CHEMPHORIA 2020 MAGAZINE

IIChE STUDENT CHAPTER
DEPARTMENT OF CHEMICAL ENGINEERING
TKM COLLEGE OF ENGINEERING

Chemphoria 2020 Edition

Stay Home Stay Safe

HOD's Message

In only a few weeks, COVID-19 has profoundly changed our lives, caused tremendous human suffering and challenged the most basic foundations of societal well-being. Beyond the immediate impacts on health, jobs and incomes, the epidemic is increasing people's anxiety and worry, affecting their social relations, their trust in other people and in institutions, their personal security and sense of belonging.

I am happy to see the amount of enthusiasm of students and eminent members of the department to contribute to the magazine. Not to be outdone, our students have devoted time and plunged into creating powerful technical writings, contemporary industrial changes, and other informative articles. I stand awed by the sheer number of articles that have come pouring in for the magazine. This shows the positive and creative energy of faculty members and students present in the department even in this pandemic time.

We proudly publish the department magazine in order to show to the outside world, and also to remind the denizens of TKMCE CHED, the progress we have made so far. We intend to continue presenting the talent and creativity of our staff and students through Chemphoria every year.

Read an enjoy this tremendous work.

Prof. Femina A.

Associate Professor and Head

Department of Chemical Engineering

TKMCE Kollam

STAFF EDITOR'S EPISTLE

The short and medium-term impacts of COVID-19 will be particularly severe for the most disadvantaged and risk compounding existing socio-economic divides. This policy brief looks at the broad range of effects that COVID-19 will have on different aspects of people's lives, with a focus on specific population groups such as children, women and the elderly.

I feel great pleasure to present yet another issue of our annual technical magazine Chemphoria 2020 even in this tough time.

Chemphoria 2020 is a perfect blend of technical thinking, knowledge and wisdom which vibrates in the inner soul of various stakeholders. It is natural to find in his ambience, the intensive use of a variety of thinking activities, strategies and group dynamics to make this issue interesting and thought provoking. I congratulate the entire student editorial team for their effort in bringing out this magazine in a very innovative way under the guidance of IIChE staff coordinator Prof. Manikandan P. M. Special thanks to Ansi A S (2018 – 2022), for the cover page design.

Once again, I congratulate all the members of the group who worked intensively for this magazine.

Prof. Shan S

Assistant Professor

Department of Chemical Engineering,

TKMCE, Kollam

STUDENT EDITOR'S NOTE

Hope can be a powerful force, especially in difficult times. Today, the world is facing the coronavirus crisis, a pandemic that has changed life for millions of people. In times like these, hope can be a powerful source of reassurance. Many who are locked at home, others who are working to help and prevent the virus, also need the reassurance and the hope that ***we shall overcome this****.*

We are extremely happy to bring out this message for our department magazine released for the year 2020.

This magazine provides a platform for us students and Staff to share information, spread the latest technical Knowledge and cultivate right ways that will equip all of us to stay competent in our respective fields of study and research.

We congratulate and thank all the students and staff Coordinators who have made untiring efforts to bring out this magazine.

Reading this magazine would definitely be an inspiration and motivation for all students and staff to contribute even more to the forthcoming issues. We hope that everyone would continue to give their full efforts to keep the momentum and continue to enhance the standards of the magazine. The outside world will come to know about the caliber of the students and the faculty through this magazine.

We extend our thanks to all the contributors for their articles.

Achuth M

Sytia Suresh

The department in a nutshell…….

Vision

Attainment of recognition by all stakeholders as well as peers as a department of choice for higher learning in the discipline and allied areas, that strives for excellence in teaching, outstanding research, scholarly activities and apply engineering expertise in meeting societal needs.

Mission

- Prepare the students for graduate study through an effective curriculum and produce Chemical Engineering professional who can serve the industry and the society at large by imparting the best of scientific and technological knowledge.
- Provide competitive and stimulating academic environment to nurture creativity, self-learning and inter-personal skills.
- Foster the pursuit of new knowledge and innovative ideas in chemical engineering through industry-institute interaction and facilitate progressive research.
- Practice ethical approach, pursue sustainable development and instill a passion for lifelong learning.

