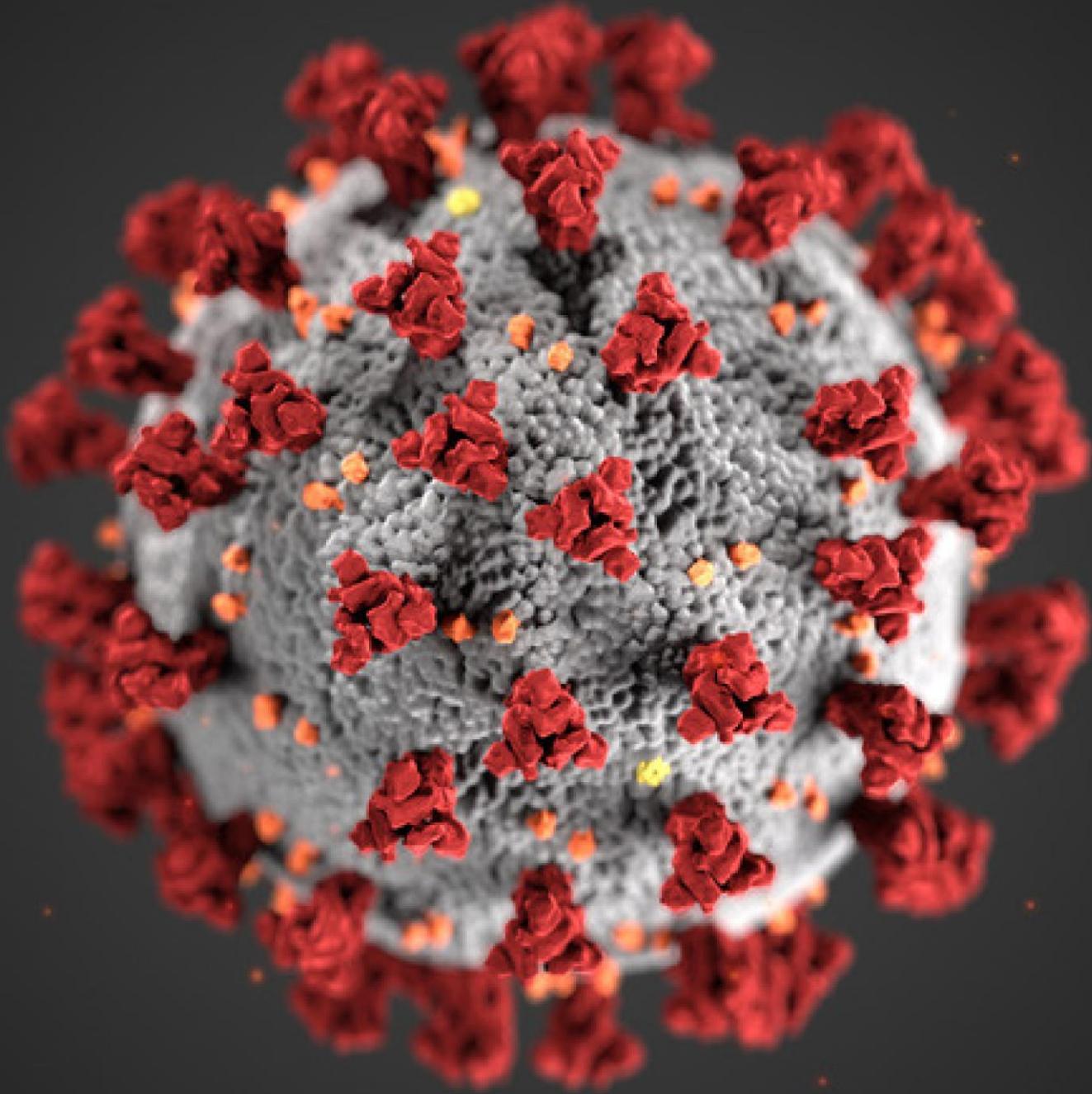


Issue 5

Jan-June  
2021

# OZONE

EDITION 5.0



A MAGAZINE BY  
**IICHE-GVPCE(A) STUDENT CHAPTER**

**DEPARTMENT OF CHEMICAL ENGINEERING**



**GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING  
(AUTONOMOUS)**



# TEAM OZONE



**Nikhil Binani**  
*(Co Ordinator)*



**Prathyusha.B**  
*(Editor)*



**K.Sanjana**  
*(Article Contributor)*



**Prasanna**  
*(Article Contributor)*

# **OFFICE BEARERS**

**2021-2022**

## **Convenor**

Prof. M. S. N. Murty, Professor & Head of the department  
(Chemical Engineering)

## **Faculty Coordinators :**

1. Dr. C. V. Nageswara Rao, Associate Professor
2. Mr. G. Naga Chaitanya, Assistant Professor

## **Executive Committee :**

1. P.V.V.Mahadesh - 4th Year (President )
2. P. Akhila - 4th Year (Secretary)
3. S. Sri Lekha - 4th Year (Treasurer)
4. P.Tejaswini - 3rd Year (Vice - President)
5. A. Harsha Jagan - 3rd Year (Joint - Secretary)

