# 2024

Third Edition

# ABSORB.

**"Reshaping Chemical Engineering: Towards a Climate Resilient World"**

## A Chemical Engineering Department Initiative


**Chemical Engineering Association**
**National Institute of Technology Andhra Pradesh**


**Reach out to us at chea@nitandhra.ac.in**

# Content

## Features

# Director's Message.

## From the desk of our Beloved Director

**Prof. B S Murty**
**Director (In-Charge)**

It is with great pleasure that I extend my congratulations on the launch of the third edition of "ABSORB." by the Department of Chemical Engineering.

The department's focus extends beyond mere enrollment numbers, fostering a culture that cultivates well-rounded engineers. The dedication of both faculty and students is commendable, evident not only in academic pursuits but also in co-curricular activities. Faculty support plays a crucial role in encouraging students to undertake challenging projects and showcase their talents on a broader platform.

This magazine, a testament to the outstanding efforts of the student team, delves into captivating themes within the field of chemical engineering, demonstrating its direct relevance to our community. As we navigate a global energy crisis, it's imperative to recognize the pivotal role chemical engineering plays in shaping a sustainable future. Advancements in fuels, fertilizers, and other allied fields hinge on the innovative spirit fostered within this department.

The department's commitment to student success is evident in the insightful talks organized by renowned academics and industry experts.

These initiatives undoubtedly serve to motivate students and refine their professional aspirations.

My sincere congratulations extend to the Head of Department, faculty advisor, student coordinator, and all members of the Chemical Engineering Association. Your unwavering dedication not only paves the way for future generations of engineers but also upholds the esteemed reputation of NIT Andhra Pradesh.

I wish you all continued success in your endeavors. Happy Reading!!

# Registrar's Message.

## From the desk of our Beloved registrar

**Dr. P. DINESH SANKAR REDDY**
**Registrar & Associate Professor**

Hello Readers,

Greetings!
it gives me immense pleasure to announce the third edition of the Chemical Engineering Student's Magazine, "ABSORB.". The students who have been involved in the development of the magazine have worked passionately over the course of the past few months to gather resources, creating and exploring new ideas, capture the reader's attention, and bring a new perspective into the field of chemical engineering. I wish the magazine stands up to its name and gives its readers an ocean of knowledge to absorb.
Chemical Engineering is a branch of engineering that emerged upon the development of unit operations, that uses the principles of physics, chemistry, and mathematics, to create and sustain chemical reactions and produce essentials we use in our day-to-day life at an industrial scale.
The study of chemical engineering first emerged as a direct consequence of the industrial revolution. Chemical engineering since then has been one of the prominent streams of engineering.

The Department of Chemical Engineering, National Institute of Technology, Andhra Pradesh was established on 20th August 2015 at our temporary campus in Tadepalligudem. With an intake of 30 students every year, the department has been one of the pivotal parts of the institute through the years.
I wish all the students and readers, a great future ahead and that they use their skills to work for the development of our nation.

# Department Head's Message.

## From the desk of our beloved HOD

**Dr. VINOTH KUMAR RAJA**
**Assistant Professor & HOD**

Dear Readers,

Greetings!
First and foremost, I would like to congratulate my dear students for their great initiation to publish the third edition of the Department's Magazine named, ABSORB. I believe that this magazine ABSORB. will motivate the students and teachers to share their creativity and new ideas with the world and facilitate their overall development, as well as enlighten and account for the various activities and achievements of the students and staff members, and events organized by the department.
The Department of Chemical Engineering was set up in the National Institute of Technology Andhra Pradesh at the time of the inception of the institute in 2015. With time the department has grown in every sphere. The students of the department are highly encouraged to get hands-on experience with the industry and acquainted with state-of-the-art technology.

Chemical engineering is a very diverse branch of engineering that embodies in itself a wide array of subjects. Right from the morning when you take a wave-like glob of your toothpaste to when you switch off the lights in the evening, chemical engineering is omnipresent. With this wide range of subjects to choose from, our student editors have diligently narrowed it down to a few.

Having said this, I leave the floor to my dear students. I am very proud to say that the students of the department have worked hard to assemble this Departmental Magazine. I am sure that all the readers of this magazine are impressed by their efforts. I wish the students luck for their future and pray for them to bring glory to themselves, to the institute, and to the country. Also, I invite the readers of ABSORB 3.0 for their contribution and suggestions to the forthcoming issues.

# From the Editorial Board.

Through the years of human history, we have evolved from small scale social groups hunting for survival in the Stone age, to highly innovative civilizations such as the Indus Valley, to the modern-day civilizations after the industrial revolution in the 18th century. This industrial revolution paved the ways for the need of studying and controlling industrial processes and unit operations in detail, leading to the inception of this new discipline of Engineering in the late 19$^{th}$ century, evolving into the modern-day Chemical Engineering in the 20$^{th}$ century. In the present era, chemical engineers influence large scale economies and production chains in various industries spanning from Pharmaceuticals and Petroleum to Agriculture and daily household products.

The Chemical Engineering Association of National Institute of Technology, Andhra Pradesh congratulates every Engineer, in being an integral part of our national growth and development and brings in front of you, the latest incorporation of the Departmental Magazine, ABSORB. 3.0, with the enthusiastic participation of the Association members and the mentorship of the Faculty Advisor, Department Head, and the Hon'ble Director of our Institute.

ABSORB. 3.0 aspires to provoke a temperament in the readers to imagine, envision and innovate, for a sustainable, modern, and beautiful planet, and constantly learn and orient themselves with the latest technological challenges and developments that the world is coming across. Besides the constant learning process, the current edition of magazine is also aimed at reminding the readers of the multitude of social challenges, certain aspirants may face and to promote in achieving an egalitarian workplace in STEM (Science, Technology, Engineering, and Mathematics).

We hope of making this reading a delightful and informative experience for the readers, while this being a memorable process for the whole ABSORB. team members in composing this edition of the Magazine.

Kudos! and Happy Reading!

# CLIMATE CHANGE
## A MOMENT OF INTROSPECTION

"Global Warming, Melting Ice Caps, Rising Sea Level, El-Nino, Wildfires, Ocean Plastic" and many more! All of us have been hearing and reading about these buzzwords for the past few decades, and most of us have started to ignore it, thinking that it is a cliché. But what indeed is the cost of this ignorance?

Beginning with the fundamental question: When and how did climate-change and its associated implications begin? One should be very careful while answering this question, as the earth's climate has been changing the patterns dating back to 4.5 billion years from now, when planet earth was a hot ball of fire and hostile to any form of life. It is because of the change in its climatic patterns since then, that earth could support life in the most fascinating way as we are seeing today. While this climate change was a constructive and natural phenomenon, it is completely a logical fallacy to argue that, what we are experiencing and discussing as climate change in current, is not because of any human intervention but a natural process. It is unequivocal that human activities, since the Industrial revolution have impacted the environment in an adverse and potentially irrevocable manner.

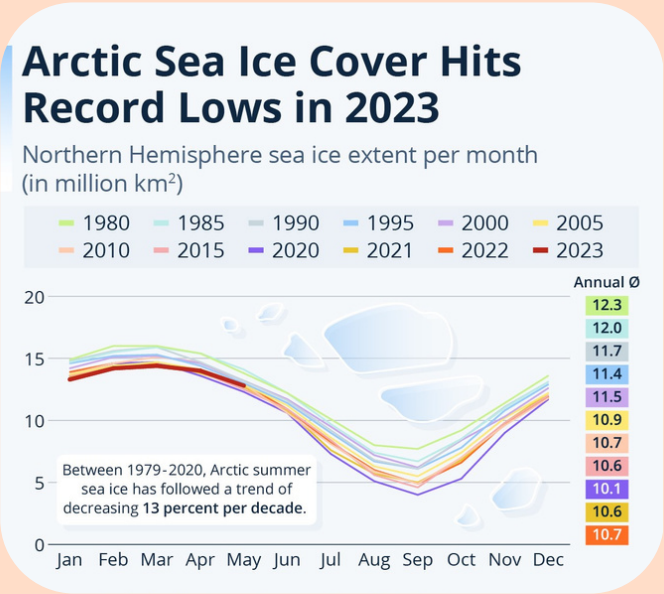
The onset of human-induced adverse climate change dates to the 18th century when Industrial Revolution and rapidly developing mechanization in the West, have made the scientists, innovators and business owners oversee the thought of what their approach to development would cost in the long run.