Program Educational Objectives (PEOs)

- Succeed in their chosen career path, as practitioners in process industries and organizations or pursue advanced technical and professional degrees.
- Exhibit the required mathematical and problem-solving skills and competencies, necessary to adapt to the changing technologies and become lifelong learners.
- Possess integrity and ethical values both as individuals and in team environments and address global and societal issues including health, safety and protection of environment.

Program Specific Outcomes (PSOs)

- Analyze and apply the knowledge of Unit Operations and Unit Processes to function as process engineer.
- Design process equipment and develop processes considering safety, economic, environmental and ethical aspects.
- Communicating effectively with peers and society and function as a member or a leader for managing projects, adapting to technological changes.

Program Outcomes (POs)

Engineering graduates will be able to:

- **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **Problem analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **Conduct investigation of complex problem:** Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse, and in multidisciplinary settings.
- **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage project and in multidisciplinary environment.
- **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

About IIChE….

Indian Institute of Chemical Engineers is a confluence of streams of professionals from academia, research institutes and industry. It provides an appropriate forum for joint endeavours to work for human beings through application of chemical engineering and allied sciences. Programmes of IIChE are immensely beneficial, opening up doors of new and existing possibilities.

The student chapters guide its members in career choice and arrange lectures, seminars, short courses, plant visits, etc., at regular intervals to better equip and empower the students when they are out of their academic precincts

Vision

Over the years the Institute has developed a distinct profile of its own. Even though the IIChE is always molding itself and playing a proactive role to keep up with the ever-changing needs of the society and the economy, its basic objectives largely remain unchanged since its inception. One may shortlist them as:

- To promote advancement of chemical engineering and draw up a code of ethics in the profession
- To maintain and widen contacts with chemical engineering professionals in India and abroad
- To ensure regular exchange of ideas with other national and international professional institutes in this field
- To act as an authoritative body on matters pertaining to the teaching and the profession of chemical engineering
- To conduct examinations and assist persons engaged in the industry to qualify as chemical engineer
- To confer awards, diplomas and certificates to such persons as may be deemed fit.
- To undertake publication work. i.e., journal, monographs, proceedings of seminars/symposia/workshops
- To conduct meeting and transact business in administrative, academic and technical matters relating to the profession

Mission

The primary objective of a student's chapter is to promote among chemical engineering undergraduates a feeling of fraternity, brotherhood and to complement the objectives and activities of the institute. It shall also render all possible assistance to the regional centers in matters relating to student members.

Objectives

The activities of the student's chapter specifically include the following:

- To arrange lectures, film shows and video shows related to the chemical engineering education and profession
- To arrange seminars, workshops, group discussions and debates and to promote interaction of the institute with industry
- To establish and operate book banks for the use of its members
- To arrange excursions and plant visits of interest to chemical engineers' undergraduates
- To assist and guide student chemical engineers in their career planning and placement

IIChE Torch Bearers for the academic year 2020 – 2021

Faculty in charge	:Prof. Manikandan P. M.
Secretary	:Mr. Aravind G
Joint Secretary	:Mr. Mishal Mussaddique
Treasurer	:Miss. Jasna
Executive Members	:Mr. Akhiland C
	Miss. Soja J S
	Mr. Bibin Francis
	Miss. Karthika Sunil
	Mr. Abhijith M
	Miss. Faheema Nadirsha

Dedication

This magazine is dedicated to all who lost their life due to COVID-19

CONTENTS

Classroom precautions during COVID-19

A key lesson learned during the pandemic is the important role teachers play in ensuring that learning continues. As schools reopen, a lot will depend on teachers to ensure that children will be able to continue their education in a safe and healthy environment; and make up for knowledge and skills that may have been lost.

As a teacher, knowing the facts will not only protect yourself but also your students. Be aware of fake information and dangerous myths about COVID-19 circulating that are feeding fear and stigma.

Understanding COVID-19, how it spreads and how we can protect ourselves and others is an important first step in establishing classroom procedures and protocols. Students need to understand what it is in order for them to follow the rules. Listen to their concerns and ideas and answer their questions in an age-appropriate manner. Discuss the different reactions they may experience and explain that these are normal reactions to an abnormal situation.