## **Literary and public relation:**

1. Nikhil Binani - 4th Year (Co-ordinator)
2. Prathyusha.B - 3rd Year (Blog Editor)
3. K. Sanjana - 2nd Year (Article - contributor)
4. G.D.V. Prasanna - 2nd Year (Article - contributor)

**Events division :**

1. I. Vaishnavi - 4th Year (Co-ordinator)
2. Bilwesh Avvari- 3rd Year (Co-ordinator)
3. B. Lalitha devi - 2nd Year (Co-ordinator)

**Enrollments Division :**

1. Pradeep varma - 2nd Year (Co-ordinator)

**Techincal services division:**

1. C.H.Naveen Kumar - 4th Year (Co-ordinator)
2. V.S.Vishnu Vardhan - 3rd Year (Website editor )
3. M.V.Sudheera - 2nd Year (Website editor )

**Design and creatives division:**

1. S.N.Amrutha Gorla - 2nd Year (Newsletter Editor)
2. Syed Khwaja Abdul Karim - 2nd Year (Graphics Editor)

# This issue:

Dr. Krishna Yella  
01

Hydrophonics  
03

Vaccination: An end to pandemic  
06

Microplastics  
08

Covid polluton  
12

Lithium sulphur batteries  
15

Paint that kills COVID 19 with cu  
17

Charging stations for electric vehicles  
18

Anthrax Toxin  
20

Chem - cross  
21

Quiz  
22

# **DR.KRISHNA ELLA**

---

*founder and chairman of Bharat Biotech*



## **INTRODUCTION**

Krishna Ella is an Indian scientist and entrepreneur. He is the founder and chairman of Bharat Biotech where he is also a Managing Director. He is also one of the people to give India its indigenous COVID-19 vaccine.

## **ORIGIN**

Krishna Ella was born into an Tamil speaking agriculturist family in Tiruttani village in Tiruvallur district of Tamil Nadu in 1969

## **SCHOOLING AND ACADEMIC DEGREE**

*Ella obtained a bachelor's degree from the Tamil Nadu Agricultural University and joined for a Master's degree at the University of Agricultural Sciences, Bangalore. On a Rotary fellowship he completed his masters from University of Hawaii. He attained his PhD from University of Wisconsin-Madison.*

# ACHIEVEMENTS



- *Ella's company is the first to manufacture a preservative-free vaccine (Revac-B mcf Hepatitis B Vaccine), and launch India's first cell-cultured Swine Flu vaccine. They also manufacture the world's cheapest Hepatitis vaccines. Bharat Biotech is the first in the world to find a vaccine for the Zika virus*
- *Since he started Bharat Biotech in 1996, the company has delivered vaccine doses to over 70 countries in the world, held over 140 global patents and has an R&D pipeline with 11 vaccine candidates for various diseases, including three for the coronavirus. In the past 25 years, Ella has consistently come out with a vaccine every three to four years*

- *While the world searches for an answer for the COVID-19 conundrum, Bharat Biotech has come out with a vaccine. The efforts of all the scientists of Bharat Biotech are been instrumental in putting an end to the pandemic.*

## AWARDS

- *ET Now Special Recognition for Healthcare Industry Award*
- *J R D Tata—Best Entrepreneur of the Year*
- *Marico Innovation Award*
- *University of Southern California—Asia-Pacific Leadership Award*
- *Best Technology and Innovation Award from the Prime Minister of India in 2008.*
- *Dr. Ella has been awarded more than 100 National and International awards which include Bio Spectrum Person of the Year in 2013*

# HYDROPONICS



We all know ,how soil plays a crucial role in cultivation of crops...

## HYDROPONICS

*SOIL FREE FARMING  
TECHNIQUES  
NUTRIENTS AND  
SUBSTRATES  
PROS  
CONS*

But have u ever thought ,that a plant can be grown without soil ?? Yes, here we are going to witness such a technology which is accomplishing the needs of the growing population.

Everyone can be a urban farmer with our hydroponic solution – you neither need a balcony nor water to grow your vertical farm at home. Hydroponic Growing Offers Advantages, But Won't Replace Soil. Traditionally, farmers have grown plants in nutrient-rich soil. Now an increasing number of growers rely on hydroponics, which uses a variety of soil-less media in a controlled environment.

## HYDROPONICS

- Hydroponics is a type of horticulture and a subset of hydroculture which involves growing plants (usually crops) without soil, by using mineral nutrient solutions in an aqueous solvent.
- Terrestrial plants are grown with only their roots exposed to the nutritious liquid, or, in addition, the roots may be physically supported by an inert medium such as perlite, gravel, or other substrates.



## TECHNIQUES FOLLOWED IN HYDROPOONICS :

- Static solution culture
- Continuous-flow solution culture
- Aeroponics
- Fogponics
- Passive sub-irrigation
- Ebb and flow (flood and drain) sub-irrigation
- Run-to-waste
- Deep water culture
- Rotary

The formulation of hydroponic solutions is an application of plant nutrition ,with nutrient deficiency symptoms mirroring those found in traditional soil based agriculture.