El-Nino current flow across the regions

To contemplate whether climate change is indeed a concerning situation or not, one must go through the evident phenomena around the world that have continuously intensifying impact on the local and global weather and climate. One such example in the Indian subcontinent is the El-Nino effect, which is a major culprit for irregular rainfalls and drought in some regions, while surplus rainfalls leading to floods in other regions. Although not due to climate change, but another example for the implication of human activity is the disaster of Joshimath in Uttarakhand, where torrents of water gushed down, leading to uncontrollable erosion and eventually land subsidence. A few other evident examples are, the high surface temperatures in Arizona, Forest fires in Canada and Australia, and of course, the melting polar ice caps. All these examples lead to an overwhelming question: Can this be reversed? Can we control climate change? Well, there could be two ways of answering this question.

One approach (The easiest one though) could be stopping all human activities involving exploitation of natural resources, causing greenhouse gas emissions, and tampering with the geology, and going back to living like a caveman. This would be the least appreciated and accepted answer to most people, as leaving behind all the technological innovation and development, just because climate change looks like an unsolvable problem, is not quite an exciting approach.

Uncontrolled forest fire

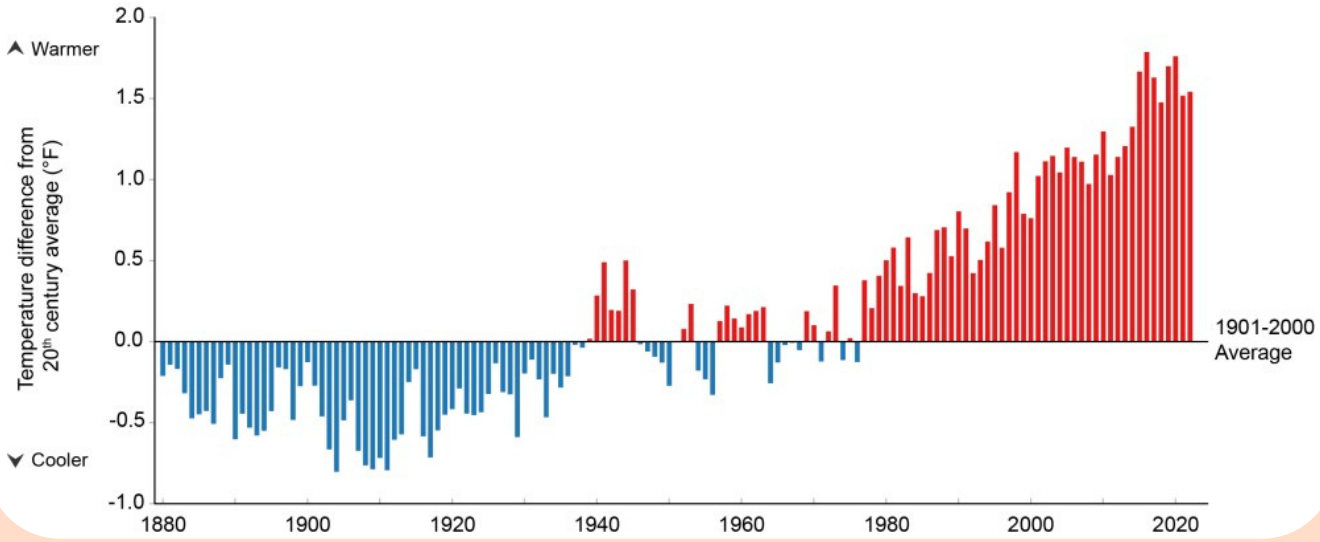



Arctic ice cover data

The Second Way: While all the current Research and Development around the world comes under this approach, i.e., trying to replace the old and less sustainable technology with newer, more efficient, and sustainable ones. However, this is not the complete answer! The next question that immediately arises is, can our R&D cope up with the pace of climate change? In other words, what if it is too late by the time, we have the solution to the problem? Well, this question brings the horror to climate change.

While there are innumerable questions, for which we need to find answers, we can always look back to how more sustainable technology is helping slow down the climate change. Cleaner Energy, Electrification, Carbon Capture and Sequestration, Advanced materials for construction are just a few of the examples to the new technologies contributing towards sustainability. However, one cannot ignore the fact that these technologies are just baby steps in front of the potential cataclysmic developments in the environment in future.

This article is a reminder for everyone overseeing climate change as a fancy topic of discussion, written with an intention to be a few minutes of thought-provoking inspiration to all the young innovators, engineers and entrepreneurs.




Annual global surface change for land and ocean

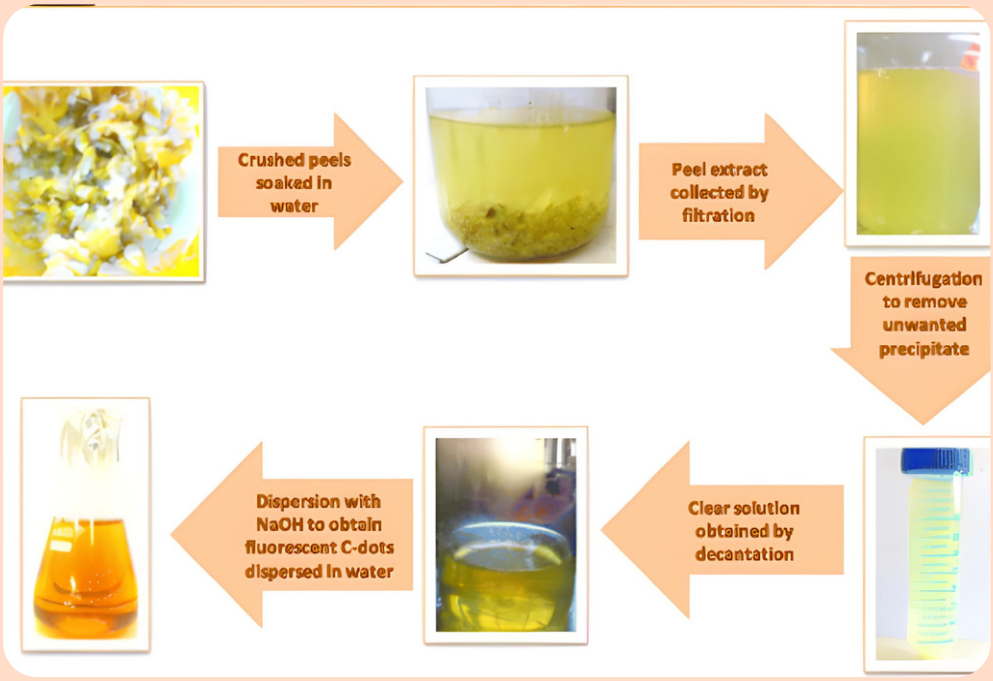
*Every action we take today shapes the world of tomorrow. Let's choose wisely and work towards a sustainable future for all.*

ABHIRAM KALLURI
2020-2024

# KITCHEN WASTE TO CARBON DOTS

The synthesis of carbon dots (CDs) from kitchen waste represents a significant advancement in waste management and nanotechnology. This article explores the innovative approach for converting kitchen waste into CDs, promising materials with various applications, including bioimaging, sensing, and drug delivery and discusses the synthesis process, the properties of CDs, and their potential applications, highlighting the importance of converting waste into value-added products.

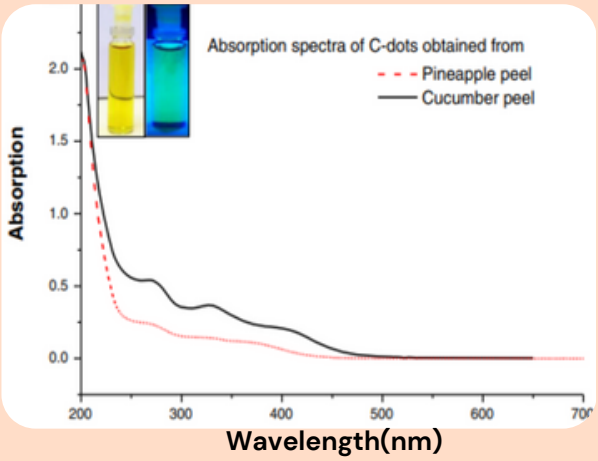
Managing kitchen waste is a growing concern due to its environmental impact and potential health hazards. Converting this waste into valuable products presents an attractive solution.. Synthesizing CDs from kitchen waste offers a sustainable approach to waste management.