Make sure to use information about COVID-19 from reliable sources such as UNICEF and WHO, as well as the health authorities in your country. By staying informed about the situation and following the recommendations of public health experts, we can protect our own wellbeing and those around us.

Physical distancing at schools

When it comes to physical distancing, it is important that you establish some classroom ground rules in accordance with the procedures established by your school's administration, as well as the protocols established by your respective country's Ministry of Health and/or local health bodies and authorities. Recommended measures include:

- Maintain a distance of at least 1 metre between everyone present at school
- Increase desk spacing (at least 1 metre between desks), stagger recesses/breaks and lunch breaks (if difficult, one alternative is to have lunch at desks)
- Limit the mixing of classes for school and after-school activities. For example, students in a class will stay in one classroom throughout the day, while teachers move between classrooms; or classes could use different entrances, if available, or establish an order for each class to enter and leave the building/classroom
- Stagger the school day to vary the start and end times and avoid having all the students and teachers together at once
- Consider increasing the number of teachers, if possible, to allow for fewer students per classroom (if space is available)
- Advise against crowding during school pick-up or day care, and if possible avoid pick up by older family or community members (i.e. grandparents). Arrange school pick up/drop off times differently (according to age group) to decrease any large gatherings of children at a given time
- Use signs, ground markings, tape, barriers and other means to maintain 1 metre distance in queues around entrances
- Discuss how to manage physical education and sports lessons

- Move lessons outdoors or ventilate rooms as much as possible
- Encourage students not to gather and socialize in big groups upon leaving school grounds.

To do

To encourage your students to stick to the rules, it can be helpful to create a dos and dont's list with them. Develop a list together around how students will greet each other; how desks will be arranged; physical distancing measures during lunch breaks (who they will sit with, play with during breaks, how they can schedule time with all of their friends across the week).

Health and hand hygiene

Teachers have a critical role to play in ensuring students understand the precautions they should take to protect themselves and others from COVID-19, and it is important you lead by example in the classroom.

Handwashing is one of easiest, more cost efficient and effective way of combating the spread of germs and keeping students and staff healthy.

Encourage students to get into the practice of regularly washing their hands and/or applying hand sanitizers at key moments, such as entering and leaving the classroom; touching surfaces, learning materials, books, and after using a tissue to blow their nose.

Students should always cough and/or sneeze into their elbow. However, if by accident they do so in/on their hands, instruct them to immediately wash their hands or apply hand sanitizer. If students sneeze or cough into a tissue, ensure that it is disposed of immediately and that they wash their hands. It is extremely important to normalize the idea of frequent and routine handwashing.

Even with clean hands, encourage students to avoid touching their eyes, nose and mouth. Germs can transfer from those areas on to their clean hands and spread around the classroom this way.

Reinforce frequent handwashing and sanitation and procure needed supplies. Prepare and maintain handwashing stations with soap and water, and if possible, place alcohol-based hand sanitizers in each classroom, at entrances and exits, and near lunchrooms and toilets.

To do

- Identify some practical steps/activities you can take to demonstrate good hygiene practices to your students.
- Creating a hand hygiene song to sing with your students
- Have students draw hygiene posters for the classroom
- Set a hand hygiene ritual. You can select a specific time during the day, such as before/after lunchtime for everyone to wash their hands/apply hand sanitizer
- Physically demonstrate how to wash your hands and apply sanitizer
- Keep a points system in your classroom, giving points to students each time they wash their hands or apply sanitizer
- Have students create a public service announcement on hand hygiene and place these posters/ announcements throughout the classroom or school in highly visible places

Mask wearing in schools

If wearing fabric masks is recommended in your school, then make sure your students are familiar with when they should wear masks and any related school policies, such as how to dispose of used masks safely to avoid the risk of contaminated masks in classrooms and playgrounds.

Explore with your students how to handle and store masks properly.

All efforts should be made to ensure the use of a mask does not interfere with learning. No children should be denied access to education because of mask wearing or the lack of a mask because of low resources or unavailability.