### Elements and it's key roles

#### Inorganic

- Essential macronutrients
  - Nitrogen , calcium, potassium ,sulphur magnesium, phosphorus
- Essential micronutrients
  - Iron, zinc, copper, boron, molybdenum, manganese, nickel...
- Variable micronutrients
  - Chlorine, aluminium, silicon, titanium

One of the most obvious decisions hydroponic farmers have to make is which medium they should use.

Here comes the substrates used in hydroponics techniques

- Expanded clay aggregate
- Grow stones
- Coconut Coir
- Rice husks
- Perlite
- Vermiculite
- Pumice, sand
- Gravel
- Wood fibre
- Sheep wool, Rock wool
- Brick shards
- Polystyrene packing peanuts

Nutrients solutions have it's unique role in hydroponics, since we are avoiding soil in greater amounts, nutrients solutions need to take the role of soil



## PLANTS THAT CAN BE GROWN USING HYDROPONICS

Almost any crop can be grown hydroponically, the most common are leaf lettuce, tomatoes, peppers, cucumbers, strawberries, watercress, spinaches ,kale, beans, chives basil, mints, blue berries, celery and some herbs.

### Pros

- Nutrient Intake Since the plants' root system is open, nutrients and oxygen are delivered directly to the roots.
- No Pests, No Problem Without the use of soil the growing environment is easier to keep clean and clear of any unwanted intruders
- More Personal Space plants are not fighting for root space so they grow up, taking up less space.

### Cons

- Setup Costs initial setup of a hydroponic system is expensive.
- Learning Curve It needs your time and complete attention
- Equipment Failure If a piece of the system fails, like a water pump, your plants can be killed off within a matter of hours.

# VACCINATION: AN END TO THE PANDEMIC



## VACCINE IS THE KEY

*In these two years of pandemic, we have realized that end to this pandemic is only through vaccination. If 70% of a nation's population gets vaccinated, it is highly likely that the corona would come to its end. But in reality, for countries with a large population like India it is difficult to have 70% of the population to get vaccinated. 16 million doses of the COVID vaccine have been given in India. More than 43 million people have received 2 doses of the vaccine and are considered fully vaccinated.*

*Top health officials in India have stated that both Covaxin and Covishield are effective against the mutated, UK/South Africa/Brazil virus.*

*At the current rate of vaccine delivery, which dropped from 3.5 million a day in March to an average of 1.6 million daily doses this week, and assuming vaccine supplies keep up with that rate, it will take until February 2022 for the country to vaccinate 300 million people. And that's still only 20% of the population.*

*But we can decrease the time needed for vaccinating 70% population by increasing the production rate. The main problem with increasing production rate is that the technology used is not available in much of the pharmaceutical industries.*

*Many people believe that vaccination isn't effective or it has some side effects but in reality it is the only solution we have to save ourselves from this pandemic because covid-19 is much more dangerous than this vaccine. There is no 100% chance that it will help us to prevent covid but it will definitely help us to lessen the damage.*

# COVAXIN

## DEVELOPER



Covaxin has been developed by Hyderabad-based Bharat Biotech International Ltd in association with the Indian Council of Medical Research (ICMR) and the National Institute of Virology (NIV).

## TYPE OF VACCINE

Covaxin is an inactivated viral vaccine. This vaccine is developed with Whole-Virion Inactivated Vero Cell-derived technology. They contain inactivated viruses, which can not infect a person but still can teach the immune system to prepare a defence mechanism against the active virus. These conventional vaccines have been in use for decades now. There are vaccines for some other diseases as well which are made using the same technology like Seasonal influenza, polio

## EFFICACY

Both the vaccines have shown more than satisfactory results ever since the inoculation started in India.

Covaxin's 81% according to interim 3rd phase trial results.

Second dose of Covaxin is scheduled after 4-6 weeks after the first dose

# COVISHIELD

## DEVELOPER



Covishield has been developed by the Oxford-AstraZeneca and is being manufactured by the Serum Institute of India (SII).

## TYPE OF VACCINE

Covishield has been prepared using the viral vector platform which is a totally different technology.

A chimpanzee adenovirus – ChAdOx1 – has been modified to enable it to carry the COVID-19 spike protein into the cells of humans. Well, this cold virus is basically incapable of infecting the receiver but can very well teach the immune system to prepare a mechanism against such viruses. The exact technology was used to prepare vaccines for viruses like Ebola.

## EFFICACY

Covishield vaccines it is 84 days or 12-16 weeks after the first dose.

The effectiveness of the Covishield vaccine is nearly 90% as per the global reports .