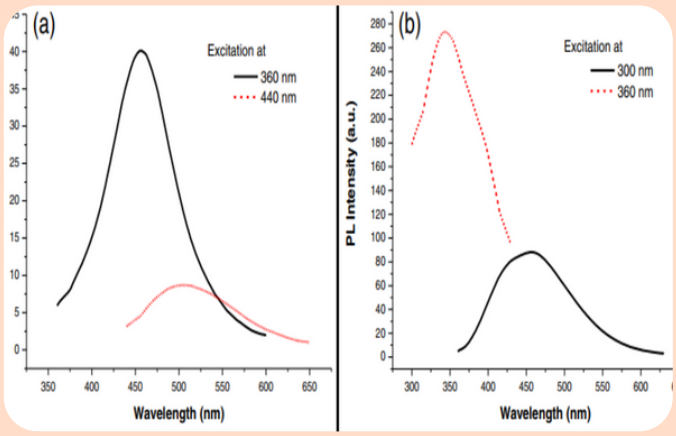

Step-wise procedure for green synthesis of C-dots from kitchen[1].

The synthesis of CDs from kitchen waste involves several steps. First, the waste is collected and processed to extract the organic components. These components are then subjected to a hydrothermal treatment, heating them in a sealed container at high temperatures and pressures. This process breaks down the organic matter and converts it into CDs. The resulting CDs are then purified and characterized to determine their properties.

CDs synthesized from kitchen waste exhibit unique optical properties, including fluorescence, which makes them useful for bioimaging and sensing applications. Additionally, due to their biocompatibility and ability to encapsulate drugs, CDs have been studied for their potential use in drug delivery systems.




UV-visible absorption spectrum of C-dots prepared from cucumber peel and pineapple peel [1].




Fluorescence intensity of C-dots derived from (a) Cucumber peel, (b) Pineapple red [1].

Synthesizing CDs from kitchen waste not only provides a sustainable solution to waste management but also opens up new opportunities for the development of value-added products.

# CONCLUSION

The synthesis of carbon dots from kitchen waste represents a significant advancement in waste management and nanotechnology. This innovative approach offers a sustainable solution to kitchen waste disposal while also providing a valuable resource for various applications. Further research is needed to explore the full potential of CDs synthesized from kitchen waste and develop new and innovative applications for these materials.

> *Don't let waste go to waste. Let's embrace innovation and creativity to repurpose it into useful materials for a more sustainable tomorrow.*

AMIT KUMAR
2020 - 2024

# NANOTECHNOLOGY
## IN CHEMICAL ENGINEERING

Design and development of materials and systems at the molecular and atomic levels are fundamental to chemical engineering and nanotechnology. As a result, they have a significant overlap and can work together in several ways. This article discusses the benefit of nanotechnology to chemical engineering.

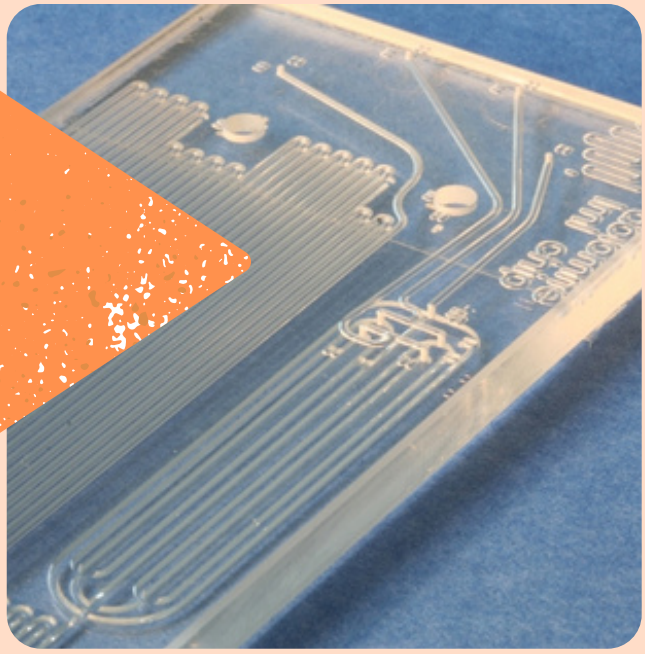
Nanomaterials have shown utility in chemical engineering due to their small size and great potential in designing efficient catalysts. However, their preparation remains challenging, a hurdle that chemical engineering can help alleviate.

Nano Particle

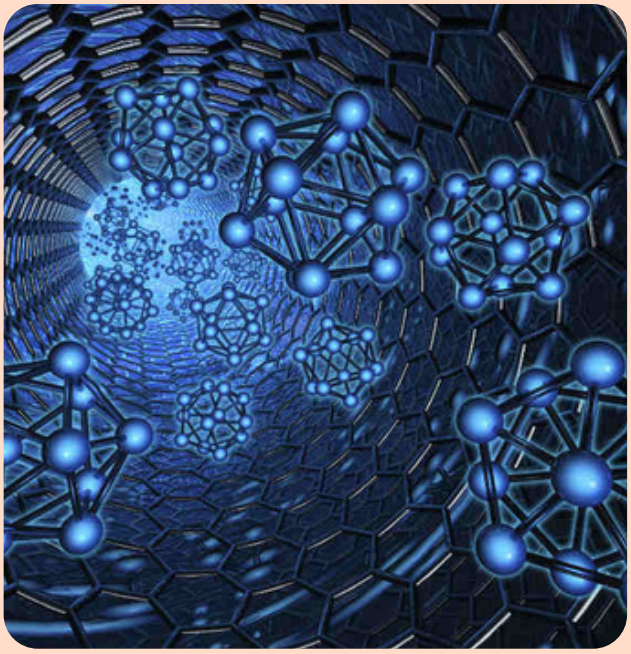
Chemical engineers integrate lab-developed processes into commercial manufacturing processes and then strive to maintain and enhance them. Chemical engineering has matured to the point that numerous commodity items based on well-established methods are available. It is common knowledge that a material's micro and nanostructure, in correlation with its chemical compositions, are crucial in defining its qualities.

Microfluidic Reactors have come into the picture, allowing miniaturization of single or multiple laboratory-based procedures and giving rise to lab-on-chip technology, which reduces the cost by minimizing sample volume and increasing analysis speed and nanotechnology helps to fabricate these reactors.

Nanotechnology can be employed to manipulate the structure of nanomaterials to enhance their properties. Polymers manufactured in the chemical industry have their structure altered using nanotechnology for various chemical applications and industrial activities. Nanotechnology is now being utilized in the chemical industry to develop rules to increase the catalytic performance of industrially manufactured goods.



Nano chip



Nano structure

Nanotechnology also helps to clean ceramic and other commercial materials. Ceramic surfaces contain chemicals and industrial wastes that must be removed and cleaned. Nanoparticles are employed to clean surfaces and defend them from environmental damage. Due to their long shelf life, these nanomaterials are effective for extended periods.

Recent research highlights the treatment of textile effluent using graphene-based nanomaterials. Textile discharge, if not properly treated, is harmful to both human health and the environment[1].

New research finding indicates improved $CO_2$ absorbance in liquid form using $Fe_3O_4$ and water nanofluid under the influence of an external magnetic field. This approach has garnered significant interest as a means to address environmental concerns[2].

# Future Outlook

Chemical engineering will continue to employ various processes to synthesize and enhance a wide range of materials. Nanotechnology and its ability to alter the structure of materials will play a crucial role in optimizing processes and reducing costs. Anticipated applications include wastewater treatment, air filtration, and advancements in energy storage devices.

KONDA HARSHITHA
2021 - 2025

# Microplastics

## An emerging threat to human health

Paper cup (source of microplastic)

Disposable paper cups have long been a staple for hot beverages, offering convenience and portability. However, recent studies have shed light on a concerning aspect of these seemingly innocuous containers: potentially releasing harmful substances, including microplastics, ions, and heavy metals, into the beverages. This investigation delves into the degradation of the plastic linings of paper cups when exposed to hot water, revealing significant implications for human health.

Paper cups are predominantly composed of paper, but their interiors are often lined with a hydrophobic film made of plastics like polyethylene. These plastic linings, comprising a small percentage of the cup's weight, prevent leakage and maintain beverage temperature. However, when subjected to hot liquids, these plastic layers can degrade, leading to the migration of chemicals into the beverage.

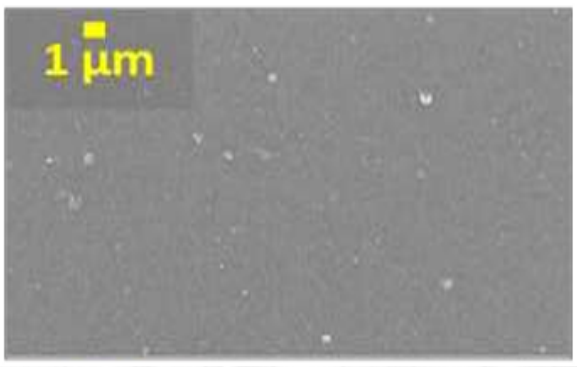
Past researches have demonstrated the transfer of various compounds from food packaging into food products, highlighting the need to assess the safety of commonly used disposable containers.