If you have students with disabilities, such as hearing loss or auditory problems in your class, then consider how these children may miss learning opportunities because of the degraded speech signal stemming from mask wearing, the elimination of lipreading and speaker expressions and physical distancing. Adapted masks to allow lipreading (e.g. clear masks) or use of face shields may be explored as an alternative to fabric masks.

Cleaning and disinfecting

Information on how to maintain the cleanliness and sanitization of your classroom.

Daily cleaning and disinfecting of surfaces and objects that are touched often, such as desks, countertops, doorknobs, computer keyboards, hands-on learning items, taps, phones and toys.

Immediately clean surfaces and objects that are visibly soiled. If surfaces or objects are soiled with body fluids or blood, use gloves and other standard precautions to avoid coming into contact with the fluid. Remove the spill, and then clean and disinfect the surface.

Tips for staff using cleaning materials

- Ensure you understand all instruction labels and understand safe and appropriate use
- Follow the instructions on the labels
- Cleaning products and disinfectants often call for the use of gloves or eye protection. For example, gloves should always be worn to protect your hands when working with bleach solutions
- Do not mix cleaners and disinfectants unless the labels indicate it is safe to do so. Combining certain products (such as chlorine bleach and ammonia cleaners) can result in serious injury or death
- Diluted household bleach solutions may also be used if appropriate for the surface
- Check the label to see if your bleach is intended for disinfection and has a sodium hypochlorite concentration of 0.5%. Ensure the product is not past its expiration date. Some bleaches, such as those designed for safe use on coloured clothing or for whitening may not be suitable for disinfection
- Household bleach will be effective against coronaviruses when properly diluted

To do

- Come up with some fun and creative ideas and rules with your students for avoiding high-risk and high-touch areas in their school/classroom. For example, not touching the railing while walking up and down the stairs, or keeping classroom doors open to avoid touching door-knobs
- Come up with some rules together as a group and write these down on a flipchart paper that you can later hang up in the classroom
- Create fun reminders/posters that can be hung in the hallways to remind others to stick to the sanitation rules.

A Paint that kills COVID-19 with Cu^{+1}

COVID-19 infection and hospitalization rates in the US shot back up in early November, closing bars, preschools, and other public amenities across the country. Public health officials are reemphasizing the cornerstone roles that handwashing, masks, and social distancing have in combating the pandemic.

At the same time, the home-care industry has been hard at work bringing new and existing cleaning products to the fight. The US Environmental Protection Agency's List N, which contains all the products the agency permits to claim the ability to kill SARS-CoV-2 on surfaces, has grown from 200 entries in March to 508 in mid-November.

The EPA recently emphasized the need to supplement those efforts with surfaces and surface treatments that provide long-lasting activity against viruses and other microbes. In October, the agency issued guidance on how companies can prove a product's efficacy against SARS-CoV-2 before making such claims, a move EPA administrator Andrew Wheeler says in a news release would provide "an expedited path for our nation's manufacturers and innovators to get cutting-edge, long-lasting disinfecting products into the marketplace as safely and quickly as possible."

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 Guardiant 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 and metallic look so that it could be incorporated into a wide variety of materials and surfaces,” says Joydeep Lahiri, vice president of Corning’s specialty surfaces division. Though the pure Guardiant 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.

Cu^{+1} is the active antimicrobial form of the element. The challenge that Corning’s technology solved, Lahiri says, was keeping the copper in that oxidation state while also letting it get to the microbes. In April 2019, the firms published a paper in Nature Communications on their innovation, which they describe as an “alkali copper aluminoborophosphosilicate glass ceramic material that acts as a sustainable delivery system for Cu^{+1} ions”

The R&D team found literature describing the use of glass to keep copper in the +1 state, Lahiri explains. But in the team's tests, paint incorporating a copper-glass phase wasn't effective against pathogens, probably because the copper couldn't escape the glass to do any microbe killing. Replacing some of the aluminum oxide in the glass with boron, phosphorus, and potassium oxides created a second phase in the material that is more water labile. Paint made with the biphasic ceramic-glass copper material reduced counts of SARS-CoV-2 as well as Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella aerogenes, and Escherichia coli on the surface by more than 99.9%, matching an efficacy previously achieved by metallic copper using EPA test standards.

