaction (MCR) that allows amidine formation directly on solid-phase peptide scaffolds. The method exploits **ketenimines**, highly reactive intermediates formed *in situ* from terminal alkynes and sulfonyl azides, which can then be selectively attacked by nucleophilic amines. This three-component reaction, catalysed by copper(I) iodide (CuI) in the presence of a mild organic base (DIPEA), offers a flexible platform to introduce diverse modifications without the need to remove the peptide from the resin.

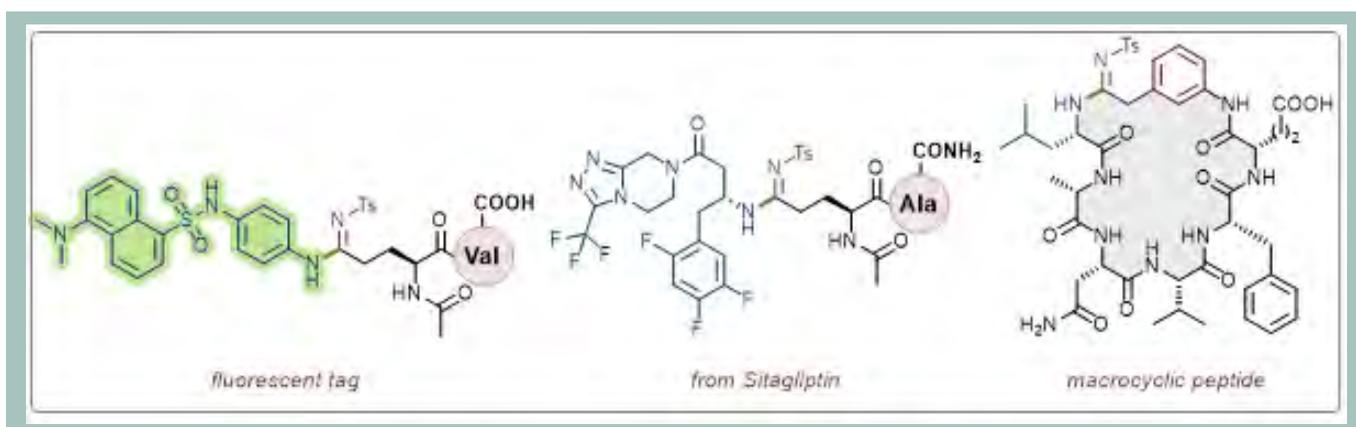


The strength of this strategy lies in its exceptional versatility. Using a single reaction framework, the team synthesised  $\delta$ - and  $\epsilon$ -amidino amino acids, noncanonical arginine isologues, fluorescently tagged peptides, PEGylated derivatives and hybrids linking drug molecules such as Ciprofloxacin and Sitagliptin to peptide scaffolds. The reaction also supports backbone and side chain macrocyclisation, enabling access to structurally constrained architectures highly sought after in modern peptide medicinal chemistry. Even aromatic scaffolds can be incorporated directly into the peptide backbone, expanding the structural diversity achievable within a single step.

Mechanistic studies explain the method's efficiency. The transient ketenimine intermediate reacts selectively with nucleophilic amines, even in sterically or electronically complex environments. Mild reaction conditions preserve peptide integrity while installing chemically robust amidines, overcoming the limitations of traditional amidine synthesis, which often requires multiple steps, protecting-group manipulations or solution-phase chemistry.

*Amidines act as proteolytically stable bioisosteres of peptide bonds, enabling the creation of peptide structures with enhanced stability and broadened medicinal potential.*

*Ketenimines are reactive intermediates formed in situ, capable of undergoing selective bond formation with diverse nucleophiles, allowing chemically efficient functionalization within complex molecular environments.*



Importantly, this MCR is fully compatible with solid-phase peptide synthesis, the most widely used technique for producing peptides. This compatibility allows for flexible incorporation of modifications, facilitating the creation of peptide libraries for bioassay screening - a fundamental requirement in peptide drug discovery. Compounds obtained through this method, from fluorescently tagged peptides to drug-peptide conjugates, demonstrate a broad spectrum of applications across medicinal chemistry and chemical biology.

Historically, peptide modifications such as stabilisation, labelling or macrocyclisation were addressed through separate, step-intensive synthetic routes. This ketenimine-enabled strategy consolidates these capabilities into a single programmable step, unifying structural diversification, functional tagging and conformational control. By reducing synthetic complexity while maximising chemical and structural versatility, this method provides researchers with a powerful new toolkit to explore amidine-rich and functionally enhanced peptides. With the growing focus on peptide therapeutics, this approach enables next-generation peptides featuring greater stability, enhanced biological activity and innovative structural designs.

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*Ketenimine Multicomponent Strategy for Multifaceted Amidine Functionalization of Peptides on the Solid Phase*

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## CATALYZING INDIA'S RISE AS A RESEARCH AND INNOVATION POWERHOUSE



*Established under the Anusandhan National Research Foundation Act, 2023, ANRF is envisioned as an apex body to seed, grow and promote research and development (R&D) across India's universities, colleges and research institutions. The foundation aims to foster a strong culture of research and innovation nationwide, in alignment with the National Education Policy.*

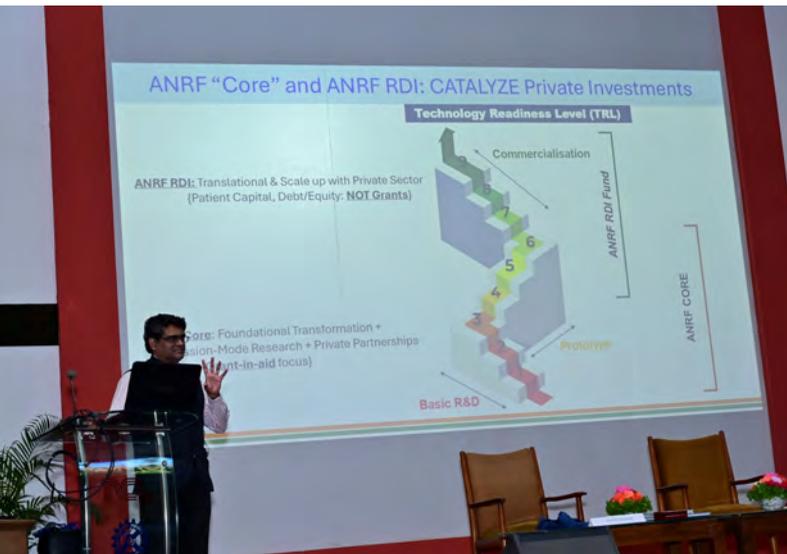


The 84th *CSIR Foundation Day celebrations*, held on 12th September 2025 at the CSIR-National Chemical Laboratory (NCL) auditorium, featured an inspiring keynote address by Dr Shivkumar Kalyanaraman, CEO of the Anusandhan National Research Foundation (ANRF). His lecture, titled “*Catalyzing India's Rise as a Research and Innovation Powerhouse*,” explored the transformative role that ANRF is set to play in building India's future as a global leader in science, technology and innovation.

Dr Kalyanaraman emphasised that ANRF's mission goes beyond funding: it seeks to build a robust ecosystem that nurtures curiosity, collaboration and creativity, enabling Indian researchers to address national and global challenges. During his address, he outlined several major initiatives of ANRF designed to catalyse the research and innovation landscape in India. These include a ₹50,000 crore grants program over five years to strengthen R&D capabilities across academic and research institutions,

as well as a ₹1 lakh crore Research, Development, and Innovation (RDI) capital programme targeting deep-tech domains such as artificial intelligence, quantum computing biotechnology. He explained that the RDI initiative includes a Special Purpose Fund managed by ANRF, which supports second-level fund managers investing in high-impact research ventures. These programs, he said, will stimulate interdisciplinary collaboration and accelerate India's transition into a knowledge-driven economy.

A key theme of Dr. Kalyanaraman's lecture was the creation of a Principal Investigator (PI)-friendly ecosystem. He highlighted ANRF's efforts to streamline administrative procedures, modernize procurement systems and reduce bureaucratic hurdles, allowing researchers to dedicate more time to scientific inquiry. He also underscored the importance of partnerships, calling on industry, academia



and research organisations to work together with ANRF to achieve the shared vision of “*Viksit Bharat*”— a developed India driven by innovation and knowledge.

Dr Kalyanaraman brings to ANRF a wealth of experience spanning academia, industry and technology leadership. An alumnus of IIT Madras, he has served as the Chief Technology Officer for Microsoft's Energy Industry in Asia. He has previously held significant positions at GE Power Conversion and IBM Research. A Fellow of the IEEE and the Indian National Academy of Engineering, he has been recognized as an ACM Distinguished Scientist. He has received the Microsoft Gold Club award for his contributions to technology and innovation.