# Micro plastics A New Pollution threat

*In This Article*

---

What Are  
Microplastics

---

Why are microplastics a  
problem

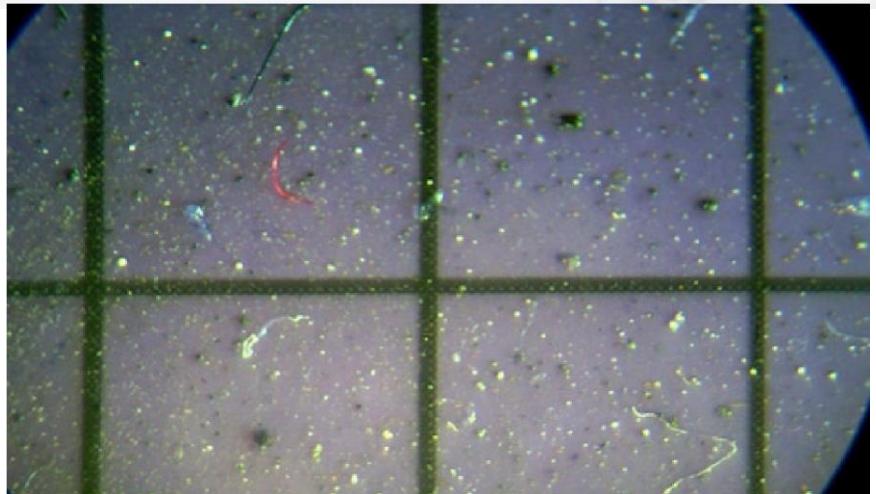
---

Effects of microplastics

## Measures to reduce the spread of microplastics

# MICRO PLASTICS

*A new pollution threat*



Russian scientists recently collected samples of snow polluted with microplastics that then melts and seeps into the ground in Arctic. That their preliminary findings confirm that airborne plastic fibres are turning up in snow . Russian scientists are trying to understand the scale of a potential threat to the environment in Siberian remote parts of the wilderness.



## What Are Microplastics?

- Microplastics are small plastic particles less than 0.2 inches (5 mm) long, according to the National Oceanic and Atmospheric Administration (NOAA).
- In 2014 alone, researchers estimated there to be up to 51 trillion pieces of microplastics in the ocean. This quantity outnumbers the stars in the Milky Way by 500 times.
- In contrast, macroplastics are larger objects like plastic bottles, hair combs, and toothbrushes. Both types of plastic continuously flow into the ocean, but microplastics prove much more challenging to remove due to their small size.

## How Microplastics Are Made?

- Microplastics often originate from macroplastics that have broken apart in the ocean. Plastic may break apart due to weathering from the sun, wind, or other causes.
- The microbeads in many personal care products — such as toothpaste and facial scrubs — also count as microplastics.
- Microbeads often consist of polyethylene plastic, though they may also contain polystyrene or polypropylene.
- Microplastics even occur from synthetic clothing.

# **Why Are Microplastics A Problem?**

- These small particles serve as carriers for bacteria and persistent organic pollutants (POPs).
- POPs are toxic organic compounds that, much like plastic, take years to degrade. They consist of chemicals like pesticides and dioxins, which are hazardous to human and animal health in high concentrations.
- POPs causes biomagnification which results in severe health hazards

## **EFFECTS OF MICROPLASTICS**

### **ENVIRONMENT**

- POPs aren't very water-soluble, meaning they don't dissolve easily. Because of this quality, it's easy for them to accumulate within aquatic sediment and create toxic reservoirs.
- Naturally, this leads to a more prominent risk factor for large marine creatures and humans.
- Affect organism behavior: Earthworms create burrows in abnormal ways when microplastics are present in the surrounding earth. These altered patterns negatively impact the soil's condition and the earthworms' physical fitness.
- Contaminate groundwater: Plastic particles release chemicals into the ground, which can leach into groundwater supplies and affect drinking water quality.
- Pollute food sources: Plastic debris has been found in foods like salt, beer, and sugar.

### **HUMANS**

- That humans ingest microplastics is through eating marine animals that have consumed the material.
- Even if you don't eat seafood, you have come into contact with microplastics at one point or another through your drinking water or the very air you breathe.
- For example, bisphenol A (BPA) has links to behavioural changes and increased blood pressure. PBDEs can cause endocrine disruption and neurodevelopmental dysfunction in humans, as well as liver and kidney damage.



## ***MARINE LIFE***

- Many microplastics enter the ocean with their own set of harmful additives from the plastic manufacturing process.
- Microplastics may contain fillers, colorants, flame retardants, and many more chemicals as a result of plastic processing. .
- The rate of diffusion — or the spreading of a substance — isn't the same for all of these chemicals, if an animal ingests enough microplastics, they may be exposed to high concentrations of a particular substance



## ***WHAT CAN WE DO TO SLOW THE SPREAD OF PLASTIC DEBRIS??***

- Buying natural-fiber clothing: Natural-fiber materials like organic cotton and wool biodegrade over time instead of staying in the natural environment like synthetic fibers.
- Using reusable goods: Substitute your single-use plastic bottles and straws for reusable options that you can wash and use again.
- Recycling plastic according to local guidelines: If you can't reuse every plastic you consume, be sure to recycle them according to guidelines from your local waste management program.
- Using alternative transportation: car tires contribute a lot of microplastic dust to the atmosphere.



# COVID POLLUTION

*Accumulation of plastic waste during COVID-19*



PLASTIC WASTE IN  
THE PANDEMIC

NEED OF SINGLE-USE  
PLASTIC IN THE  
PANDEMIC

A FIGHT TO  
ELIMINATE THE  
SINGLE-USE PLASTIC

## PLASTIC WASTE IN THE PANDEMIC

As lockdowns took effect to slow the spread of coronavirus disease 2019 (COVID-19), the global demand for petroleum collapsed. As a result, oil prices plummeted, making the manufacture of virgin plastics from fossil fuels less expensive than recycling. This cost incentive, along with lifestyle changes that increase plastic use, has complicated the challenge of overcoming plastic pollution.