The topic of microplastics attracted researchers from all over the world. They started exploring how microplastics get created and ultimately accumulate in the human body and their potential associated health risks. The health implications of this exposure are just beginning to be understood, but early research suggests a range of possible risks. One concern is the physical damage that microplastics can cause as they accumulate in the body. In animal studies, these particles have been found to cause inflammation, oxidative stress, and cellular damage.

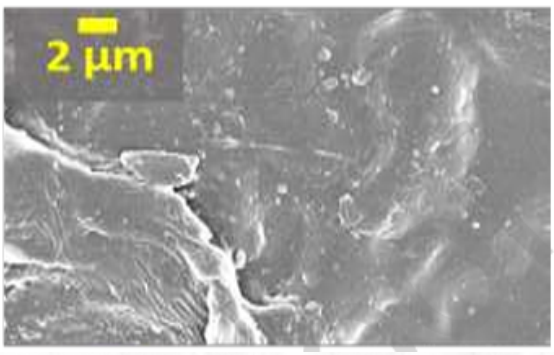
Moreover, microparticles have a small size(<5 mm), which allows them to cross biological barriers such as the gut and the blood-brain barrier, potentially leading to systemic effects.

Experiments were performed on disposable cups, by pouring hot water around 90°C into the cups, allowing them to stand for 15 minutes, and separating the plastic lining from the paper. Various techniques were used, including fluorescence microscopy, FTIR (Fourier Transform Infrared) spectroscopy, SEM (Scanning Electron Microscope) imaging, AFM (Atomic Force Microscopy) imaging, ion chromatography, tensile strength testing, elemental analysis, and ICP-MS (Inductively Coupled Plasma Mass Spectrometry), to characterize the cups, liners, and any substances leached into the beverages after exposure to hot water[1].

Paper cup (source of microplastic)




Before Exposure

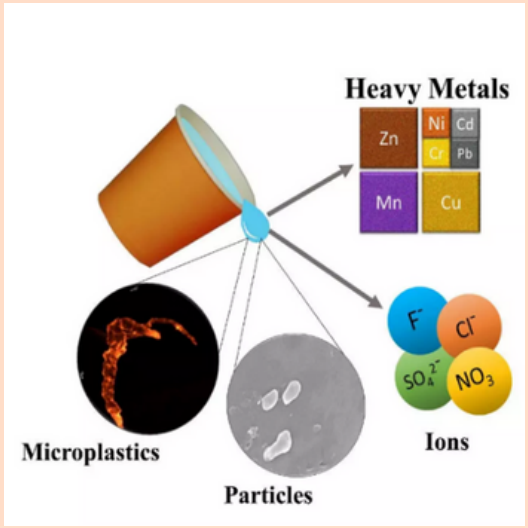



After Exposure

Surface of the film of Sample before and after exposure to hot water, viewed under a scanning electron microscope at 10,000X magnification[2].

According to the research[(2)], fluorescence microscopy revealed a staggering number of micron-sized microplastic particles leaching into hot water from the paper cups, with approximately 25,000 particles detected in a 100 ml sample after 15 minutes[2]. SEM analysis further elucidated the presence of millions of submicron plastic particles per ml in the same water sample. FTIR analysis confirmed the cup liners' composition, predominantly High Density Polyethylene (HDPE) plastic in most cases. SEM and AFM imaging provided visual evidence of liner degradation and surface roughening after exposure to hot water, potentially facilitating microplastic release.


(a)




(b)

(a) Quantity of microplastics in a paper cup, (b) Constituents of paper cup

Ion chromatography detected the presence of fluoride, chloride, nitrate, and sulfate ions in the hot water, likely originating from chemicals used in cup production. Tensile strength tests demonstrated a weakening of the plastic liners after heat exposure, corroborating material degradation. Elemental analysis revealed decreased carbon, hydrogen, and nitrogen percentages in the liners post-hot water contact, indicating material breakdown. Additionally, ICP-MS identified the presence of toxic heavy metals such as lead, chromium, and cadmium in the plastic liners. These toxic heavy metals pose a serious threat when they go beyond permissible limits and cause hepatotoxicity.

In conclusion, microplastic pollution represents an emerging threat to human health that requires urgent attention and action. By reducing plastic consumption, improving waste management practices, and advancing scientific research, we can minimize the risks posed by microplastics and safeguard the health of current and future generations. We can only mitigate this growing environmental and public health crisis through concerted efforts at the individual, community, and global levels.

*Invisible but insidious, microplastics silently infiltrate our ecosystems, posing a significant threat to marine life and human health alike.*

SAIFY IMAM
2021 - 2025

# Modern Computational Techniques to Reduce Resource Utilization and Redundancy in Industries

The quest for efficiency and sustainability in industrial processes has led to the exploration of modern computational techniques. These techniques, driven by advancements in data science, artificial intelligence, and optimization algorithms, aim to mitigate resource utilization and reduce redundancy. This article delves into the innovative approaches industries can adopt to enhance productivity while minimizing environmental impact.

### 1. Data-Driven Decisions:

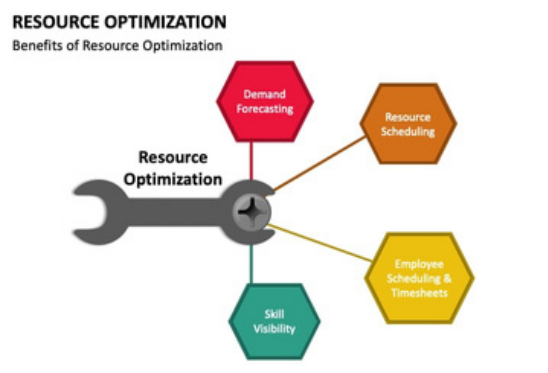
No longer just spreadsheets and intuition, industries can now gather and analyze vast production data. Sophisticated analytics tools reveal hidden patterns and inefficiencies, empowering data-driven decisions. It translates to reduced waste, optimized processes, and better business outcomes.

### 2. Predicting the Future:

Unplanned downtime is a nightmare. Machine learning algorithms, trained on historical data, can predict equipment failures before they occur. It allows for proactive maintenance, minimizing disruptions, and extending equipment lifespans. This not only extends the lifespan of equipment but also minimizes the need foe emergency repairs, reducing downtime and resource wastage.

### 3. Supply Chain Symphony:

From raw materials to finished products, optimizing the supply chain is critical. Advanced algorithms analyze data to find the most efficient routes, transportation modes, and inventory levels. It minimizes environmental impact, reduces redundancy, and ensures resources are used at their full potential.



### 4. Energy Efficiency Champions:

Industries account for a significant portion of energy consumption. Intelligent energy management systems powered by real-time data identify periods of low demand and adjust energy usage accordingly. It saves costs, conserves resources, and positions industries as champions of environmental sustainability.

### 5. Virtual Testing Grounds:

Before making real-world changes, industries can experiment in a virtual sandbox. Simulation and modeling techniques allow testing and optimizing processes in a controlled environment. It identifies and eliminates potential issues before they arise, optimizing resource utilization and minimizing waste.

### Building a Sustainable Future:

Modern computational techniques are not just tools but instruments of change. By embracing data-driven decision-making, predictive maintenance, and optimized supply chains, industries can usher in a new era of responsible and efficient manufacturing. It enhances their bottom line and contributes to a greener, more sustainable future.

### My view

By leveraging data analytics, industries can optimize production with real-time insights. For instance, intelligent predictive maintenance, Like Boeing, proactively anticipates and mitigates equipment problems to minimize operational disruptions. As demonstrated by Amazon's algorithms, supply chain optimization (SCOT) ensures efficient routes and inventory management, minimizing resource redundancy. Simulations, exemplified by Toyota's virtual manufacturing environments, enable proactive issue identification and process refinement before implementation.

In conclusion, adopting these techniques, inspired by industry leaders, positions companies at the forefront of responsible and efficient manufacturing.