In closing, Dr Kalyanaraman expressed optimism about India's research future, noting that ANRF will act as a transformative bridge between academia, industry and government. By enabling sustained investments, simplifying research processes and promoting cross-sector collaboration, ANRF aims to position India as a global hub of scientific excellence.



सीएसआईआर- राष्ट्रीय रासायनिक प्रयोगशाला  
National Chemical Laboratory  
(Council of Scientific and Industrial Research)

# 84th

## CSIR FOUNDATION DAY

Chief Guest



**Dr. Shivkumar K,**  
CEO, Anusandhan National Research Foundation



Friday September 12th, 2025  
At 03:30 PM  
Venue: NCL Auditorium  
[Register on](#)  


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**Title of the Lecture**

**ANRF Vision: Catalyzing India's Rise as a Research and Innovation Powerhouse**

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**Abstract**

Anusandhan National Research Foundation (ANRF) has been recently established as a statutory body with a governing board chaired by the Hon'ble Prime Minister. This body is aimed at driving a significant transformation in Research and Innovation across all stakeholders in India. This includes all of government, academia (public, private), industry, startups, CSR, Foundations and beyond. Collaboration across disciplines, teams vs individuals, institutions, international and quality / impact will be a major focus. The talk will also outline the vision, principles and high level approaches ANRF will use to drive collaborations and co investments across stakeholders. The talk will also include an overview of ANRF in operationalizing its grants program (₹50000 CR over 5 years, including partnerships and mission-mode programs) and the RDI (research, development and innovation) capital program (₹1 lakh CR over 5 years). We invite deeper community participation from all stakeholders, and especially industry, academia, labs, foundations/pilanthropy to come together with ANRF on the journey to Viksit Bharat.

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**About the speaker**

Shiv has been appointed by Hon'ble Prime Minister of India as CEO, Anusandhan National Research Foundation (ANRF). He was previously CTO, Energy Industry, Asia at Microsoft. Previously he was Executive General Manager of Growth Offerings at GE Power Conversion responsible for new Line of Business development in e-Mobility, Commercial & Industrial Solar and digital AI innovations. Earlier he was at IBM Research - India, and the Chief Scientist of IBM Research - Australia. Before IBM, he was a tenured Full Professor at Rensselaer Polytechnic Institute in Troy, NY, USA. Shiv has degrees from Indian Institute of Technology, Madras (B Tech, CS), Ohio State University (MS, PhD) and RPI (Executive MBA). Shiv is a Distinguished Alumnus Awardee of IIT Madras (2021), recognizing 0.3% of IITM's alumni over the years) & Ohio State University (2021), Fellow of the IEEE (2010), Fellow of Indian National Academy of Engineering (2015), ACM Distinguished Scientist (2019), Microsoft Gold Club (2024), MIT Technology Review TR100 young innovator (1999).

79th Independence Day

## 79<sup>th</sup> INDEPENDENCE DAY ON AUGUST 15, 2025,



*CSIR-National Chemical Laboratory (CSIR-NCL), Pune, celebrated India's 79th Independence Day on August 15, 2025, with great patriotic spirit at its campus. The celebration began with the ceremonial hoisting of the national flag by Dr Ashish Lele, Director of CSIR-NCL. In his address, Dr Lele highlighted the importance of scientific innovation in nation-building and acknowledged the contribution of researchers, staff and students toward advancing India's scientific progress. The event also featured patriotic songs and participation from members of the CSIR-NCL community, marking the occasion with pride and unity.*



## PHENOME INDIA - CSIR COHORT PROJECT



*The second phase of sample collection under the Phenome India - CSIR Health Cohort Knowledgebase (PI-CHeCK) project was successfully conducted at the CSIR-National Chemical Laboratory (NCL) and the CSIR-Unit for Research & Development of Information Products (URDIP) between July 2<sup>nd</sup> and July 13<sup>th</sup>, 2025. This year's drive witnessed a remarkable increase in participation and operational scale compared to the previous year, reflecting both growing awareness and institutional support for this nationwide health cohort initiative.*

A total of 698 individuals (employees, pensioners and their spouses) participated in this year's sample collection drive, marking a significant rise from the 625 participants in 2024. CSIR-NCL alone accounted for 636 tests, surpassing the previous year's total of 595. The unexpectedly high turnout led to the creation of an additional 150 sampling slots in the final five days of the campaign, reflecting the strong interest of the NCL and URDIP communities in contributing to this national health data initiative.

The success of the event was made possible through the sustained institutional support provided by CSIR-NCL and CSIR-URDIP. The initiative received continued encouragement and strategic guidance from Dr Ashish Lele, Director, CSIR-NCL, whose leadership has been

central to the seamless execution of PI-CHeCK activities at the laboratory. The presence of former Directors Dr Sivaram and Dr Paul Ratnaswamy, along with Dr Shekhar Mande, former Director General of CSIR, during the sample collection days served as a motivating force for participants and volunteers alike, highlighting NCL's enduring legacy of scientific engagement and community spirit.



The 12-day sample collection period was marked by coordinated planning and execution involving volunteers, students and staff from multiple institutions. A team of trained student volunteers from IGIB, IICB, MDRF and NCL played a pivotal role in the technical and logistical aspects of the sampling process. Their work encompassed participant coordination,

sample handling, data management and procedural compliance; all of which were carried out with efficiency and professionalism, including during weekends. The NCL Medical Centre also played a vital facilitative role by providing continuous access to its facilities, enabling seamless integration of medical and sampling workflows and ensuring participant comfort and safety.

With the successful completion of this second phase, the CSIR-NCL and URDIP teams have reaffirmed their strong commitment to the Phenome India mission: to build a comprehensive health cohort that will enable a deeper



understanding of the genetic, environmental and lifestyle factors influencing the health of the Indian population. As the project moves into its future phases, the high levels of participation, organisation and community engagement demonstrated in 2025 set a benchmark for excellence.

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## INTERNATIONAL MICROORGANISMS DAY 2025



Dr Girish Mahajan followed with a compelling talk on the potential of “Make in India” technologies. He highlighted areas where local innovation could transform fields from metabolite production to large-scale microbial cell factories, citing emerging possibilities in microbial biotechnology. His message was clear: India's future in biotech depends on harnessing domestic expertise and resources.



*On 16 September 2025, the CSIR-National Chemical Laboratory (NCL), Pune, hosted a vibrant celebration of International Microorganisms Day, organised by its Biochemical Sciences Division. With an audience of students, researchers and science aficionados, the event featured distinguished speakers Dr Rahul G. Warke (Director R&D, HiMedia Laboratories, Mumbai) and Dr Girish Mahajan (Senior Vice President, Microbiology Department, HiMedia Labs). Dr Ashish Lele, Director of CSIR-NCL, also participated in the proceedings, marking a synergy of industry and academic excellence.*

The programme opened with the release of a new video showcasing the NCIM (National Collection of Industrial Microorganisms) facility by Dr Warke. He recounted the inspiring journey of HiMedia Laboratories - from humble beginnings with homemade media to its present status among the top global players in microbiological reagents. His address emphasised how simple ideas, combined with perseverance and scientific rigour, can yield breakthroughs. Dr Warke called for young scientists to embrace entrepreneurship and underscored the relevance of microbiology in fulfilling the goals of *Viksit Bharat* under the newly minted BioE3- Biotechnology for Economy, Environment and Employment policy of the Government of India.





### Dr Mahesh Dharne

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Dr Ashish Lele spoke eloquently on media formulation, particularly cell culture media and its critical importance to biotech and industrial microbiology. He pointed to opportunities for collaboration between CSIR-NCL and HiMedia in areas such as formulation, scale-up and process design. A notable theme in his remarks was the increasing convergence of biology with computing, the role of Artificial Intelligence in optimising formulations, enhancing bioprocesses and accelerating scale-up.

The event also touched on the Government of India's BioE3 policy, approved in August 2024, which aims to foster innovation, sustainable biomanufacturing and a circular bioeconomy; to promote biotechnology R&D, entrepreneurship and high-performance manufacturing; and to address national priorities including climate resilience, food security and job creation. Throughout the talk, a recurring message emerged: *microorganisms are not just tools for science, but cornerstones of sustainable development*. The speakers urged young researchers to take up challenging projects, think broadly and anticipate the demand for bio-based solutions in industry, healthcare, agriculture and environment. The gathering came to a close on a note of collaboration. Dr Warke, Dr Mahajan and Dr Lele all called for stronger linkages between academia and industry, mutual projects of interest between CSIR-NCL and HiMedia and for young scientists to see themselves as innovators and change-makers. The shared vision: to respond to global challenges through biology, backed by supportive policies, collective effort and inspired thinking.