# NEED OF SINGLE-USE PLASTIC IN PANDEMIC

During the pandemic, personal protective equipment (PPE) has driven increased plastic pollution. In response to high PPE demand among the general public, health care workers, and service workers, single-use face mask production in China soared to 116 million per day in February, about 12 times the usual quantity . The World Health Organization has requested a 40% escalation of disposable PPE production . If the global population adheres to a standard of one disposable face mask per day after lockdowns end, the pandemic could result in a monthly global consumption and waste of 129 billion face masks and 65 billion gloves . Hospitals in Wuhan, the center of the COVID-19 outbreak, produced more than 240 tons of single-use plastic-based medical waste (such as disposable face masks, gloves, and gowns)per day at the peak of the pandemic, 6 times more than the daily average before the pandemic occurred. If the increases observed in Wuhan hold true elsewhere, the United States could generate an entire year's worth of medical waste in 2 months .

Individual choices during lockdowns are also increasing plastic demand. Packaged take-out meals and home-delivered groceries contributed an additional 1400 tons of plastic waste during Singapore's 8-week lockdown . The global plastic packaging market size is projected to grow from USD 909.2 billion in 2019 to 1012.6 billion by 2021, at a compound annual growth rate of 5.5%, mainly due to pandemic response .

This global health crisis puts extra pressure on regular waste management practices, leading to inappropriate management strategies, including mobile incineration, direct landfills, and local burnings . Improper disposal of just 1% of face masks translates to more than 10 million items, weighing 30,000 to 40,000 kg . Waterlogged COVID-19– related plastic has been observed on beaches and in water , potentially aggravating the challenge of curtailing microplastics.



It is pretty obvious that even before the pandemic, India was nowhere in the race to

eliminate single-use plastics by 2022, says Bandela. Eliminating it has to be a many-fold strategy: a mixture of a ban on few items that do not have recyclable capacity and a strong Extended Producer Responsibility policy, for instance.

The plastic industry needs to step up action across the whole value chain, says Anderson. “This includes design, sourcing, manufacture, end-use and recycling. We must look at solutions that have a significantly lower impact over the life cycle of the plastic product,” she says. Thus, investments in waste management systems and recycling capacities are crucial. “Once plastic reaches our seas, it becomes a global problem that can only be resolved through international action and global partnerships.”

.

**WITHOUT A CONCERTED  
EFFORT TO PROTECT THE  
ENVIRONMENT DURING  
AND AFTER THE  
PANDEMIC, WE ARE  
UNLIKELY TO MEET THE  
UNITED NATIONS'  
SUSTAINABLE  
DEVELOPMENT GOALS**

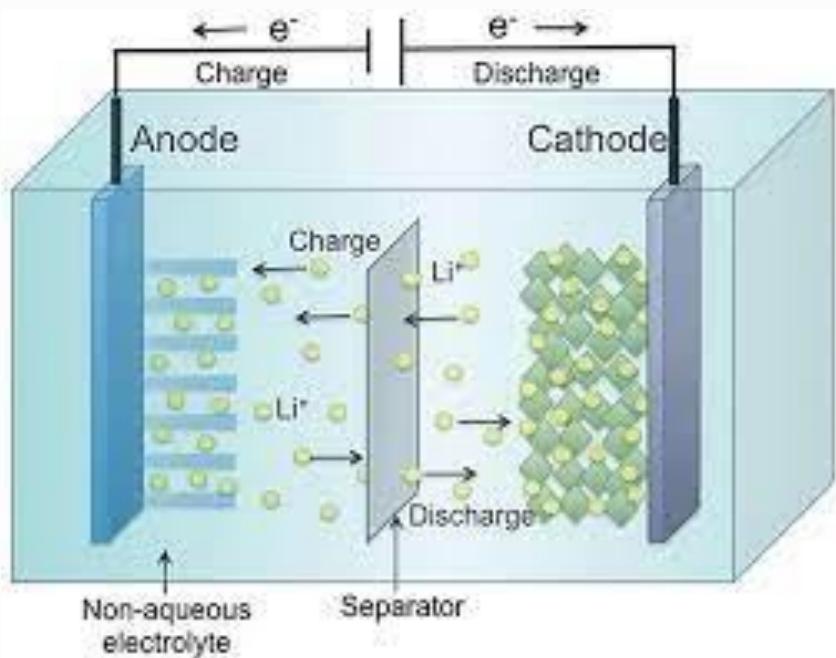
# Lithium - sulphur batteries

New Co-living Spaces in the CBD

## Novel catalyst Material Could Enable Better Lithium-Sulfur Batteries, Power Next-Gen Electronics

At the heart of most electronics today are rechargeable lithium-ion batteries (LIBs). But their energy storage capacities are not enough for large-scale energy storage systems (ESSs). Lithium-Sulphur batteries (LSBs) could be useful in such a scenario due to their higher theoretical energy storage capacity. They could even replace LIBs in other applications like drones, given their light weight and lower cost.