In fact, Lahiri says, the firms went 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.

Though it may seem like the water-labile phase would wash away during cleaning before long, Stevenson says PPG's wear-simulation tests suggest that the antimicrobial action will stand up to more than 5 years of scrubbing and still meet that 99.9% kill standard. The firms are awaiting EPA approval and expect the paint to hit the market in the next few months.

POLYURETHANE RAW MATERIALS FROM OLD BOTTLES

Polyurethanes are exceptionally versatile. The materials, formed by reacting polyols with diisocyanates, can be made into skateboard wheels, rigid structures for cars, memory foam for mattresses, and insulation for refrigerators and buildings. But the nature of polyurethanes—custom blends of molecules bound tightly and often irreversibly with cross-links—makes recycling them a challenge compared with thermoplastics like polyethylene terephthalate (PET) or polypropylene, which can be melted down again. Plastics producers have attempted to boost the sustainability of polyurethanes with greener inputs, such as polyols derived from soybean oil. Huntsman is taking a similar strategy, except in its case it is making polyurethanes more sustainable in a way that helps address the broader plastic waste problem: by using polyols derived from recycled plastics.

The company just opened a plant in Taiwan that makes its Terol aromatic polyester polyols from postconsumer PET bottles. The 22,000-metric-ton-per

year plant is its second to use the technology. Huntsman started operating the first in Houston in 2013, where it says it has since consumed the equivalent of 5 billion PET bottles. At these plants, Huntsman starts with a glycolysis-like process that breaks down the PET into shorter-chain oligomers. This is in contrast to companies such as Loop Industries and Eastman Chemical that depolymerize PET all the way down to the building-block chemicals dimethyl terephthalate and ethylene glycol for condensation back into PET or other polyesters.

Huntsman reengineers the oligomers to build up desirable molecular weights, functionalizes the polymer backbones, and combines the resulting aromatic polyester polyols with other polyols to get desired properties for various applications. Pavneet Mumick, Huntsman's global vice president of polyurethane technology and innovation, says the final polyols the firm is making now have 30–40% recycled content. Huntsman can boost the total postconsumer content number to 60%, he says. Huntsman doesn't pick up the bottles curbside and process them itself. Rather, it buys flaked PET made from bottles that recycling companies have already collected, sorted, and cleaned. That final part is important. According to Mumick, tight quality control of incoming recycled PET is critical to maintain the high-quality standards of the polyol products.

Aromatic polyester polyols impart rigidity, insulation properties, and fire performance to polyurethane foams, Mumick says, making them a good fit for insulation board and spray foam insulation for construction applications. This is in contrast to polyether polyols, which are more flexible and find themselves in applications like memory-foam mattresses. A chronic problem in plastics recycling is downcycling, in which plastics are turned into objects less valuable than what they were originally used for. Mumick calls Terol an example of upcycling because the recycled polymers are used in applications like insulation that help conserve energy for many years."When all of those things start to add up, they become a very good sustainability story," Mumick says.

SANDALWOOD OIL WITHOUT SANDALWOOD TREES

The warm and fuzzy push by consumers for biobased ingredients has a dark side: natural doesn’t always mean sustainable. Sandalwood oil is one example. Essential-oil producers steam-distill the fragrance ingredient—which has a rich herbal scent reminiscent of hops, eucalyptus, and Angostura bitters—from shredded sandalwood trees. The trees become richer in oil as they grow older and are harvested when they are between 15 and 30 years old.

But demand has grown faster than the trees themselves, leading to unsustainable cultivation practices and even illegal harvesting of trees from protected woodlands in Australia, India, and Hawaii. The supply of sandalwood oil is volatile because of weather and labor issues, and difficult to scale up because of the long wait for mature trees. In fact, the global population of Santalum album, Indian sandalwood, is on the decline, according to the International Union for Conservation of Nature and Natural Resources.

