Sri Venkateswara College of Engineering

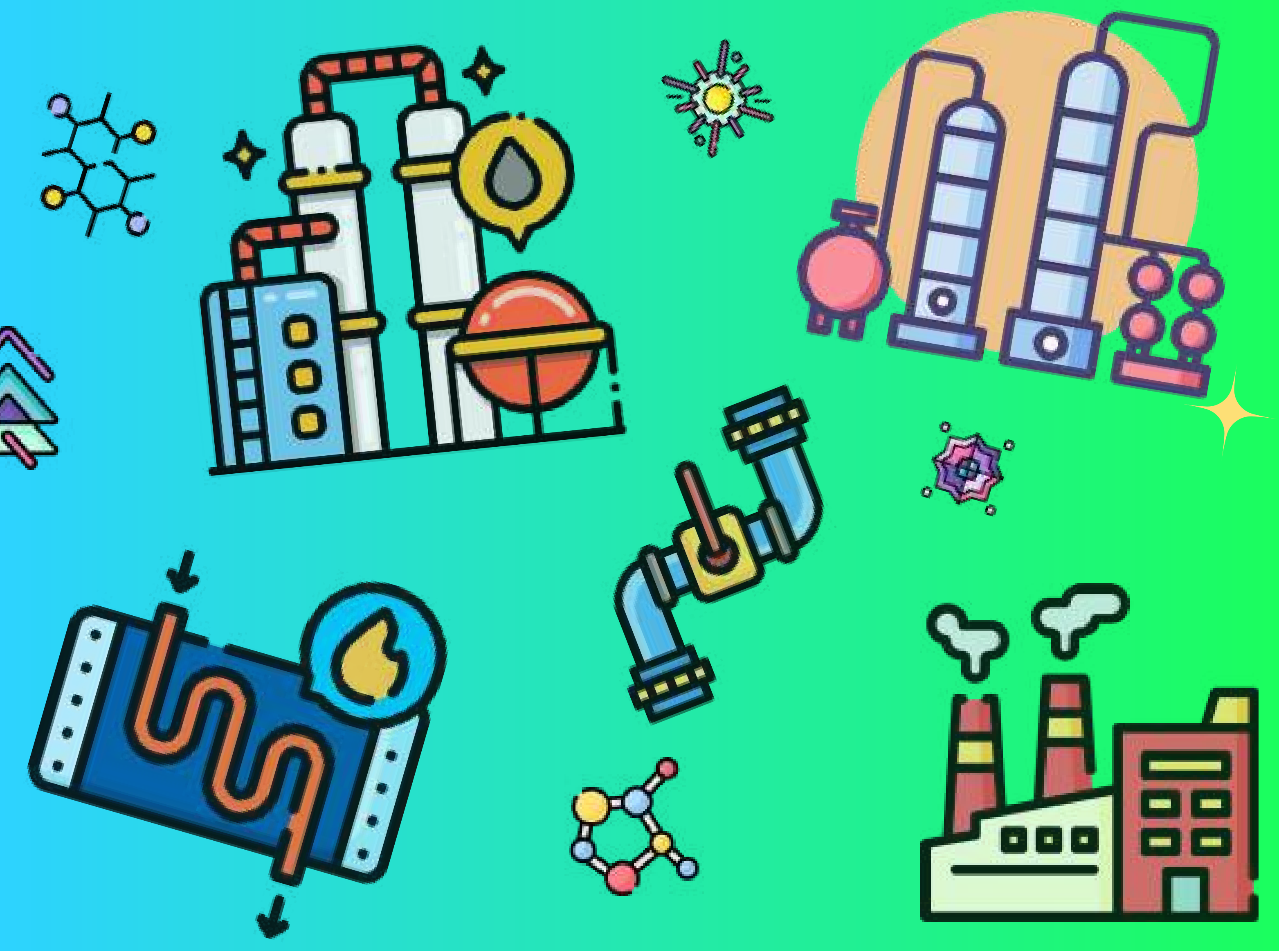
CHEMEVO

DEPARTMENT OF CHEMICAL ENGINEERING

2022 - 2023

SRI VENKATESWARA COLLEGE OF ENGINEERING

AUTONOMOUS - AFFILIATED TO ANNA UNIVERSITY



VISION

To be a leader in Higher Technical Education and Research by providing state-of-the-art facilities to transform the learners into global contributors and achievers.