But the same mechanism that is giving them all this power is keeping them becoming a widespread practical reality. Unlike LIBs, the reaction pathway in LSBs leads to an accumulation of solid lithium sulfide ( $\text{Li}_2\text{S}_6$ ) and liquid lithium polysulfide ( $\text{LiPS}$ ), causing a loss of active material from the sulfur cathode (positively charged electrode) and corrosion of the lithium anode (negatively charged electrode). To improve battery life, scientists have been looking for catalysts that can make this degradation efficiently reversible during use.



In a new study published in ChemSusChem, scientists from Gwangju Institute of Technology (GIST), Korea, report their breakthrough in this endeavor. “While looking for a new electro catalyst for the LSBs, we recalled a previous study we had performed with cobalt oxalate ( $\text{CoC}_2\text{O}_4$ ) in which we had found that negatively charged ions can easily adsorb on this material’s surface during electrolysis.

This motivated us to hypothesize that  $\text{CoC}_2\text{O}_4$  would exhibit a similar behavior with sulfur in LSBs as well,” explains Prof. Jaeyoung Lee from GIST, who led the study

To test their hypothesis, the scientists constructed an LSB by adding a layer of  $\text{CoC}_2\text{O}_4$  on the sulfur cathode.

Sure enough, observations and analyses revealed that  $\text{CoC}_2\text{O}_4$ ’s ability to adsorb

sulphur allowed the reduction and dissociation of  $\text{Li}_2\text{S}_6$  and LiPS. Further, it suppressed the diffusion of LiPS into the electrolyte by adsorbing LiPS on its surface, preventing it from reaching the lithium anode and triggering a self-discharge reaction. These actions together improved sulfur utilization and reduced anode degradation, thereby enhancing the longevity, performance, and energy storage capacity of the battery.

Charged by these findings, Prof. Lee envisions an electronic future governed by LSBs, which LIBs cannot realize. “LSBs can enable efficient electric transportation such as in unmanned aircrafts, electric buses, trucks and locomotives, in addition to large-scale energy storage devices,” he observes. “We hope that our findings can get LSBs one step closer to commercialization for these purposes.”

Perhaps, it’s only a matter of time before lithium-sulfur batteries power the world.

# A PAINT THAT KILLS COVID-19 WITH COPPER

Elemental copper provides permanent antimicrobial activity, but large surfaces clad in copper are expensive and not the right look for most places. To bring the disinfecting power of copper to a broader range of walls, handrails, and other surfaces around the home and workplace, Corning developed a copper-containing biphasic glass-ceramic material it calls Guardian and worked with PPG Industries to incorporate it into a line of latex paints called Copper Armor.

The overall idea here was to create a material that maintains the antimicrobial potency of copper while getting rid of its metallic character.

## "copper metal"

"The overall idea here was to create a material that maintains the antimicrobial potency of copper while getting rid of its metallic character and metallic look so that it could be incorporated into a wide variety of materials and surfaces". Though the pure Guardian material is a pale blue-green powder, PPG was able to flex its formulation experience to make the paint in all the normal shades and sheens beyond the industry standard tests, which analyze the kill rate under warm, wet conditions. The paint also got a kill rate of 99.9% while dry at room temperature, much more like what it would see in a real-world setting.



# CHARGING STATIONS FOR ELECTRIC VEHICLES



## Charging stations for electric vehicles

Electric vehicle charger or evse electric vehicle supply equipment is used to provide electric power to plug in electric vehicles. Batteries can only be charged with DC power but electric vehicles contain onboard ac to dc converters that allows vehicles to be charged in households with ac supply. Charging stations contain larger ac to dc converters that supply already converted dc supply directly to the electric vehicles to enhance faster charging to the vehicles. The need arose due to the increase in prices of fossil fuels and rise in global warming. We need charging stations to charge electric vehicles, at regular intervals, similar to the petrol stations available. These charging stations are developed and placed in kerala where the charging stations are mounted on to a pole, this is a very good example of conserving space and charging electric vehicles. The pole mounted charging station is only applicable for vehicles that need little amount of charging like electric scooters and autos.

### Modes of charging:

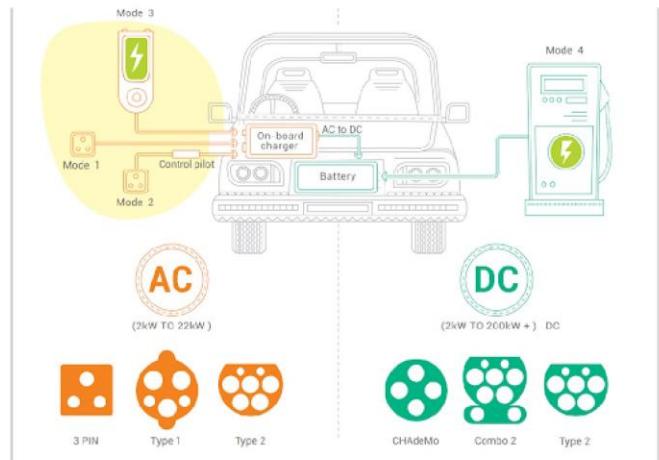
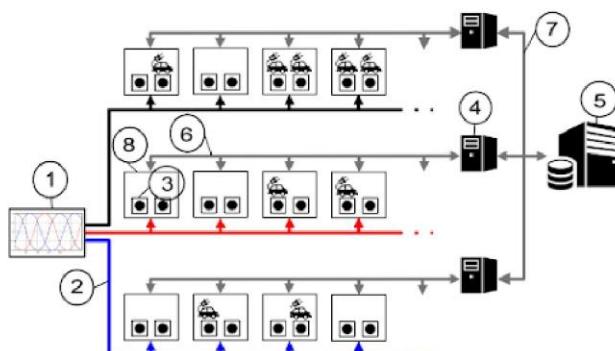
Level 1 - can be installed in our homes, charges very slowly.