> *Our biggest cost is not power, or servers, or people. It's lack of utilization. It dominates all other costs.*
>
> ***~Jeff Bezos***

SANJAY MALLADI
2021 - 2025

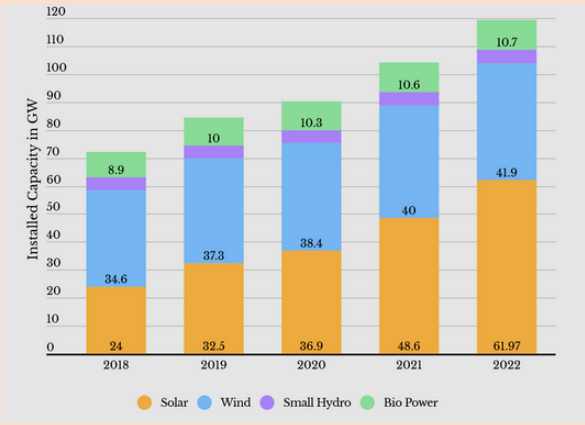
# Renewable energy & Alternate fuels

## Introduction:

India, a country with a rapidly growing population and rising energy demands, is increasingly looking to renewable energy and alternative fuels to satisfy its electricity needs while reducing its negative impact on the environment. In recent years, technological breakthroughs have opened up new options for capturing renewable energy and researching alternative fuels such as fuel cell technology, providing potential alternatives for India's energy future.

## Renewable Energy in India

India has made considerable progress in using renewable energy sources including solar, wind, hydro, and biomass. The government has set high goals for increasing the percentage of renewable energy in its entire energy mix, intending to reach 175 gigawatts (GW) of renewable energy capacity by 2022, with further targets established for succeeding years. Solar energy, in particular, has experienced tremendous expansion, with India emerging as one of the world's major solar power markets.




Share of various renewable source of energy

Wind energy is another important component of India's renewable energy portfolio, with the country ranking among the top wind power producers globally. Coastal regions and states with considerable wind potential, such as Tamil Nadu, Gujarat, and Rajasthan, have received significant investment in wind energy projects.

Despite hurdles such as environmental issues and land acquisition, hydropower remains a significant source of renewable energy in India. The government has been working on improving the efficiency of current hydropower plants while also investigating the feasibility of minor hydropower facilities.

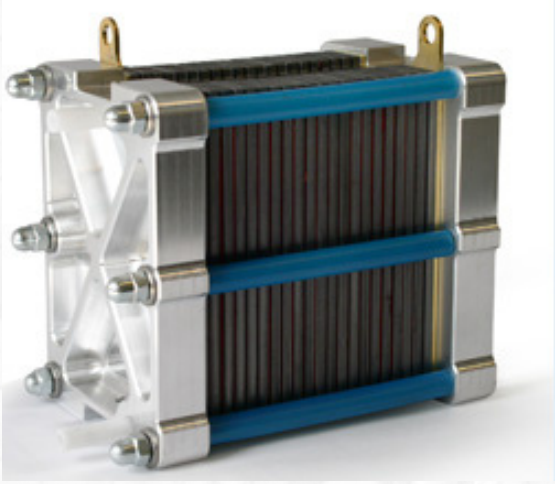
## Alternative Fuels in India:

In addition to renewable energy, India is looking at alternative fuels to minimize its dependency on traditional fossil fuels such as gasoline and diesel. Fuel cell technology is one potential technology that is gaining pace. It provides an environmentally friendly and efficient alternative to traditional combustion-based engines.

Fuel cells produce electricity by electrochemical processes involving hydrogen and oxygen, with the only waste being water and heat. This technology has tremendous promise for a variety of applications, including transportation, fixed power production, and portable electronics. Fuel Cell Vehicles (FCVs) provide zero-emission mobility, addressing concerns about air pollution and greenhouse gas emissions. While India has mostly concentrated on battery-powered electric cars (EVs), fuel cell vehicles provide an appealing alternative for long-range and heavy-duty applications such as buses, trucks, and commercial vehicles.

## Conclusion:

India's move to renewable energy and alternative fuels is a huge step towards a more sustainable and environmentally friendly future. As technological improvements continue to influence the evolution of renewable energy and alternative fuels, including fuel cell technology, India has the potential to capitalize on these discoveries and emerge as a worldwide leader in clean energy implementation. By utilizing its tremendous renewable energy potential and adopting innovative solutions, India can set the way for a cleaner, more resilient energy landscape that benefits both the environment and the economy.



Fuel Cell

> *Renewable energy is not a choice; it's a necessity. Let's prioritize innovation and investment in clean technologies to safeguard our planet and ensure energy security for all.*

PRIYA SIVALANKA
2022 - 2026

# Mitigation of Ocean Acidification and Ocean Plastic

## Introduction

The world's oceans, covering more than 70% of the Earth's surface, are under siege from two interconnected crisis, ocean acidification and ocean plastic pollution. Both issues pose significant threats to marine ecosystems and the well-being of our planet. This article centers on the causes and consequences of these problems and explores innovative strategies to mitigate them.

## Understanding Ocean Acidification:

Ocean acidification is a direct consequence of excessive carbon dioxide ($CO_2$) emissions into the atmosphere. When $CO_2$ is released into the air, a significant portion is absorbed by the world's oceans. This results in a chemical reaction

$$CO_2\ (g) + H_2O(l) \rightarrow H_2CO_3\ (aq)$$

This lowers the pH of seawater, making it more acidic. Besides $CO_2$, direct dumping of industrial waste (such as Sulfuric Acid ($H_2SO_4$), metals like Chromium (Cr), Zinc (Zn and chlorine products) and agricultural waste (such as urea, and pesticides) is also responsible for lowering pH levels. This shift in pH levels disrupts marine life in multiple ways:

1. Coral Bleaching: Corals, the vibrant ecosystems of the ocean, are particularly vulnerable to acidified waters. Lower pH levels inhibit the growth of their calcium carbonate skeletons, leading to coral bleaching, reduced biodiversity, and habitat destruction.
2. Impact on Shellfish: Acidic oceans hinder the ability of shellfish, like oysters and mussels, to build and maintain their protective shells. This affects not only these species but also the livelihoods of those who depend on them for sustenance.
3. Disrupted Food Chains: Acidification disrupts the food chains by affecting the prey-predator dynamics of many marine species. As shellfish populations decline, the entire ecosystem is thrown into disarray. This may birth food shortage issues too.

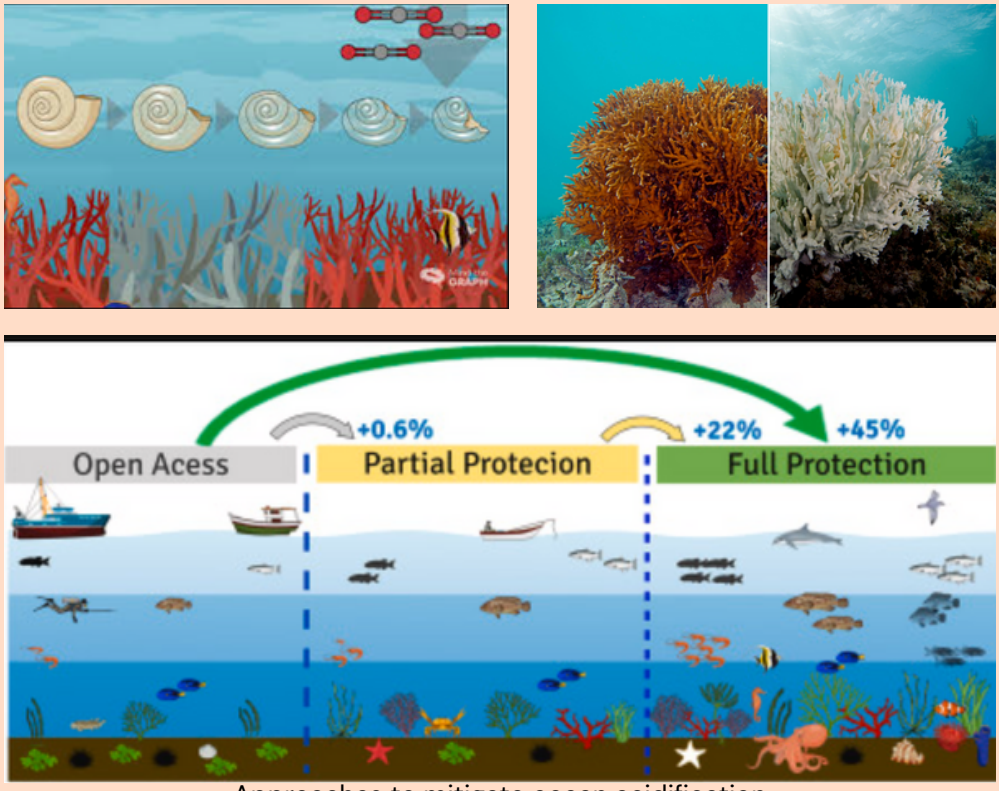
## Approaches to Mitigate Ocean Acidification:

1. Reducing $CO_2$ Emissions: At the root of ocean acidification is excessive $CO_2$ in the atmosphere. We must prioritize sustainable energy sources, reduce carbon emissions, and support international efforts to combat climate change. The use of solar panels and hydraulic power are some examples of energy production which does not produce $CO_2$,

Carbon Capturing is one of the most appropriate approaches to reduce ocean acidification as in the $CO_2$ which is waste fore some industries is used as raw material for some other industries. In this way, it reduces the $CO_2$ and helps in economics.