## PROMOTING LINGUISTIC EXCELLENCE: CSIR-NCL HOSTS INTER-OFFICE HINDI EXTEMPORE SPEECH COMPETITION

An Inter-Office Hindi Extempore Speech Competition was organised on 25 July 2025 at the CSIR-National Chemical Laboratory, Pune under the auspices of the Town Official Language Implementation Committee (TOLIC-2), Pune, Ministry of Home Affairs, Department of Official Language. The event witnessed the participation of approximately 40 employees and officers from various central government institutions located in Pune.

*TOLIC (Town Official Language Implementation Committee) is a coordinating body established by the Government of India to promote and monitor the effective use of Hindi in central government offices within a city.*



TOLIC

The programme was presided over by Dr. Ashish Lele, Director, CSIR-NCL and Chairman, TOLIC (Category-2), Pune. Prof. (Dr.) Kamayani Gajanan Surve, Professor and Head, Hindi Department, Mahatma Phule College, Pimpri, Pune, graced the event as the Chief Guest and Judge. The judging panel also included Mrs. Pooja Kulkarni (Senior Administrative Controller, NCL), Mr. Kaushal Kumar (Administrative Officer, NCL & Internal Judge) and Dr. Swati Chaddha (Senior Hindi Officer, NCL & Secretary, TOLIC-2, Pune).

The proceedings commenced with a welcome address by Dr. Swati Chaddha, who also briefed the participants regarding the rules and structure of the competition. Dr. Lele subsequently welcomed the Chief Guest by presenting her with a ceremonial plant. In his address, he emphasised the unifying role of the Official Language and highlighted the importance of TOLIC-led initiatives in fostering linguistic proficiency and inter-institutional interaction.

In her remarks, Prof. Surve underscored the significance of extempore competitions in enhancing linguistic competence, critical thinking and self-confidence. She noted that such platforms encourage participants to



engage with diverse subjects and refine their communication skills. The competition featured enthusiastic participation from representatives of several institutions, including the Armed Forces Medical College, DRDO, IITM, Zoological Survey of India (Western Regional Centre), Ammunition Factory, Film and Television Institute of India, India Meteorological Department, various public sector insurance companies, Central Ground Water Board, PM Shri Kendriya Vidyalaya BEG, ARDE and R&DE (E), among others.



At the end of the event, Mr. Kaushal Kumar presented a memento to Prof. Surve as a token of appreciation for her contributions as Chief Guest and Judge. He concluded the programme with a heartfelt vote of thanks, acknowledging the collective effort that made the event a success. He encouraged all participants to continue contributing to the promotion of Hindi and to strengthen the collaborative platform provided by TOLIC.



## CELEBRATING HINDI: CSIR-NCL PUNE ORGANISES HINDI PAKHWADA 2025

The Pakhwada featured a diverse range of activities. The celebrations began with participation in the *5th All India Official Language Conference* in Gandhinagar, Gujarat, by Dr Swati Chaddha (Senior Hindi Officer) and Mr Gopal Mahanta (Assistant Section Officer). This was followed by competitions including Hindi essay writing, handwriting, dictation, vocabulary and general knowledge contests, held on successive days. These activities saw active participation from all sections of the NCL community.

A highlight of the Pakhwada was the Hindi Workshop on “*Hindi – Direction and Status*” conducted on 24 September 2025. The workshop, attended by nearly 53 staff members, featured Dr Sunil Devdhar (former officer, All India Radio, Pune) as Chief Guest, along with Mrs Pooja Kulkarni, Mrs Kinka Goyal and Dr Swati Chaddha. Participants engaged in interactive sessions aimed at enhancing Hindi usage in professional communication and understanding its significance in administration and research.



*The CSIR-National Chemical Laboratory (NCL), Pune celebrated Hindi Pakhwada with great enthusiasm from 14 to 29 September 2025, under the guidance of its Hindi implementation committee. The fortnight-long event aimed to promote the use of Hindi in official work and foster linguistic pride among officers, employees and research scholars. The celebrations included a series of competitions, workshops and language-related activities, all designed to enhance proficiency and engagement with the national language.*

The celebrations concluded with a Prize Distribution Ceremony on 29 September 2025. Mr. Anand Agarwal, Editor-in-Chief of *Aaj Ka Anand*, Pune, graced the occasion as Chief Guest, with Dr. Ashish Lele, Director, NCL, as Guest of Honour. Winners of various competitions, officers demonstrating exemplary use of Hindi in official work and members of the evaluation committee were felicitated. The event began with a traditional Saraswati Vandana, creating an auspicious start.

In his address, Dr. Lele highlighted the importance of Hindi as a national language and symbol of India's identity, emphasising NCL's efforts in publishing Hindi booklets, website translation and organising communication through Hindi media. Mr. Agarwal noted the richness and scientific structure of Hindi, reinforcing its global significance. The Hindi Pakhwada 2025 successfully combined learning, celebration and recognition, strengthening the use of Hindi across NCL and inspiring all participants to continue promoting the language in official and professional spheres.

HINDI PAKHWADA

## SWACHHATA HI SEVA CAMPAIGN



The campaign began with the Swachhata Oath on 17 September, administered across all buildings, with oversight by Heads of Divisions and Wardens, encouraging every member of the NCL community to pledge for a cleaner and healthier environment. Simultaneously, activities aimed at improving overall cleanliness, disposing of scrap and waste and maintaining hygienic surroundings were initiated.

A key highlight was the plantation drive under “*Ek Ped Maa ke Naam*”, held on 18-19 September in the NCL gardens. Participants enthusiastically planted saplings, promoting greenery and environmental awareness. Alongside this, the campaign leveraged social media, displayed awareness banners and organised drives to clean toilets, public spaces, staircases and corridors, ensuring active engagement and visibility of the cleanliness initiatives.

On 25 September, the “*Safai Mitra Suraksha Shivir*” was conducted jointly by the Medical and HLS departments to educate sanitation workers on safety and hygiene practices. A thorough inspection of campus premises was conducted on 30 September, led by the Nodal Officer and team to ensure adherence to cleanliness standards.



*The CSIR-National Chemical Laboratory (NCL), Pune actively participated in the Swachhata Hi Seva (SHS) campaign 2025, held from 17 September to 1 October 2025, demonstrating its commitment to cleanliness, hygiene and environmental stewardship. The campaign was organised across all campus areas, including laboratories, hostels, guest houses, dispensary, gardens and security zones, involving staff, research scholars and administrative personnel.*

SWACHHATA



The campaign concluded with the felicitation of *Safai Mitras* and sanitation workers on 1 October, acknowledging their invaluable contributions to maintaining a clean and safe environment. Through the Swachhata Hi Seva campaign, NCL Pune successfully combined awareness, action and recognition, reinforcing the importance of cleanliness in their workplace, promoting environmental responsibility and honouring the efforts of those who sustain hygiene across the campus.



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## Symposium on “Emerging Trends in Molecules and Materials (ETMM)”



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The CSIR-National Chemical Laboratory, Pune, organised a one-day symposium titled “*Emerging Trends in Molecules and Materials (ETMM)*” on 16 September 2025. Hosted by the Physical and Materials Chemistry Division, the event brought together scientists, researchers and students to discuss frontier developments in molecules and materials, particularly those aimed at enabling sustainable technologies. The symposium also celebrated the legacy of Dr Vijayamohan K. Pillai, former Director of CSIR-NCL and a pioneering figure in electrochemical science, whose contributions have significantly shaped India's research ecosystem.

Central to the event was the emphasis on CSIR-NCL's ongoing advancements in sustainable energy technologies, reflecting Dr Vijayamohan's scientific vision. The institute showcased progress in fuel cells, advanced batteries, supercapacitors and battery recycling, supported by world-class testing and characterisation facilities. A highlight was the announcement of a fuel-cell-powered cargo three-wheeler, developed in collaboration with MEDA, CECRI, Hydovert and CIRT, signaling new pathways for clean mobility. In parallel, the laboratory's efforts in next-generation battery systems - including sodium-ion, lithium-sulfur, anode-less and zinc-based chemistries, were discussed. Notably, M/s. Rechargion, a start-up founded by a CSIR-NCL scientist, became the first in India to have its sodium-ion battery technology pass all qualification tests at ARI Pune.