Level 2 - pulls more power and charge ev faster than level 1. You will often find this kind of charging station at wevenues like restaurants or sports stadiums where drivers can leave their vehicles to charge while they spend time inside

Level 3 and Level 4 charging stations represent the high end of EV charging. Installing Level 3 charging stations requires direct access to the power grid, which can only be performed by highly-skilled technicians usually working with special arrangements with local authorities.

### Construction of a charging station:

The station is fed by three-phase electric power with voltage between phases of 400 V. Each charging point is connected to one single-phase at 230 V and 7.3 kW.



Components of the charging station: (1) power source; (2) three-phase electric power; (3) charging points; (4) masters; (5) server with database; (6) asynchronous serial connections; (7) communication TCP/IP (Transmission Control Protocol/Internet Protocol); (8) slaves.

The station is controlled by a server together with a number of masters and slaves. Each slave controls two charging points of type 2/AC.

A master is connected to eight slaves and has a user interface. The server centralizes the control and receives signals from the slaves regarding events as connection or disconnection of EVs. The server also sends orders to the slaves to activate and deactivate charging points in accordance with the schedule.

Even though there are many spaces available (180 in our experimental study), not all the charging points in these spaces can be active at the same time due to the available power being limited.

### Cost and investment details:

- Land Cost = Around Rs.5 Lakhs To 10 Lakhs.
- Investment For Office = Around Rs.1 Lakhs To 1.5 Lakhs
- Security Deposit Fee = Around Rs.1.5 Lakh To 2 Lakhs (Depend On Company)
- Machine = Around Rs.2 Lakh To 25 Lakhs (Depend On Stations) You can set up fast charging machine or normal charging slot for EV station business.

### Working Capital:

- Staff Salary = Around Rs.30 000 To 60,000 Per Month
- Other Charges = Around Rs. 1.5 Lakhs

### Conclusion:

- With the increase in the awareness of global warming, hike in fuel prices and the depletion of fossil fuels, the need for an effective and efficient alternative is necessary.
- Electric vehicles pave a path for green and an economical way to battle the current situation. Also, the scope for electric vehicles is likely to increase in the future due to the arising problems.
- To travel farther destinations an electric vehicle charging station is a necessity to be taken care of.

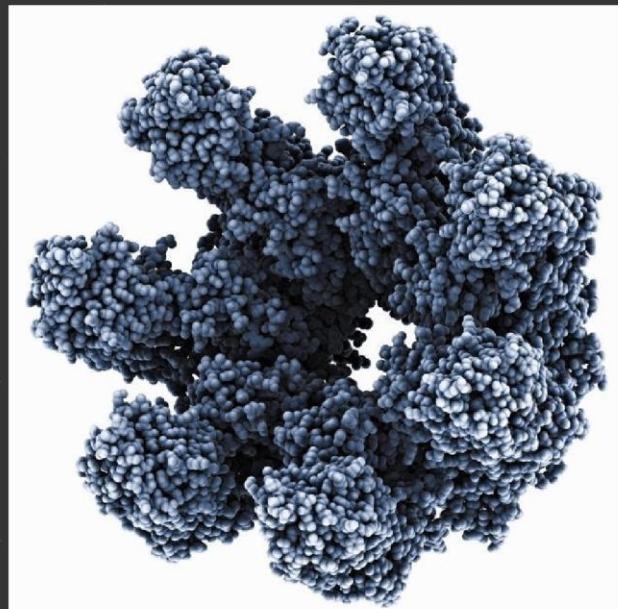
# ANTHRAX TOXIN

Deadly anthrax toxin blocks multiple types of pain in mice, study shows that a toxin from the microbe which causes anthrax can silence multiple types of pain in mice. Researchers found the toxin targets pain-sensing cells to alter signaling and block pain. Building on that finding, researchers engineered an anthrax protein vehicle to deliver different types of treatments into pain receptors and modulate nerve-cell function. The findings can inform the design of therapies that selectively target pain-sensing fibers without the widespread systemic effects of opioids and other pain killers.