2. Marine Protected Areas: Establishing Marine Protected Areas (MPAs) can create safe havens for vulnerable species and ecosystems, allowing them to recover and adapt to changing conditions.

3. Reeling in healthy future: Sustainable fishing isn't just a catchphrase; It's a lifeline for threatened species and a promise to a thriving ocean for future generations. Sustainable fishing means we should kill only selected fish in required quantity.




Approaches to mitigate ocean acidification

## Ocean Plastic Pollution: A Persistent Problem

Plastic's insidious legacy disrupts the delicate balance of ocean, poisoning food chains, suffocating habitats, and leaving trail of ecological devastation in its wake. Plastic waste, ranging from microplastics to large debris, inundates the oceans, causing harm to marine life, ecosystems, and coastal communities. Example of some consequences include:

1. Wildlife Entanglement: Animals such as sea turtles, seabirds, and marine mammals become ensnared in plastic debris, often leading to injury or death.

2. Ingestion: Marine species often mistake plastic fragments for food, resulting in ingestion that can lead to malnutrition, poisoning, and death.

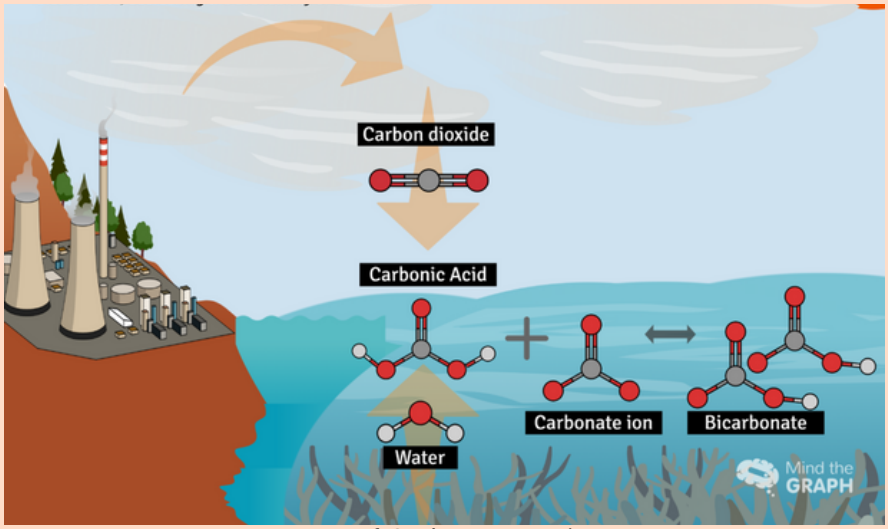
3. Environmental Impact: Plastic waste disrupts ecosystems, alters habitats, and leaches toxic chemicals into the water, which can have a cascading effect on marine life.

## Addressing Ocean Plastic Pollution

Tackling ocean plastic pollution requires a collaborative effort from individuals, governments, and organizations:

1. Reduce Single-Use Plastics: Governments and industries should promote the use of reusable items, phase out single-use plastics, and encourage the recycling of plastic waste.
2. Plastic Cleanup Initiatives: Organizations like The Ocean Cleanup and local community efforts are actively removing plastic debris from oceans. Supporting and expanding such initiatives is crucial.
3. Awareness and Education: Public awareness campaigns can inform people about the consequences of plastic pollution and motivate them to reduce plastic consumption and participate in cleanup activities.

Deep Ocean view




Process of Carbon capturing

## Conclusion

Saving our oceans isn't just a matter of scientific necessity, it's a matter of fundamental rightness. We have a moral duty to combat acidification and plastic pollution for the sake of delicate ecosystems and countless lives they sustain. These issues affect not only our ocean health but also future generation's health and well-being. By reducing carbon emissions, protecting vulneable marine ecosystems, and curbing plastic pollution, we can work together to ensure that the world's oceans remain vibrant, diverse, and resilient for years. The time for action is now, every effort counts in preserving our blue planet.

*The ocean sustains life on Earth, yet it's under threat from human activities. It's time to take action, mitigate ocean acidification, and rid our seas of plastic pollution for the sake of future generations.*

ANKIT KUMAR RAJAK
2021 - 2025

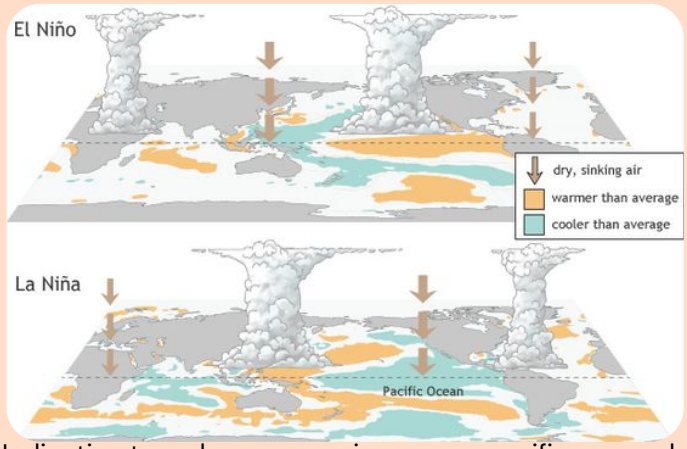
# Climate Modeling & Predictive Analysis

## Introduction:

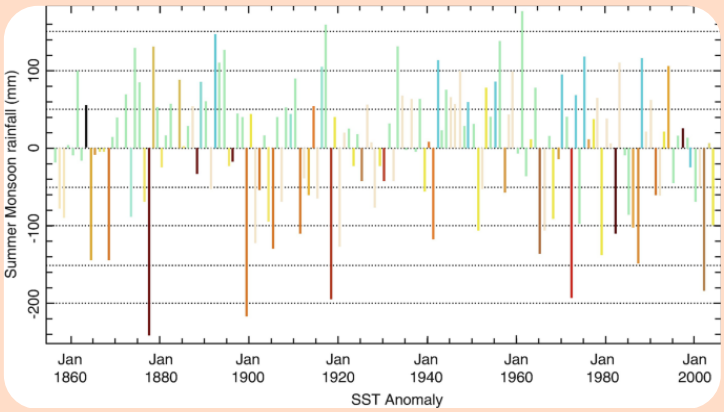
Step into the world of climate science where unsung heroes, like chemical engineers, are making waves. These experts don't just work in labs; they're also tackling big issues like climate change. Let's dive into their role in understanding El Nino's impact on Indian Ocean temperatures. Get ready for a journey through data, models, and the pursuit of climate resilience. So, what's the deal with El Nino and why does it matter for the Indian Ocean? Let's find out!

## Decoding the Past:

Harvesting Insights from a Sea of Data to understand what's happening now and what might happen in the future, we need to look back. Chemical engineers have been digging into loads of data about Indian Ocean temperatures, weather patterns, and those tricky El Niño events. They've uncovered some interesting stuff that shows how the Indian Ocean affects the world's climate. But it's not just about understanding the past, these engineers are also working on practical solutions for the future. They're not just crunching numbers, they're also influencing governments, industries, and organizations to take action against climate change and make our world more resilient. Cool, right? Let's keep going!




Indicating two phases recurring across pacific ocean due to El Nino & La Nina [1].



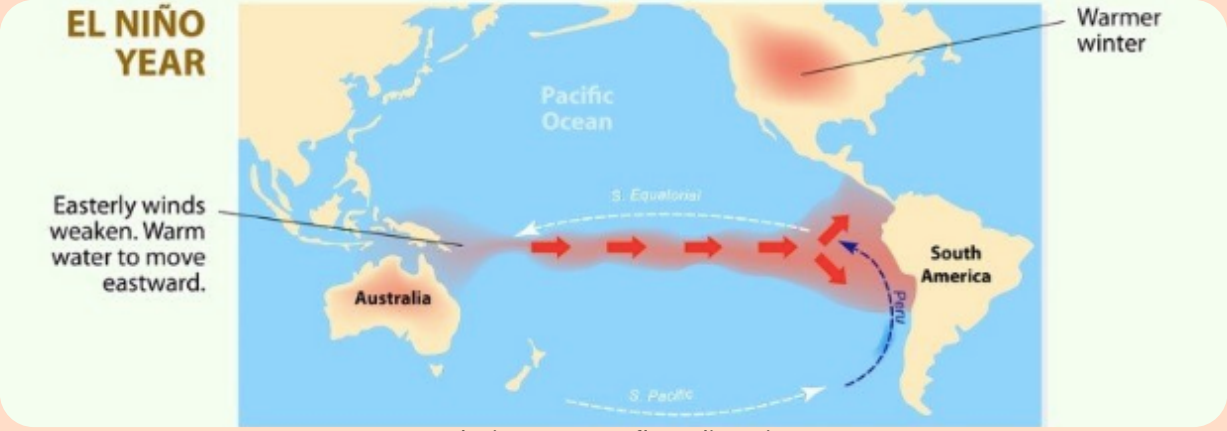

Impact of El Nino & La Nina on crop production [1].