The symposium consisted of four technical sessions that featured invited talks from distinguished speakers such as Dr B. L. V. Prasad (Director, CeNS Bengaluru; Chief Scientist, CSIR-NCL), Prof. Santosh Haram (Savitribai Phule Pune University), Dr Satish Ogale, Prof. Shabana Khan (TCG Crest, Kolkata), Prof. Amitava Das (IISER Kolkata), Prof. Shaijumon (IISER Thiruvananthapuram) and Prof. A. V. Murugan (Pondicherry University). Their lectures covered topics including functional nanomaterials, flexible batteries, peptide-based therapeutics and photo electrocatalysis, offering insights into emerging trends and interdisciplinary directions. Complementing these talks, student researchers presented work on areas such as Li-S battery interlayers, repurposing spent graphite, next-generation electrocatalysts, MXenes and graphitic carbon nitride-supported boron quantum dots. The symposium concluded with a felicitation ceremony honouring Dr Vijayamohan's visionary leadership, reinforcing his enduring impact on India's pursuit of cleaner and more sustainable energy solutions.

## 2-Day

### Workshop on In-house Patent Cell



The CSIR-National Chemical Laboratory, Pune, in partnership with the Office of the Principal Scientific Adviser (PSA) to the Government of India and BIRAC under the UTTHAN initiative, organised a two-day workshop titled “*Setting up and Running an In-house Patent Cell*” from 23-24 September 2025. This workshop marks the beginning of a nationwide capacity-building series aimed at equipping scientific and academic institutions, especially in Tier 2 and Tier 3 cities, with the expertise needed to manage and leverage intellectual property (IP).

The inaugural session featured an address by Prof A.K. Sood, Principal Scientific Adviser to the Government of India, who emphasised the growing strategic value of IP in shaping India's innovation-driven economy. Dr Jitendra Kumar, Managing Director of BIRAC and Dr Ashish Lele, Director of CSIR-NCL, delivered keynote remarks highlighting the urgent need for institutions to develop structured IP processes, ensure timely protection of inventions and promote stronger academia-industry collaboration. Dr Lele also welcomed the participants and underscored the pivotal role of coordinated national efforts in strengthening the innovation ecosystem. Led by Dr Nitin Tewari, Scientist, CSIR-NCL, the workshop drew over 40 participants from institutions across Tier 1, Tier 2 and Tier 3 cities. The programme featured expert sessions from academia, industry and government on a broad spectrum of IP-related themes, including patent filing and prosecution,



drafting essentials, institutional IP policy formulation and the operational frameworks necessary to establish a functional in-house patent cell.

Case studies, interactive discussions and practical guidance enabled participants to gain clarity on common challenges such as prior art searches, documentation practices and navigating the patenting workflow. Speakers also emphasised how institutional IP cells can serve as catalysts for technology transfer, innovation management and enhanced research commercialisation.

The workshop provided participants with practical tools, best practices and a deeper understanding of how structured IP management can accelerate innovation. As the first in the UTTHAN workshop series, the event sets the momentum for a broader national effort to empower institutions with IP expertise and strengthen India's innovation ecosystem.

## FEATURED TECHNOLOGY OF THE QUARTER

### A Sustainable Leap in Plasticizer Production: Auto-Catalytic Synthesis of Tributyl Citrate

#### Synopsis:

*Tributyl Citrate (TBC) is a vital organic ester used in various industries. It serves as a non-toxic plasticizer. However, the conventional synthesis of TBC presents significant environmental challenges, including complex post-processing steps and ecological concerns. To address these issues, CSIR-NCL has developed an innovative auto-catalytic process for TBC synthesis utilizing reactive distillation. This method is optimized for efficiency and sustainability, resulting in high-purity TBC (95% to 99.9%) with a colorless composition and ecological superiority. This process offers a transformative and eco-friendly alternative in the plasticizers market. Currently, the technology is available for licensing and co-development for larger production.*

#### Introduction:

Organic esters play a crucial role in various industries, particularly in the chemical and pharmaceutical sectors. The esters derived from bio-based organic acids have emerged as promising alternatives to halogenated petroleum-based conventional solvents. Among these, Tributyl citrate (TBC) stands out as a non-toxic plasticizer with diverse applications. It is a high-boiling substance used as a solvent and plasticizer for polymers especially for PVC and its copolymers. TBC is heat-stable and does not discolor when processed in compounded resins. It is a plasticizer permitted in the field of food additives, food contact material, toys, and medicine (e.g. as enteric coatings for controlled release drug delivery systems), printing ink coatings, and is widely used in cosmetics and biodegradable polymers. Moreover, TBC is environmentally friendly as the materials used in synthesis are available from renewable resources by fermentation processes.

#### The Problem:

Industrially, TBC has been produced through esterification reactions of citric acid with butanol, traditionally employing concentrated sulphuric acid as a catalyst. However, this catalytic process entails numerous post-processing steps such as deacidification, neutralization, washing, drying, bleaching, and filtration. Apart from the increased complexity this process brings about serious issues like equipment corrosion, long reaction times, and intricate post-processing operations. The use of homogeneous catalysts further complicates the process due to separation difficulties. Additionally, it poses challenges related to wastewater management and contributes to environmental pollution. This conventional manufacturing process also faces challenges such as poor reaction selectivity, low product quality, color intensity, and the generation of by-products, making it an unsustainable and ecologically unfriendly option.

#### Details of Technological Offerings:

- The autocatalytic and semi-continuous mode process.
- Use of reaction distillation to enhance productivity and purity.
- The resulting tributyl citrate exhibits purity levels greater than 95%
- The product obtained is colorless
- Optimized, validated, and scaled-up process to 5-liter, ready for larger production

#### The Solution

CSIR-NCL has developed a new auto-catalytic process for TBC synthesis. This auto-catalytic reaction produces a colorless solution with no impurities, making it superior to traditional homogeneous catalytic reactions. The absence of additional catalysts streamlines the process and significantly reduces the environmental impact.

## The Value Proposition

- **Reactive distillation-based Process:** It streamlines the process of synthesis and eliminates the need for complex post-processing steps.
- **Auto-catalytic & cost-effective:** It aids in reducing the reliance on external catalysts. This not only simplifies the production but also makes it more cost-effective.
- **Eco-friendly:** The only discharge in this process is water, making it environmentally sustainable. The auto-catalytic reaction produces a colorless solution with no impurities.
- **No separation step:** Unlike traditional methods, the auto-catalytic process eliminates the need for separation steps, further streamlining the production and reducing overall costs
- **High purity:** With purity levels ranging from 95% to 99.9%, the resulting tributyl citrate meets high-quality standards, making it suitable for various applications.
- **Scalable and cost-efficient process:** Relatively simple and low-cost production process with minimal waste and byproducts production.

## Applications:

- **Non-toxic plasticizer:** TBC is widely used in toys, medical products, printing ink, coatings, pharmaceuticals, cosmetics, flavors, fragrances and food packaging materials
- **Granulation of non-toxic PVC:** TBC serves as a vital component in the production of non-toxic PVC
- **Biocompatible Substitutes:** TBC can be employed as a biocompatible substitute for phthalic acid esters.

## Market Potential:

The global plasticizers market is estimated to have generated revenue of USD 17.1 billion in 2023, and it is expected to grow at a CAGR of 5.6% during the forecasted period, to reach USD 24.7 billion by 2030. Moreover, the global demand for Tributyl citrate Market is presumed to reach a market size of nearly USD 991.86 Mn by 2028 with a CAGR of 6.7% under the study period 2022 - 2028.

## Current Status and Future Prospective

CSIR-NCL has successfully demonstrated and optimized the process at a mini-pilot scale (5L), showcasing its feasibility for large-scale production. The consistency of the product and its purity have been validated. The technology has been protected with national and international patents. The technology is now available for licensing and co-development opportunities.

In summary, the autocatalytic synthesis of Tri-butyl citrate marks a significant step towards sustainable and efficient plasticizer production. By addressing the challenges associated with traditional catalytic processes, this new process developed by CSIR NCL not only offers a green alternative but also provides a cost-effective solution with wide-ranging applications. As industries increasingly prioritize sustainability, the autocatalytic process stands as a beacon of change in the realm of ester synthesis.