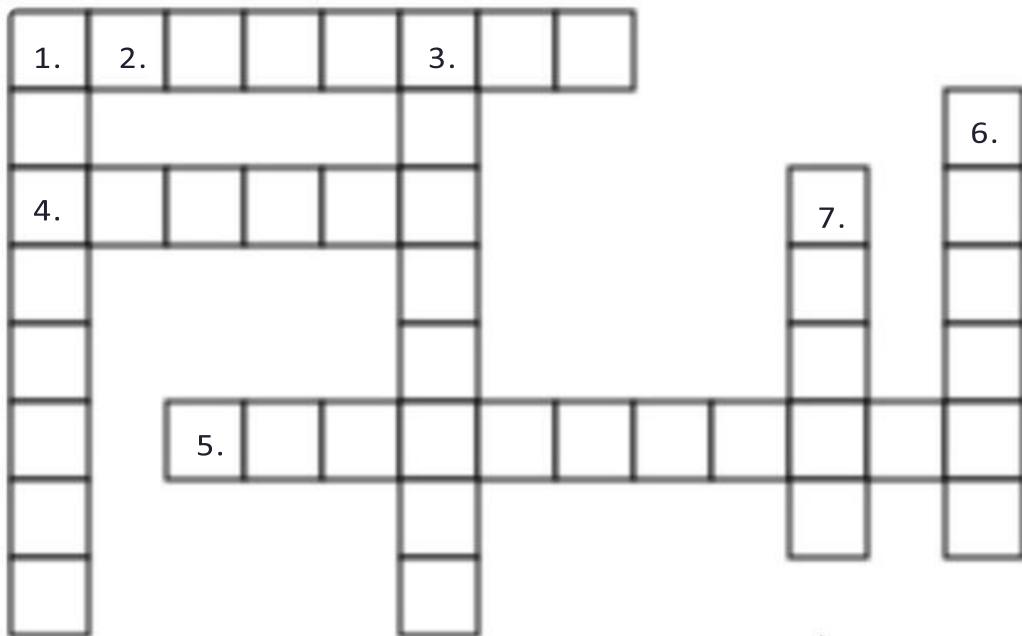
The research reveals that this specific anthrax toxin works to alter signaling in pain-sensing neurons and, when delivered in a targeted manner into neurons of the central and peripheral nervous system, can offer relief to animals in distress. The work, led by investigators at Harvard Medical School in collaboration with industry scientists and researchers from other institutions, is published Dec. 20 in *Nature Neuroscience*.

"This molecular platform of using a bacterial toxin to deliver substances into neurons and modulate their function represents a new way to target pain-mediating neurons," said study senior investigator Isaac Chiu, associate professor of immunology in the Blavatnik Institute at Harvard Medical School.

The researchers caution, however, that for now, this approach remains purely experimental and still needs to be tested and further fine-tuned in more animal studies and, eventually, in humans.



# Chem - cross



## Down

1. Substance formed by the union of two or more elements of the periodic chart.
3. It is neither metallic nor organic, and is used a lot for decorations.
6. Capacity to carry out a work
7. Anything that flows is called a

## Across

2. Branch of the science that explains principles of chemistry by the application of physics.
4. Anything that occupies space.
5. Scaling up a work in larger sections or a university career that has vast opportunities.

# Quiz time!



- 1. Which of the following describes a limitation of the exponential growth model ?**
  - A. Biomass growth is assumed to be not linked to the availability of nutrients or substrates
  - B. It does not predict when cell growth will cease
  - C. It predicts that all types of cells under all conditions will grow exponentially
  - D. All of the above are correct
  
- 2. During a batch fermentation, when would the specific growth rate be lowest ?**
  - A. During exponential phase
  - B. During the lag and stationary phase
  - C. When cells are growing at their fastest rate
  - D. Throughout the fermentation
  
- 3. Which of the following is correct with regards to microbial growth ?** A. Cells are auto-catalysts and thus the rate of increase in biomass ( $dX/dt$ ) keeps changing  
B. Many factors affect cell growth  
C. The rate of increase in biomass concentration is not constant during a fermentation  
D. All of the above are correct
  
- 4. The bioreactor which is most commonly used in industry is the**
  - A. Batch Fermenter
  - B. Fed Batch Fermenter
  - C. Continuous Fermenter
  - D. Batch Continuous Fermenter
  
- 5. The specific activity of an enzyme is relatively constant between pH 3-8. If the enzyme activity at pH 7.0 is to be modeled, which of the following would be a reasonable simplifying assumption ?**
  - A. Specific activity is not dependent on temperature
  - B. Specific activity is not dependent on substrate concentration
  - C. Specific activity is not dependent on pH. All of the above

**6. An ideal gas has maximum density at**

- A. 1 atm, 300 K
- B. 2 atm, 150 K
- C. 0.5 atm, 600 K
- D. 1 atm, 500 K

**7. Working between which pair of following temperatures, the efficiency of a carnot engine will be maximum ?**

- A. 10 Degrees F and 10 Degree R
- B. 10 Degrees F and 10 Degree C
- C. 10 Degrees R and 10 Degree C
- D. It will be same in all the above cases

**8. The ratio of mass concentration of species A to the total mass density of the mixture is known as**

- A. Mass density
- B. Concentration
- C. Mole fraction
- D. Mass fraction

**1.D 2.B 3.D 4.B 5.C 6.B 7.A 8.D**