“Naturals are very expensive. Think of how much water, how much land usage, how much shipping” that route requires, says Kate Prigge, manager of applied research at the flavor and fragrance maker Symrise. Quality and chemical proportions can also vary widely from year to year, she says, which are big downsides for an industry in which a predictable balance of flavor or aroma is crucial to a brand’s product identity.

By making your ingredients in the lab, using either hard synthesis or fermentation, Prigge says, “you can have a much more steady, reliable, economically priced, controlled source and get that same impression.”

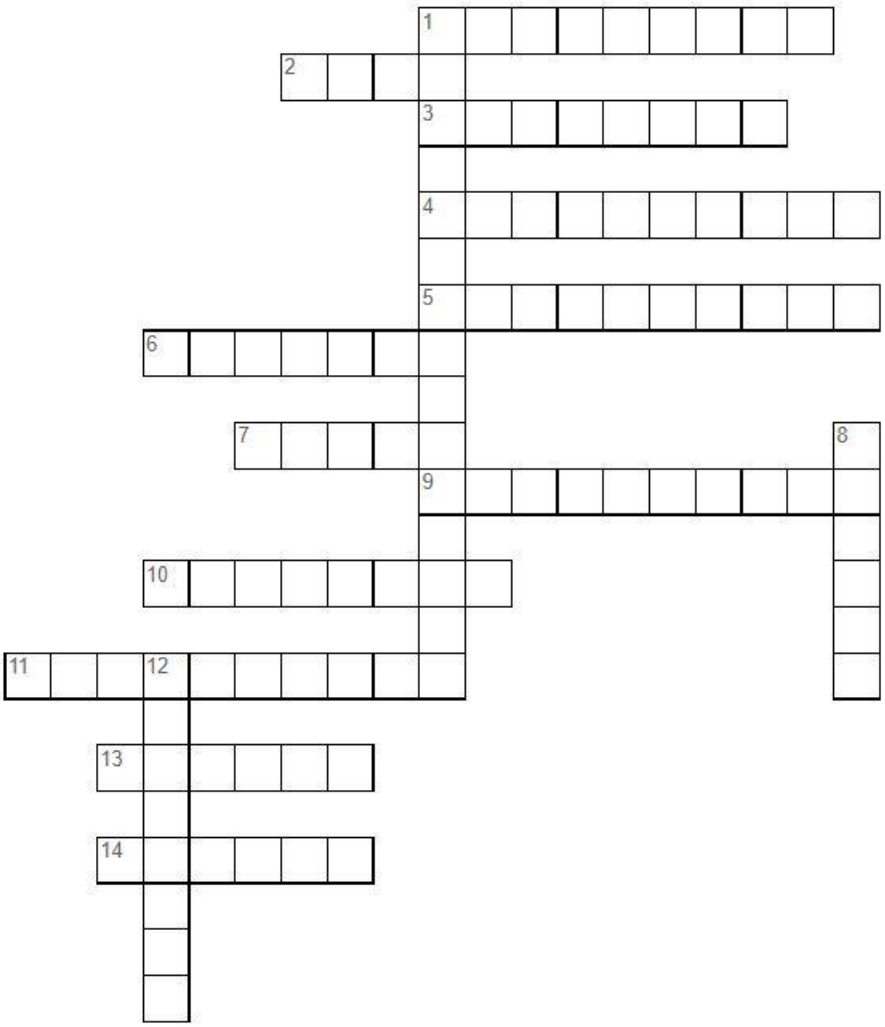
To meet the demand for natural sandalwood oil without dependence on a vulnerable supply chain, BASF is turning to fermentation. In 2019, the big chemical maker acquired Isobionics, a Dutch biotech firm focused on flavors and fragrances. In July of this year, the firms launched a microbially derived sandalwood oil replacement they call Isobionics Santalol. Isobionics also ferments several other aromatic compounds, mostly related to citrus.

Instead of relying on stressed and seasonal sandalwood trees, BASF ferments its product from cornstarch-derived sugars using Rhodobacter sphaeroides, Isobionics founder Toine Janssen says. Currently, the firm gets its raw material from European corn. Fermenting with sugar from other sources could make new facilities near target markets straightforward to build, staff, and supply. India, for example, has a customer base in Ayurvedic medical practitioners that use sandalwood oil for skin care, anxiety, and muscle spasms.