**Mastering Simulation**: Crafting Numerical Models with Precision

El Nino isn't just any old weather event, it's like a complex dance between the ocean and the atmosphere. Chemical engineers have stepped up to the challenge by creating fancy computer models that mimic this dance. These models help us understand how El Nino affects Indian Ocean temperatures.

So, what exactly is El Nino? It's when the sea surface temperatures get warmer than usual in the central and east-central Equatorial Pacific. This can lead to dry and hot conditions in places like Australia, Indonesia, and the Philippines. In India, it often means weaker monsoon rains, which can cause droughts and affect crops like rice and sugarcane.

In the past, El Nino was strongly linked to droughts in India, but that connection has weakened lately. Still, when El Niño hits, it's bad news for Indian agriculture and can even affect the economy. So, understanding El Niño is crucial for planning and preparing for its impacts. Let's keep exploring!




El Nino current flow direction

Predictive Modeling: Let's peek into the future! Predicting what's to come can be as tricky as guessing the direction of monsoon winds. But thanks to predictive models crafted by chemical engineers, we've got a sort of crystal ball. These models help us forecast when El Nino might strike and how strong it'll be. That's super helpful for preparing for its impact on the Indian climate. So, while the future might be uncertain, these models give us a heads-up in our ever-changing world. Exciting stuff, right? Let's keep moving forward!

Adapting to the Winds of Change:

Assessing Climate Change in the Indian Ocean

El Nino's effects reach far beyond the immediate horizon. Chemical engineers are on the frontlines, assessing the long-term repercussions on Indian Ocean climate. Their findings are the cornerstone for policymakers and communities to construct resilient strategies against an evolving climate backdrop.

> *I am arguing that climate models are not fit for the purpose of detection and attribution of climate change on decadal to multidecadal timescales.*
>
> ***~Judith Curry***

P. SWAROOP CHANDRA
2022 - 2026

# Women in Chemical Engineering

## INTERVIEW

***First of all, We are very thankful on behalf of Chemical Engineering Association and Department of Chemical Engineering and NIT Andhra Pradesh for giving us your valuable time for this interview. Before proceeding with this interview, We'd like to introduce you with our viewers. We are here with Dr . Barnali Bhui. She has completed her doctoral studies in Chemical Engineering from IIT Guwahati in 2022 with her thesis addressing on 2 primary issues:***
***a)Reducing $CO_2$ emission from the conventional thermal power plant, and***
***b)The reuse of generated e – waste.***
***She is currently working as an Ad-hoc faculty in the Department of Chemical Engineering at NIT Andhra Pradesh.***
***Prior to this, she worked at Sardar Patel Renewable Energy Resource Institute as a senior scientist.***

Thank you to the team of Chemical Engineering Association for providing this interaction. I'm very much glad for this discussion. It surely will motivate others students to work towards their interest in the research world and create a sustainable environment.
***So let's begin with our interview.....***

***Q1. Our first question to you is what was your motivation behind pursuing research and when did you realize about choosing research as a career?***
My main motivation towards research mainly grew during my M.Tech, where I was given a subject of simulating a shrinking core model. During the extensive research, I required knowledge on real life issues mainly from utilizing coal for power generation.
Based on the research, technological innovation was required along with energy security. Thus, these have led me to progress towards my research. This has motivated me to work towards creating a sustainable environment. The cons of existing technologies were cost intensive & generating pollution at an alarming rate. Thus, I focused to curb these issues by finding ways towards sustainability, efficiency and cost effectiveness.

***Q2. Ma'am, you mentioned too many topics that were directly related to society. So, as a PhD student, what were the social and academic challenges that you faced during your doctoral studies?***

There were many out of which I would like to highlight few of them. First of all, a technical manuscript was quite challenging, i.e., finding the novelty from that comprehensive literature work was very much time consuming. Many times you will feel that you have isolated yourself from real world. One has to contribute time towards their teaching assistant work, course work as well as towards your research commitment. One also need to acquire technical skills for their materials characterization. This could require additional time to learn new techniques, programming languages for their data analysis.

So work time balance was very much needed. So during the Ph.D. we all got to know how to distribute out time among all these factors and publishing papers in highly and peer reviewed journals . When one is engaged with their research work, they seldom get time for social gatherings.

***Q3. Ma'am, you reared too many social as well as academic challenges when you were doing Ph.D. in IIT Guwahati. Now we want to know what are the key areas of your research and what inspired you to specialize in that particular area. As you have rightly said that my main area was to solve $CO_2$ issues, First was that the which gut emitted from the thermal power plants. How to reduce it?***

Since the anthropogenic $CO_2$ emission has caused a lot of greenhouse gas emissions and global warming issues And secondly to reuse the generated e-waste, because normally the typical lifetime of an e-waste generally linkages to two to five years and it is usually dumped into the open landfills which releases many contaminants such as dioxides or furans, so to make existing powerplants using coal emit gaseous mixtures, which are quite difficult to separate & thus becomes an expensive process . It was seen that to grant electricity to 90% of Indian population 1.8 metric tone $CO_2$ was emitted approximately in 2019. Further it was observed that 2 million tons of e-waste is produced annually in India, which usually lands in open landfills. Thus my key area was to resolve these issues.

***Q4. Ma'am, you have mentioned topic like $CO_2$ emission and e-waste. These topics are concerned in this current global scenario. So how would you project the evolution of your particular field of research in the next few decades?***

These topics are quite booming and researchers around the globe are trying to find a solution to mitigate these issues. Our government has also started providing funding to create a solution where the agricultural residue can be utilized in thermal power plants. As such, National Thermal Power Corporation (NTPC) has started blending Biomass with coal 10/5 to 10% in qualified biomass so that the coal utilization can be reduced but without negotiating the total power production and meanwhile this will also lead to reduce the pollution impact towards the environment and around the globe. Thus utilization of coal. Replacement of this coal has already been started such as for the solar based energy production or wind energy and even by using biomass based thermal power plants.

***Q5. Ma'am, you have discussed the topics which will help us to go towards a sustainable environment but at the same time we are seeing an underwhelming response from the youth, both boys and girls to pursue resource as a career. What is your opinion on this current global scenario?***

I totally agree that nowadays the young minds are switching towards the IT sectors because they have a job flexibility, high salaries, or remote work opportunities. But at the end can you see that how many students are again switching these jobs on an yearly basis because of the job satisfaction. As a researcher, you will never face a monotonous life because there will be several aspects where you can work independently.

Core engineering often deals with real world problems (Manufacturing, construction, energy systems etc.). They often involve hands-on work, where it is conducting experiments or building any prototype.

***Q6. Well as you said students first prefer to get a high paying jobs and then this shift towards the jobs which are there of their own interest. So can you explain to a layman what exactly pursing research as a career and pursuing Ph.D. takes mentally and physically.***

Research means constantly exploring new ideas, solving complex problems etc. Normally research can be broadly classified as discovery and innovation. Now just take as a simple example that earlier we had a landlines for communication and cameras to take pictures. With developments in technologies and extensive research led to the innovation of mobile phones where different applications can be integrated into a single item. This became handy and economical. Personally, I felt that we are always given a freedom to choose our areas and work independently towards one research topics & methodologies. Though one faces many failures at times but that has led to personal and professional growth because facing challenges and then overcoming it was very much required. I think every researcher someday or the other has surely experienced it.

Further, we were given some administrative responsibilities also, such as to buy chemical consumables and equipment and settle bills. Thus, by the end if your Ph.D. one is proficient in technical and administrative work.

***Q7. You have stated various challenges by pursing research as a current. So how would you motivate girls who are currently studying in school and colleges?***

Earlier chemical engineering was made only for industrial purposes where the male ratio was quite high as compared to women but it has changed with years. It has progressively changed the scenario and now more research oriented work is mainly being focused in the chemical engineering area.

So, it was seen, due to the societal barriers and many other reasons, women could not come into the forefront, which in the present scenario has quietly been changed. The government has initiated certain polices and schemes which has given priority to the female as compared to male. This has led to betterment towards creating some awareness and promoting the female researchers to initiate their work.