## MOUs/ MOAs SIGNED (July to Sept 2025)

Sr. No.	Client Name	Title of MoU/ MoA	Project Leader
1	Dyes and Pigments Manufacturers Association of India (DPMAI)	Undertaking various programmes and project by developing co-operation & collaboration between CSIR-NCL & DPMAI	Dr Amol Kulkarni
2	Department of Biotechnology (DBT)	Gene Regulation from Sequence to Function BIC at CSIR-NCL	Dr Chetan Gadgil
3	Department of Biotechnology (DBT)	National Network Project for CSIR-NCL	Dr Chetan Gadgil
4	Premier Green Innovations Private Limited	Renewables Chemicals, Waste to value added Chemicals and Green H2 @ scale 1kg /hr at MRPL site	Dr Raja
5	Maharashtra Energy Development Agency (MEDA)	Establishment & Operations of a COE of a Green H2 Sector within Maharashtra State under the Maharashtra Green H2 Policy-2023	Dr Magesh Nandagopal

## TECHNOLOGIES AVAILABLE FOR LICENSING

Sr. No.	Technology	Sector
1	Continuous catalytic process for the production of 4,4' Bisphenol-A (BPA)	Chemical
2	Novel, Eco-friendly & Autocatalytic process for the synthesis of Tributyl citrate (TBC)	Chemical
3	A patented catalytic process for making Diphenylmethane (DPM)	Chemical
4	Novel process platform for the manufacturing and purification of biosimilar rHu Ranibizumab	Biopharma
5	Novel process platform for the manufacturing and purification of Anakinra	Biopharma
6	Targeted glycosylation modulating process for recombinant proteins (Including monoclonal antibodies)	Biopharma
7	High-yield production of high-value Bacterial Nano Cellulose (BNC) films from low-cost crude glycerol feed	Health
8	Efficient manufacturing process For Na-LSX (13 X) & Li-LSX Zeolite	Specialty materials
9	Continuous process for manufacturing precision Silver Nanowires at scale	Specialty materials
10	Continuous & tunable process for the large-scale synthesis of Mesoporous & Nanoporous Silica	Specialty materials
11	Simple, eco-friendly catalytic delignification process for sugarcane bagasse (SB)	Biomass valorisation
12	Dietary Supplement Formulation of Probiotic Strain for Organic Poultry Production	Agriculture/ poultry
13	Efficient catalytic process & novel reactor design for hydrogen sulfide (H <sub>2</sub> S) removal from different gas streams	Gas separation
14	Process for the novel thermostable Biosurfactant production	Environmental
15	Efficient recovery process for metals from Spent Li-ion batteries (LIBs)	Environmental
16	Novel Process for the Production of IMEGLIMIN	Biopharma
17	Novel process for manufacturing p-Aminophenol (PAP) from p-Chloronitrobenzene (PCNB)	Chemical

### Contact:

#### Dr Mangesh Vetal

Head, Technology Management Group

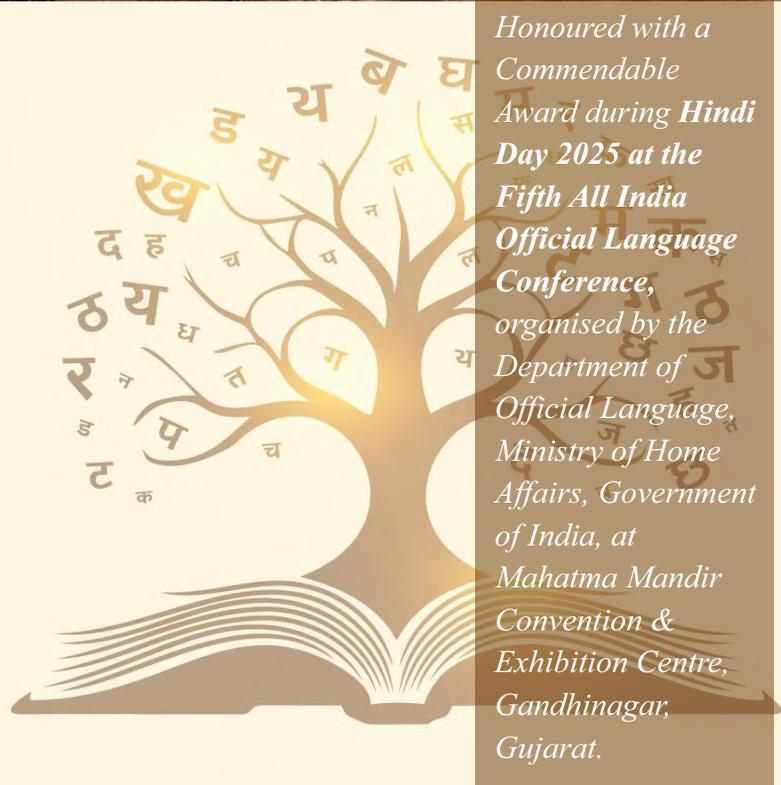
[md.vetal.ncl@csir.res.in](mailto:md.vetal.ncl@csir.res.in) (020-2590-2125)

HINDI DAY-2025



हिंदी दिवस-2025 एवं पांचवां अखिल भारतीय राजभाषा सम्मेलन  
 હિન્દી દિવસ-2025 અને પાંચમું અખિલ ભારતીય રાજભાષા સંમેલન

महात्मा मंदिर कन्वेंशन एवं एग्जिबिशन सेंटर, गांधीनगर, गुजरात  
 મહાત્મા મંદિર કન્વેન્શન અને એક્ઝિબિશન સેન્ટર, ગાંધીનગર, ગુજરાત  
 14-15 સિતंबर/ સપ્ટેમ્બર, 2025



Honoured with a  
 Commendable  
 Award during **Hindi  
 Day 2025** at the  
**Fifth All India  
 Official Language  
 Conference,**  
 organised by the  
 Department of  
 Official Language,  
 Ministry of Home  
 Affairs, Government  
 of India, at  
 Mahatma Mandir  
 Convention &  
 Exhibition Centre,  
 Gandhinagar,  
 Gujarat.

हिंदी दिवस

## Faculty Recognitions

### Name of Faculty

*Dr Syed G. Dastager* was awarded the prestigious Dr. P. K. Seth Memorial Award for Ecology and Environment.

*Dr Durba Sengupta* was selected for the Charusita Chakraborty Memorial Award 2026.

*Dr Santhosh Babu Sukumaran* was selected for the prestigious CRSI Bronze Medal.

### Student Achievements

*Ms Gayatri Shivaji Thokal* received the best poster prize for poster presentation at the 9th Asian and Oceanian Spectroscopy Conference, held from 21–25 September 2025 at Goa.

*Mr Anirudh Murali* was awarded a travel grant for participation in the 39th Annual Meeting of the Japanese Society for Biological Sciences in Space (JSBSS39), held at Teikyo University, Tokyo, Japan, from September 12 to 14, 2025. He received the best poster award and the best presenter award for his work.

*Ms Purnima Rawat* received the best poster prize for poster presentation at the International Conference on Advances in Chemical Sciences for Sustainable Energy and Environment (ICACSEE 2025), held on 21–22 July 2025 at MIT-WPU, Pune.

*Mr Amogh Auti* received best poster prize for poster presentation at the International Conference on NIPAH & Other Zoonotic Spillovers: Integrating Health Strategies for Prevention, held on 11th July 2025 at Trivandrum, Kerala.



NCL Technology and Entrepreneurship Cell (NCL TEC) organised an informative and engaging Financial Literacy Session on 23 August 2025 at CSIR-National Chemical Laboratory. The event aimed to help students, researchers and staff develop a stronger understanding of personal finance, a skillset increasingly essential in today's fast-changing economic environment.

The session featured Mr. Prasad Lendwe, Founder of *FinnovationZ*, who is widely recognised for simplifying financial concepts for young professionals. In his talk, Mr. Lendwe covered a broad range of practical topics - from effective day-to-day money management to strategies for long-term financial planning. His approachable communication style and real-life examples made the session highly relatable and easy to grasp, even for participants new to financial concepts.

*Ajinkya Krushnatray*

(President NCL-TEC)

a.krushnatray.ncl@csir.res.in

A highlight of the event was the lively Q&A segment, during which attendees sought guidance on financial issues that directly impact their academic and professional lives. Questions addressed topics such as ITR filing procedures for research scholars, choosing suitable insurance plans, managing loans and debt, identifying safe investment options for beginners and planning financial stability during career transitions. Mr. Lendwe provided clear and actionable advice for each query, helping participants build confidence in handling their personal finances.

The session concluded with positive feedback from the audience, who appreciated the clarity, practicality and relevance of the insights shared. Overall, the Financial Literacy Talk at CSIR-NCL proved to be a valuable learning experience, empowering the scientific community with the knowledge and motivation to make informed financial decisions in the future.

To mark the occasion of Teachers' Day, *SciLogy - the AcSIR Science Club* at CSIR-NCL, hosted an engaging and insightful panel discussion titled "*PhD Life and Beyond*" on September 4, 2025. Designed to illuminate both the challenges and opportunities inherent in a research career, the event brought together a diverse panel of five distinguished scientists: Dr Santhosh Babu Sukumaran, Dr Shatabdi Porel Mukherjee, Dr Kavita Joshi, Dr Rakesh S. Joshi and Dr Puneet Kumar Chaudhary. Representing multiple divisions, including OCD, PMC, AcSIR and CEPD, the panel offered a broad and interdisciplinary perspective that enriched the discussion.