α-Santalol

β-Santalol

Chemical Engineering Crossword Puzzle

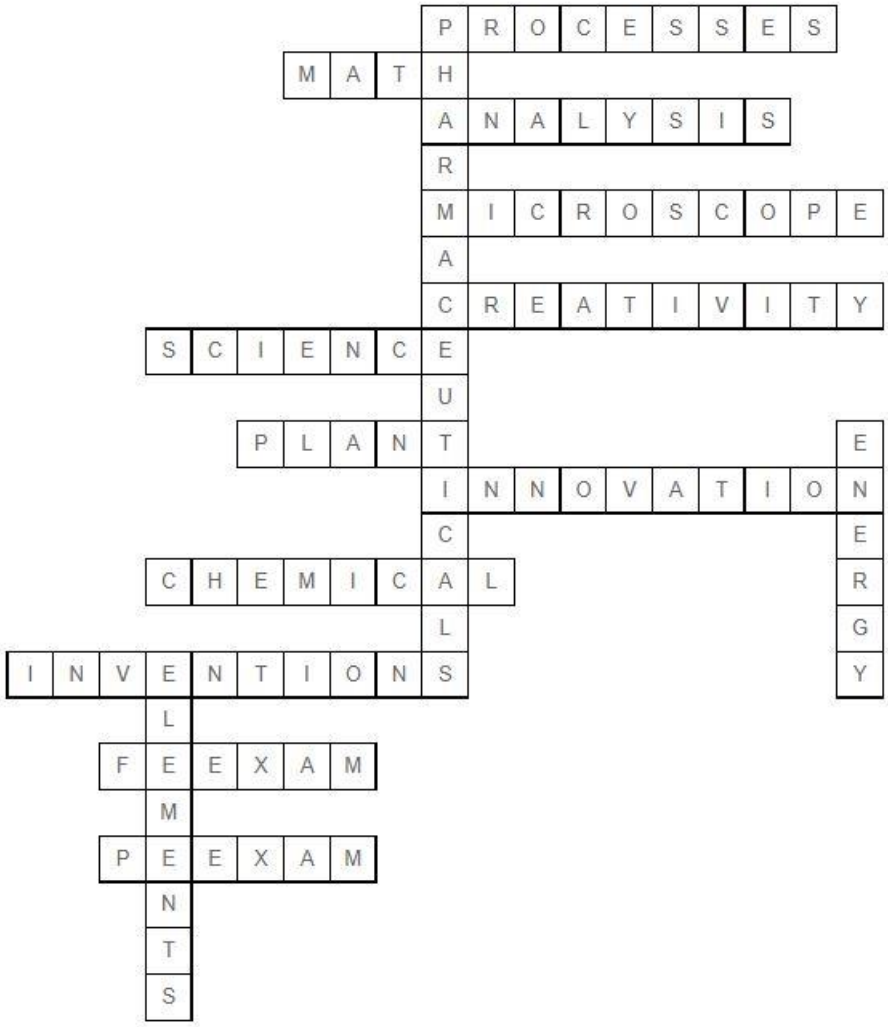


Across

1 Chemical engineers work to develop new chemical these
2 Chemical engineers must be proficient in this, relates to algebra, calculus, or trigonometry
3 When a chemical engineer examines parts he has made
4 A tool a chemical engineer may work with to look at small items
5 An important skill for chemical engineers to have in order to design new technology
6 Chemistry, biology, and physics are all types of these
7 A place where many chemical engineers work to install their devices
9 Has to do with making new, modern technology (*Blank* that excites)
10 The things chemical engineers make and work with
11 Some chemical engineers may make these and get patents for them
13 Stands for Fundamentals of Engineering Exam
14 Stands for Professional Engineering Exam

Down

1 Pharmaceuticals/A sector a chemical engineer may work in, medical drugs
8 A sector a chemical engineer may work in, something that can not be created nor destroyed
12 Chemical engineers combine these to make new chemicals, there is a periodic table of them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Thank you