***Thank you ma'am for answering all our questions patiently and providing insight about the current scenario for the role of women in chemical engineering and research.***

Dr. BARNALI BHUI
Ad-hoc Faculty
DChE, NIT Andhra Pradesh

# Insights from the GATE Achiever

## INTERVIEW

~ Siddartha Peddi
2020 - 2024

***1. What's it like to be receiving AIR 45 in Gate-2024?***

It's truly an honor to be recognized as the topper of the list. It feels incredibly rewarding to see my hard work and efforts paying off. I'm grateful for the opportunity to showcase my skills and knowledge, and I'm thankful for the support and encouragement I've received along the way. This achievement serves as motivation to continue striving for excellence and making a positive impact.

***2. Did you expect to do so well?***

To be honest, I had hoped to perform well, but I wasn't entirely sure how things would turn out. I put in a lot of hard work and preparation, so I was optimistic about my chances. However, achieving this level of success still exceeded my expectations, and I'm incredibly grateful for the outcome.

***3. What was your study strategy?***

My study strategy involved a combination of time management, and active learning techniques. Firstly, I created a detailed study plan that outlined what major topics I needed to cover within a prescribed timeline. This helped me stay focused and prioritize my study sessions effectively and consistency helped me to achieve excellent result. I tried to study for at least 5 hours on a regular basis and on holidays and weekends I extend it further to 7 hours.

I tried my best to utilize the free time and after completing each topic I used to make a short overview of the entire thing which helped me revise and recall them better.

***4. What problems did you face while preparing for the exam alongside your college routine?***

It is very difficult to manage the academics and preparation at the same time. I used to spend most of the time on preparation which affected my performance in the semester examination.

***5. How did your family and friends support you?***

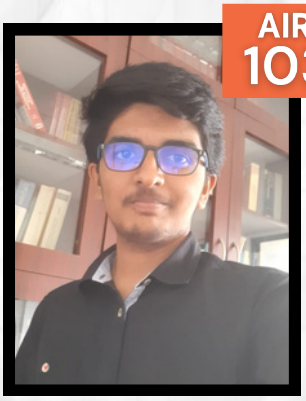
I'm incredibly grateful for the support I received form my family and friends throughout my journey. Their encouragement and belief in me played a significant role in my success. My family provided unwavering support by creating a conducive environment for studying, offering words of encouragement during challenging times, and celebrating every milestone with me.

***6. Who was your inspiration or role model?***

My role model has always been my brother, P Santosh Kumar. He helped me a lot in this journey. He is the one who guided me since the start of my preparation. He has always taught me the valuable life principles which motivated me throughout my journey. He has always boosted my confidence when I had low self – esteem.

# GATE ACHIEVERS 2024


Peddi Siddartha
2020 - 2024

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M Sai Charan
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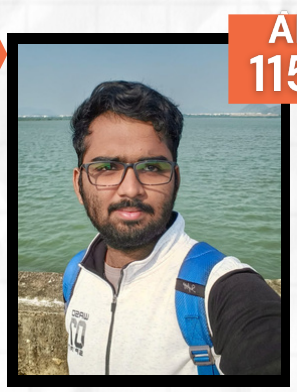


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2020 - 2024


K Ganesh P
2020 - 2024


Jitesh Kumar S
2020 - 2024

Congratulations!

# GALLERY

## LaTeX Workshop:


## Intra-Chemical Sports Meet:


# Faculty Sports

# Techkriya'23





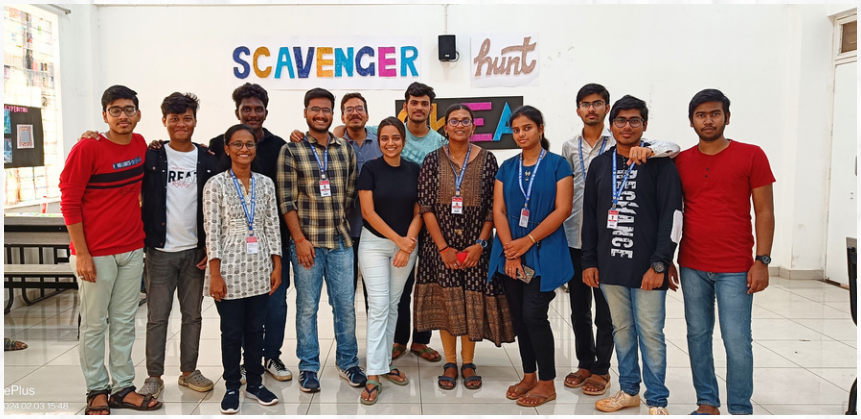


# Guest Lecture on Problem solving in industries and Introduction to Foreign Studies

# Guest Lecture on Nuclear Contamination


# Vulcanzy'24



# INDUSTRIAL VISIT

Industrial visits provide invaluable opportunities for students to gain practical insights into the workings of various industries. The Chemical Engineering branch of NIT Andhra Pradesh recently embarked on a visit to NFCL (Nagarjuna Fertilizer Corporation Limited), a prominent fertilizer industry, on March 14, 2024.

During the visit, students were exposed to the intricate processes involved in fertilizer production, from raw material acquisition to the final product. They witnessed, firsthand, the application of theoretical knowledge in real-world scenarios, enhancing their understanding of chemical engineering principles.

NFCL's state-of-the-art facilities and advanced technologies left a lasting impression on the students, offering valuable insights into the challenges and innovations within the fertilizer industry.


Overall, the industrial visit to NFCL proved to be an enriching experience for the students of NIT Andhra Pradesh, equipping them with practical knowledge and insights that will undoubtedly benefit their academic and professional endeavors in the field of chemical engineering.

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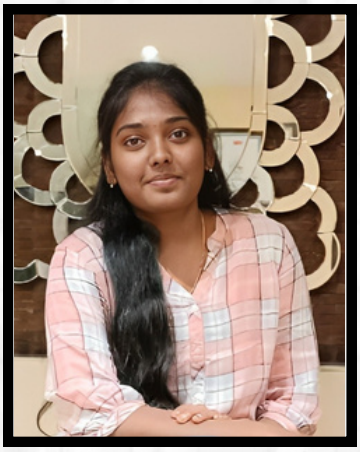

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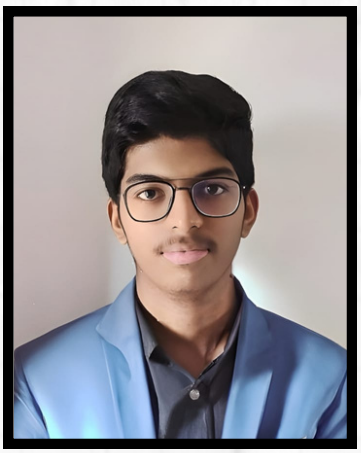

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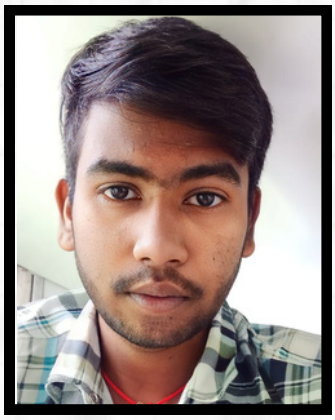

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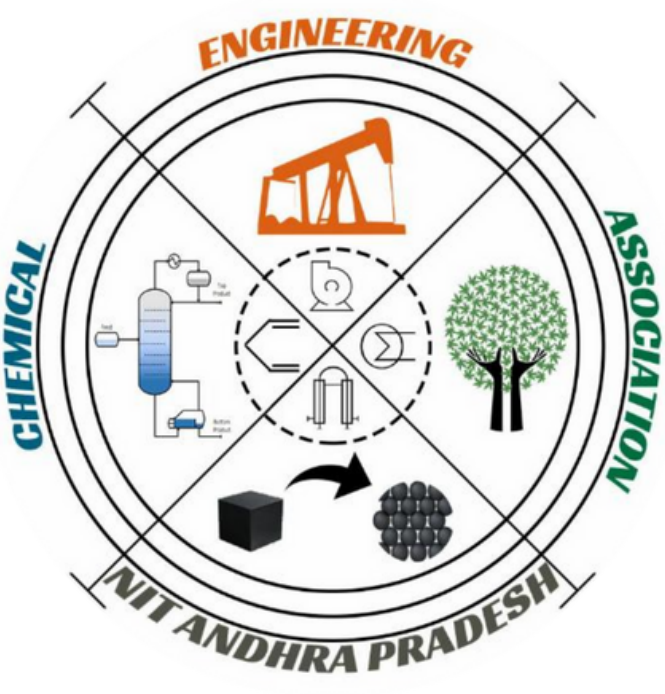


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