The conversation spanned a thoughtful range of topics, including personal motivations, research challenges, academic collaboration, institutional expectations and career trajectories beyond the PhD. Each panelist brought their own unique journey into focus, fostering a space where students could connect deeply with the realities of scientific research.

**A few core messages resonated strongly throughout the discussion:**

***Nurture Your Curiosity:*** The panellists emphasised that an enduring sense of curiosity is what fuels perseverance during the inevitable highs and lows of doctoral research.

***Build Strong Mentoring Relationships:*** Healthy communication and mutual respect between advisors and students were highlighted as essential ingredients for a productive and fulfilling research environment.

***Research Quality Matters Most:*** While institutional reputation can open doors, the panellists unanimously stressed that a student's scientific depth, novelty and rigour ultimately determine long-term success.

***Collaboration and Community:*** Engaging with lab mates and peers not only enriches the research experience but also strengthens personal resilience and professional networks.

Students responded with keen interest, often connecting the panellists' experiences to their own concerns and aspirations. The event fostered a sense of community and reassurance - reminding young researchers that while the PhD journey is demanding, it is also deeply rewarding.

## NCL SCIOLOGY PANEL DISCUSSION: PHD LIFE AND BEYOND

The panel discussion received overwhelmingly positive feedback from both students and scientists. Many attendees expressed appreciation for the candid and practical advice shared. In light of this success, SciLogy plans to organise similar interactive sessions in the future, continuing its commitment to supporting the academic and professional growth of the CSIR-NCL community.

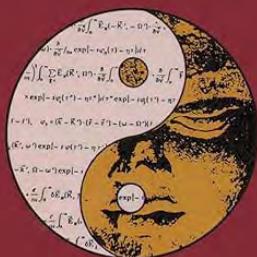
**Amrutha P. R**

(SciLogy - the AcSIR Science Club)  
pr.amrutha.ncl@csir.res.in

35TH ANNIVERSARY EDITION  
WITH A NEW PREFACE BY THE AUTHOR

# THE TAO OF PHYSICS

An Exploration of the Parallels between  
Modern Physics and Eastern Mysticism



FRITJOF  
CAPRA

*NCL Book Club is a forum to bring together all reading enthusiasts to review and discuss books/plays/biographies. On behalf of the NCL Book Club, NCL KRC/Library conducts Book Review talks.*

*Dr Kumar Vanka, Senior Principal Scientist, Physical and Materials Chemistry Division, CSIR-NCL, reviewed the book "The Tao of Physics: An Exploration of the Parallels between Modern Physics and Eastern Mysticism" By Fritjof Capra.*

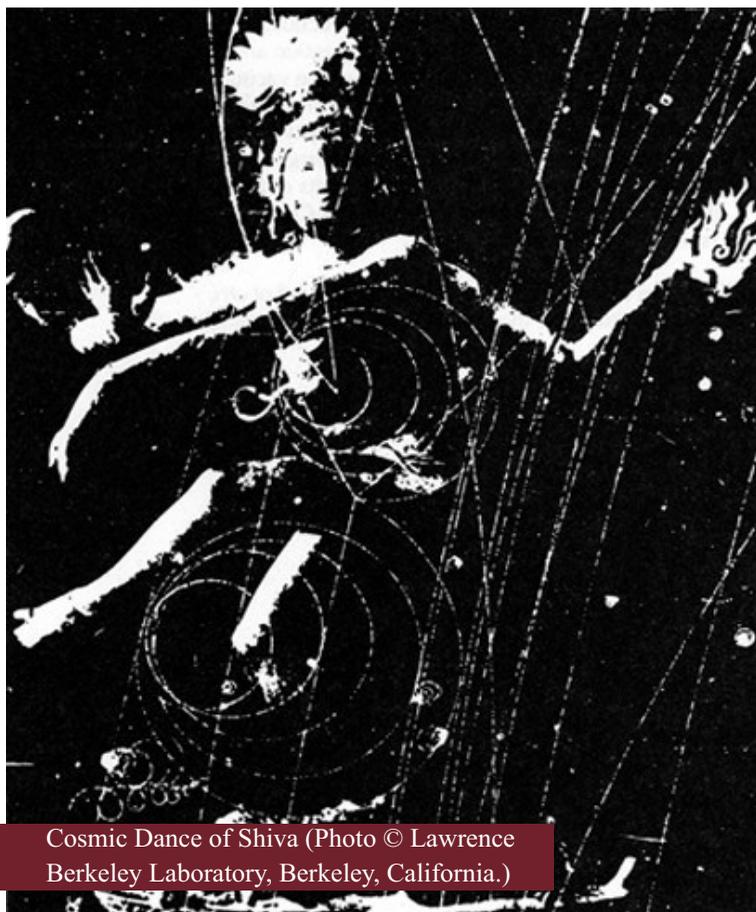
between mind and matter, observer and observed, and a reductionist approach that sought to understand the whole by analysing its parts. However, Capra then details how two monumental scientific revolutions shattered this paradigm.

The first revolution was Einstein's theory of relativity. Capra explains that relativity dismantled the Newtonian concepts of absolute space and absolute time. Instead, it presented space and time as a single, dynamic four-dimensional continuum, and matter as a form of energy. The universe was no longer a static stage upon which events unfolded, but a constantly changing, interconnected entity. This new perspective, Capra argues, aligns perfectly with the Eastern mystical view of reality as a continuous and ever-changing flow. Rather than seeing objects as static entities, Eastern thought, particularly Taoism, sees the world as an endless process of becoming.

The second, and perhaps more profound, revolution came from quantum mechanics. Capra delves into the bizarre and counter-intuitive world of subatomic particles, where the old rules of classical physics no longer apply. He discusses the principle of wave-particle duality, where entities like electrons behave as both waves and particles, depending on how they are observed. He also explains Heisenberg's Uncertainty Principle, which states that it is impossible to simultaneously know a particle's exact position and momentum. These concepts, Capra shows, directly challenge the idea of a separate, objective reality.

Fritjof Capra's influential 1975 book, *The Tao of Physics*, is a seminal work that draws parallels between the fundamental concepts of modern physics and the core philosophies of Eastern mysticism. Capra, a theoretical physicist, argues that the worldview emerging from the revolutionary discoveries of the twentieth century, particularly in quantum mechanics and relativity theory, bears striking similarities to the ancient wisdom found in traditions such as Hinduism, Buddhism, Taoism, and Zen. His central thesis is that the journey of the modern scientist and the path of the ancient mystic, while distinct in their methodologies, ultimately lead to a unified, holistic understanding of the universe.

The book begins by establishing the intellectual and philosophical backdrop of Western science, rooted in the mechanistic worldview of Newtonian physics. This classical framework describes the universe as a vast, predictable machine, composed of separate, discrete objects moving through absolute space and time. This model, Capra explains, was so successful that it became the foundation for Western thought, creating a rigid separation



Cosmic Dance of Shiva (Photo © Lawrence Berkeley Laboratory, Berkeley, California.)

In the quantum realm, the observer is not a detached spectator but an integral part of the observed system. This interconnectedness, where the very act of measurement influences the reality being measured, is the scientific counterpart to the Eastern mystical belief that the universe is a web of relationships, where all things are interdependent and indivisible.

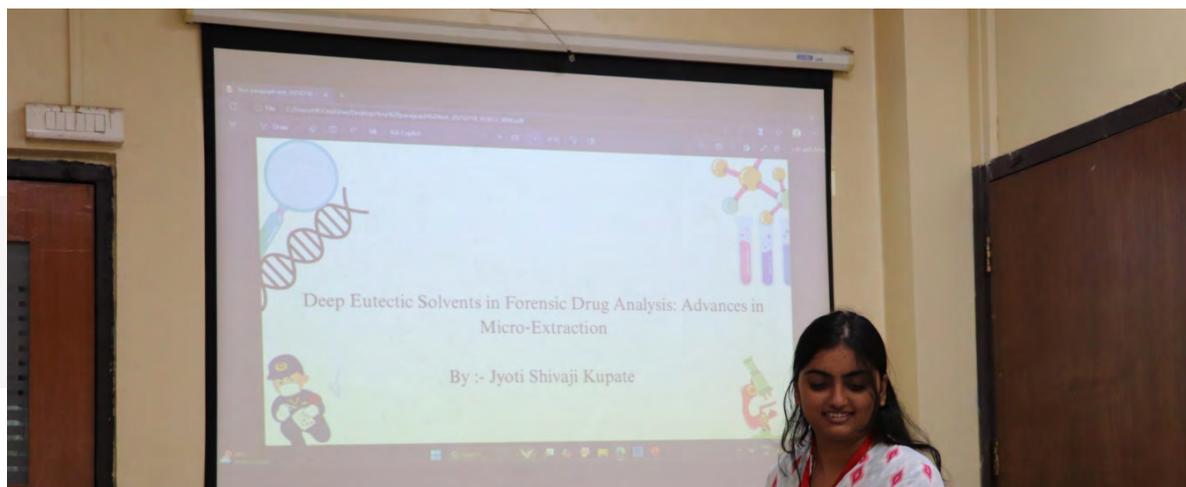
Capra dedicates significant sections to exploring the specific mystical traditions. He highlights Hinduism's concept of *Brahman* as the ultimate, all-encompassing reality, from which all things emerge and into which they return, and the illusion of separation known as *Maya*. He connects this to the quantum field theory, which posits that the universe is not a collection of separate particles but a single, underlying quantum field, with particles being merely transient, local manifestations of that field. He then explores the Buddhist concept of *shunyata*, or "emptiness," which is not a state of non-existence, but a dynamic void filled with potential and a web of infinite interrelations. This, he argues, is a perfect philosophical analogue for the quantum vacuum, a space teeming with virtual particles and energy fluctuations.

Capra also finds deep resonance in Taoism, which describes the universe as a constant interplay of two opposing yet complementary forces, *Yin* and *Yang*. He relates this dualistic dynamic to the constant creation and annihilation of particle pairs in quantum physics, a continuous dance of opposites that maintains the dynamic balance of the universe. The book's most famous metaphor, the "cosmic dance of Shiva," beautifully illustrates this point. In Hinduism, Shiva is the god of creation and destruction. Capra likens the endless interactions and transformations of subatomic particles—their creation from energy and their annihilation back into it—to this cosmic dance, a continuous, rhythmic process that is the very essence of matter.

Ultimately, Capra's central message is one of synthesis. He proposes that both the physicist and the mystic, by transcending the limitations of ordinary sensory experience and logical thought, arrive at a shared, holistic vision. The physicist, through the abstract language of mathematics and rigorous experimentation, discovers that the universe is an intricate, indivisible web of relationships where matter and energy are inseparable, and where the parts are meaningless without the whole. The mystic, through meditation, intuition, and spiritual practice, experiences this same reality directly, as an all-encompassing oneness. *The Tao of Physics* is a powerful statement that science and spirituality, far from being opposing forces, are two different paths to the same profound truth, offering a new, integrated perspective that promises to bridge the long-standing gap between Western rationalism and Eastern intuition.

### ***Dr Kumar Vanka,***

Senior Principal Scientist,  
Physical and Materials Chemistry Division  
k.vanka.ncl@csir.res.in



### Drug Polymorphism and Pharmaceutical Multicomponent Solids (07 July - 18 July 2025)

The workshop provided a concise yet rigorous overview of solid-state science in pharmaceutical development. Participants examined key solid forms - polymorphs, salts, co-crystals, co-amorphous systems and eutectics; and their influence on stability, solubility and overall drug performance. Lectures covered crystal engineering principles, thermodynamics of solid forms and mechanisms of solid-state phase transformations.

Practical sessions introduced methods for preparing and screening polymorphs, salts and co-crystals, while advanced characterisation techniques such as SCXRD, PXRD, DSC/TGA and IR were demonstrated for structural and analytical evaluation. The programme also addressed regulatory considerations, including documentation, stability requirements and intellectual property issues.

Overall, the workshop provided a concise, academically focused introduction to solid-form design and analysis, enabling participants to apply these concepts to modern pharmaceutical research.

*Recognising the need for a skilled and high-quality workforce relevant to current and emergent industries, CSIR-NCL has implemented a Skill Development Programme under CSIR's Integrated Skill Development Initiative programmes. These specifically designed and expert-led courses have been offered to upskill unemployed graduate and postgraduate students, industry staff and workers, scientists, inventors, etc.*

*During this quarter, 4 courses were conducted which were attended by 33 participants.*

## CAPACITY BUILDING



### Polymer Characterisation with GPC Techniques (21 July - 25 Jul 2025)

The course provided a focused introduction to gel permeation chromatography (GPC) for polymer analysis. Participants reviewed the history and principles of GPC, along with detailed explanations of key system components such as pumps, columns and detectors.

Training covered sample preparation and method development, followed by a live demonstration of a complete GPC run to illustrate system operation and data acquisition. Sessions on data interpretation highlighted molecular weight determination and common analytical challenges. Core topics in data analysis and routine troubleshooting were also addressed. Overall, the workshop provided a compact and practical overview of GPC techniques for effective polymer characterisation.



### Chromatographic Techniques (01 September - 12 September 2025)

This course provided comprehensive training in the principles and applications of chromatography, a core analytical method widely used in research and industry. Participants reviewed the fundamental concepts of separation science and explored how chromatographic methods enable the qualitative and quantitative analysis of complex mixtures.

The course covered a broad range of chromatographic techniques, emphasising their roles in the separation, identification, and purification of chemical components. Through lectures, demonstrations and guided exercises, attendees gained practical insight into method selection, instrument operation, and data interpretation.

Overall, the workshop provided a solid foundation in modern chromatographic practices, enabling participants to apply these essential techniques to both analytical and preparative workflows.



Synthetic Organic Chemistry (15<sup>th</sup> May - 30<sup>th</sup> Aug, 2025)

This training programme provided extended hands-on experience in modern organic synthesis. After completing an initial two-week prerequisite module covering laboratory safety, safe chemical handling, literature searching, analytical data processing, and proper record-keeping, students joined established research groups for guided laboratory work.

Throughout the course, participants engaged in a variety of organic transformations and multistep synthetic sequences. Under direct supervision, they planned experiments, set up reactions, monitored reaction progress and carried out product isolation and purification. Emphasis was placed on technique development, careful observation and adherence to safety protocols.

Students also analysed the products formed using appropriate analytical tools and compiled detailed experimental records for future reference. Overall, the programme offered a rigorous and practical foundation in synthetic organic chemistry, strengthening students' technical skills and research discipline.



# CAPACITY BUILDING



## ONE DAY AS A SCIENTIST



*The CSIR-National Chemical Laboratory (CSIR-NCL), Pune, successfully organised its week-long "One Day As A Scientist" (ODAS) from 21<sup>st</sup> to 25<sup>th</sup> July 2025. As part of CSIR's flagship Jigyasa initiative, the programme welcomed over 400 students from grades 8 to 10 from Pune, Mumbai and other districts of Maharashtra, providing them with a unique opportunity to experience the life of a scientist and gain hands-on exposure to advanced scientific research.*

The programme opened with an inspiring address by Dr. Ashish Lele, Director of CSIR-NCL, who highlighted the laboratory's pioneering work in plastics, sustainable chemistry and climate-focused innovations. Dr. Lele emphasised the importance of translating scientific discoveries into practical technologies with societal and economic impact, encouraging students to pursue careers in science and innovation for the advancement of a *Viksit Bharat*.

ODAS was structured around a series of thematic sessions, live demonstrations and interactive lectures led by CSIR-NCL's eminent scientists. Topics ranged across multiple disciplines including waste plastic depolymerisation, biotechnology, super-absorbent polymers, rheology, entomology, green technology, crystal science and AI for chemical industries. Participants also learned about idea commercialisation and

plastic recycling from experts, highlighting the laboratory's commitment to research that benefits both society and industry.

Dr. Wafia Masih, Scientist and Head of the Science Outreach Resource Center, facilitated the programme and delivered motivational sessions such as *Lab to Life: Science, Unleash Your Inner Scientist* and *Outreach, Opportunities & Innovation with Jigyasa*. Her sessions emphasised the responsibilities and values of being a scientist while inspiring students to actively engage with national and societal challenges.

The week-long programme provided extensive hands-on experiences in CSIR-NCL's state-of-the-art facilities. Students toured the pyrolysis plant, National Collection of Industrial Microorganisms (NCIM), genome sequencing labs and ellipsometry facilities, gaining first-hand knowledge of cutting-edge scientific instrumentation. Guided experiments allowed students to perform chromatography, extract DNA, explore plant tissue culture and construct small electromagnet cranes. Donning lab coats and safety gear, participants embraced the role of a scientist, proudly referring to themselves as *'Jigyasa Scientists.'*



A notable highlight was the demonstration of emerging digital technologies, including AI and VR tools, showcasing smart laboratories of the future and illustrating how technology can enhance chemical research and experimentation. Additionally, CSIR-NCL demonstrated its sustainable initiatives, such as plastic PPE recycling and eco-friendly disposal methods for Plaster of Paris idols, underscoring the institute's societal and environmental contributions.

The programme also featured a special virtual address by Dr. Jitendra Singh, Honourable Minister of Science & Technology, who encouraged the students to boldly pursue research, innovation and scientific discovery.

Across the five days, ODAS included 16 expert-led talks, 6 research facility tours, 5 hands-on laboratory sessions and 11 demonstrations, engaging all 443 participants in meaningful scientific exploration. Student feedback highlighted the programme's impact, with many expressing that it broadened their horizons, inspired their future ambitions and provided a deeper appreciation of science and technology.

## ONE DAY AS A TEACHER

On 25<sup>th</sup> August 2025, PM SHRI KV Army Area, Pune School hosted the “One Day As A Teacher” programme, featuring distinguished scientists from CSIR delivering popular science talks to students of classes XI and XII. This programme, conducted under the framework of the Rashtriya Avishkar Abhiyan, marked a notable first, bringing frontline scientific insights directly into the school environment. A total of 60 students participated in this interactive session.



The invitation for the programme was extended by the School Principal to facilitate exposure of students to emerging scientific topics through interactions with active researchers. Dr. Syed Dastager, Senior Principal Scientist at CSIR, delivered a talk titled “*Chemistry of Unknown Microorganism - The Treasure to Hunt*”. Dr. Dastager highlighted the rich diversity of soil microflora and their untapped chemical potential. He elaborated on recent advances in molecular biology and genomics that now allow scientists to study the collective genomes of previously uncultured soil microorganisms. Emphasising the importance of interdisciplinary collaboration, Dr. Dastager encouraged joint efforts between chemists and biologists, supported by innovative funding mechanisms and cross-disciplinary training, to unlock novel natural products and therapeutic compounds from soil microbes.



Dr. Rakesh Joshi, Senior Scientist at CSIR, presented a lecture on “*The Climate - Crop - Criter Connection*”, addressing the intricate interactions among climate change, crop growth and insect activity. Dr. Joshi explained how rising temperatures and shifting rainfall patterns are affecting crop cycles and expanding the range and population of pest insects, posing significant challenges to food security. He highlighted the importance of targeted, environmentally-friendly pest management strategies and highlighted the need for a comprehensive understanding of climate-driven dynamics to ensure sustainable agricultural productivity and ecological balance.

Both sessions were highly engaging, with students actively participating by asking insightful questions. Faculty and students alike expressed appreciation for the clarity, depth and practical relevance of the talks, noting that the programme provided valuable exposure to cutting-edge research and its applications in real-world challenges.

ONE DAY AS TEACHER

## VISIT OF STUDENTS AND TEACHERS FROM VISHWASHANTI GURUKUL WORLD SCHOOL TO CSIR-NCL



*On 22nd August 2025, 54 students from classes X and XI of Vishwashanti Gurukul World School, accompanied by three teachers, visited CSIR-National Chemical Laboratory (CSIR-NCL), Pune. The visit aimed to introduce students to advanced research facilities and provide first-hand exposure to scientific research, fostering curiosity and interest in science.*

The visit was organised jointly by Mr. Siddharth Bhosale and the Science Outreach Resource Center, who welcomed the students and guided them to the Central Analytical Facility (CAF). Students were divided into groups to explore the laboratory's cutting-edge instrumentation, including Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), X-ray Photoelectron Spectroscopy (XPS) and Liquid Chromatography-High Resolution Mass Spectrometry (LC-HRMS).

Under the guidance of CAF staff - Mr. R. S. Gholap, Mr. Rithik Balde, Ms. Shreya Patil, Mr. Nitin B. Dabke and Dr. Nilakshi Sadvarte, students learnt how SEM reveals high-resolution surface morphology, while TEM uncovers internal nanometer-scale structural details relevant to materials science, nanotechnology and biology. XPS was shown to enable surface chemical analysis, revealing elemental composition and oxidation states; LC-HRMS (Orbitrap) was demonstrated for detecting and quantifying metabolites and complex mixtures such as plant pigments and environmental samples. An engaging optics demonstration by Ms. Unnati Ashar illustrated refractive index through a disappearing glass rod experiment, underscoring how physics underlies everyday observations. Further, Dr. Wafia Masih explained how disciplines such as chemistry, biology, physics and mathematics converge in scientific research and introduced students to the broader network of 38 specialised laboratories under the Council of Scientific & Industrial Research (CSIR).

Students actively participated, asked questions and expressed enthusiasm for the hands-on exposure to real scientific instruments. Faculty and students praised the clarity of explanations and the opportunity to experience a research culture firsthand. The visit successfully inspired curiosity, deepened understanding of scientific principles and highlighted the practical applications of science in research and innovation.





# EMPOWERING RESEARCH & INNOVATION THROUGH ADVANCED ANALYTICAL SOLUTIONS

**Central Analytical Facility (CAF) at CSIR-National Chemical Laboratory – Your Single-Window Gateway to State-of-the-Art Instrumentation & Expertise.**

In the rapidly evolving landscape of science and technology, access to sophisticated analytical instrumentation is crucial for breakthrough research and product development. The Central Analytical Facility (CAF) at CSIR-NCL, Pune, is established as a premier 'Single-Window System' to meet this need. We provide seamless access to a comprehensive array of high-end analytical equipment, backed by expert technical support, to foster innovation across academia, industry, and start-ups.

## WHY CHOOSE CAF @ CSIR-NCL?



**SINGLE-WINDOW ACCESS**



**WORLD-CLASS INFRASTRUCTURE**



**EXPERT GUIDANCE & SUPPORT**



**FOSTERING COLLABORATION**

### ACADEMIA & RESEARCH INSTITUTES

- Faculty & Researchers
- PhD & Post-doctoral Scholars
- Students from Universities & Colleges

### INDUSTRY, START-UPS & REGULATORY BODIES

- Large & MSME Industries
- Deep-tech & Biotech Start-ups
- Incubators & Accelerators
- Government & Private Regulatory Agencies

**Key Value:** Access advanced capabilities without heavy capital investment. Special discounted rates are available for Start-ups, Incubators, and Government R&D institutions.

**Turn Over to Explore Our Facilities & Services**

## COMPREHENSIVE ANALYTICAL PORTFOLIO



### SPECTROSCOPY

**NMR:** Solution & Solid State (300, 400, 500 MHz)  
**Mass Spectrometry:** LC-MS/MS-TOF, MALDI-TOF-MS, High-Resolution MS systems  
**Optical:** UV-Vis, FT-IR, Raman, Fluorescence Spectrometers  
**Surface:** X-ray Photoelectron Spectroscopy (XPS)



### MICROSCOPY & IMAGING

**Electron Microscopy:** Transmission (TEM), Scanning (SEM) - including cryo & high-resolution capabilities  
**Advanced Imaging:** Confocal Laser Scanning Microscopy, Optical Microscopy



### X-RAY TECHNIQUES

**Diffraction:** Single Crystal XRD, Powder XRD (including high-temp & 2D scan)  
**Scattering & Imaging:** Small-Angle X-ray Scattering (SAXS), 3D X-ray Micro-computed Tomography (micro-CT), X-ray Fluorescence (XRF)



### CHROMATOGRAPHY & SEPARATION

HPLC, UPLC, Preparative HPLC (Chiral/Achiral)  
**Gas Chromatography (GC), GC-MS**  
**Gel Permeation Chromatography (GPC)** - High temp, organic, aqueous



### THERMAL & ELEMENTAL ANALYSIS

**Thermal:** TGA, DTA, DSC, STA (Simultaneous Thermal Analysis)  
**Elemental:** ICP-OES, Atomic Absorption Spectroscopy (AAS), CHNS/O Analyzer

## BEYOND ANALYSIS: ADDITIONAL SERVICES

- **Consultation & Advisory:** Expert advice on analytical method development and problem-solving.
- **Training & Skill Development:** Short-term courses and workshops on instrument operation and application for students and staff.
- **Industry Projects & Collaboration:** Partner with CSIR-NCL scientists for R&D projects requiring advanced analytical support.

## HOW TO ACCESS THE FACILITY



### REGISTER:

External users complete necessary paperwork to obtain login credentials. Internal users use the online portal.



### BOOK/SUBMIT:

Book instrument slots or submit sample requisitions online/in-person.



### ANALYSIS:

Samples are analyzed by trained staff or qualified users.



### GET RESULTS:

Collect high-quality data and reports.

**Ease of Doing Business** - Our streamlined 'Single-Window' approach ensures a hassle-free experience.

## CONTACT US

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**Phone:** +91-20-2590 2641

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