MISSION

To develop SVCE as a "CENTRE OF EXCELLENCE", offering Engineering Education to men and women at Undergraduate and Postgraduate degree levels, bringing out their total personality, emphasising ethical values and preparing them to meet the growing challenges of the industry and diverse societal needs of our nation.

DEPARTMENT OF CHEMICAL ENGINEERING

VISION

To be a leader in Chemical Engineering Education and Research by providing balanced learning and fostering research to enable the learners to meet the challenges of process industries and societal needs.

MISSION

1. To produce graduates practicing Chemical Engineering professionally and ethically.
2. To produce Chemical Engineering graduates contributing to the betterment of society in the competitive global environment.
3. To focus on the development of Chemical Engineers to foster innovation through proficiency and effective communication.

ABOUT THE DEPARTMENT

The Department of Chemical Engineering was started in the year 1994. The Department currently offers a 4-year B.Tech and 2-year M.Tech programmes in Chemical Engineering. The Department has been recognized as a Research Centre for Ph.D. Programmes by Anna University from 2011. The Undergraduate programme is approved by AICTE and accredited by National Board Accreditation (NBA), AICTE, New Delhi. The Department has taken several Strategic Initiatives to fulfill the ever-growing local and global demands in allied Chemical Engineering streams. All the laboratories contain state-of-the-art infrastructure facilities for academic and research needs and are fully equipped with the latest equipment and advanced software packages like ANSYS FLUENT, ASPEN-HYSYS, PROSIM and MATLAB. In addition, the Department has a CTS-sponsored Process Modeling and Simulation Laboratory and an exclusive, industrial-grade “Distributed Control System” (DCS) in the Process Control Laboratory. The Department has qualified & experienced faculty and staff members, who possess a deep commitment to nurturing the next generation's education and consistently pursue excellence in all areas of their expertise. The Department is also engaged in research activities in the wide areas of Chemical Engineering, Environmental Engineering, Fuel Cell Chemistry, Process Control and other related areas. The Department organizes a National Level Technical Symposium “PANSOPHY” every year and also organizes STTP/FDP/Seminars/ Workshops periodically.

MESSAGE FROM THE SECRETARY

Dr. M. Sivanandham
SECRETARY

Chemical Engineering is a field that has continuously contributed to the betterment of society and industries through innovations and advancements. In today's world, where sustainability and environmental consciousness are paramount, the role of Chemical Engineers becomes even more critical. These professionals play a crucial role in developing processes and technologies that are both efficient and eco-friendly. As the Secretary of SVEHT, I am delighted to announce that the Department of Chemical Engineering is launching a e-magazine dedicated to this dynamic field. This magazine will serve as a platform to showcase the ground-breaking research, projects, and achievements of our esteemed faculty members and talented students. It will provide insights into the latest developments in Chemical Engineering, including cutting-edge technologies, sustainable practices, and their applications in various industries. I am confident that this e-magazine will not only disseminate valuable knowledge but also ignite a passion for research and innovation among our readers. I extend my heartfelt appreciation to the editor and the entire editorial team for their efforts in bringing this initiative. Their dedication and hard work will undoubtedly make this e-magazine a tremendous success.

Secretary

MESSAGE FROM THE PRINCIPAL

Dr. S. Ganesh Vaidyanathan
PRINCIPAL

In the realm of scientific and technological progress, Chemical Engineering stands tall as a discipline that has revolutionized numerous industries, touching every aspect of modern life. It is with immense pride and enthusiasm that I extend my heartfelt congratulations to the Department of Chemical Engineering on the launch of their much-awaited magazine. This magazine comes at a time when the world is seeking innovative solutions to address global challenges, and the Department of Chemical Engineering has consistently been at the forefront of such endeavours. The magazine promises to be a valuable resource, providing valuable insights into the latest research, developments, and breakthroughs in the field of Chemical Engineering. It will be a testament to the relentless pursuit of excellence by our faculty and students. My heartfelt appreciation goes to the faculty members and students for their dedication and hard work in bringing this magazine. May this magazine illuminate minds, spark innovation, and reaffirm the vital role of Chemical Engineering in shaping a sustainable and prosperous future for all.

Principal

MESSAGE FROM HEAD OF THE DEPARTMENT

Dr. N. Meyyappan
HEAD OF THE DEPARTMENT

The Department of Chemical Engineering at SVCE has been a pioneer in providing exemplary education and fostering a research-driven environment since its inception. As the Head of the Department, it fills me with immense pride to introduce our exclusive magazine dedicated to showcasing the exceptional work and accomplishments of our students and faculty members. Chemical Engineering is a domain that constantly evolves to address the ever-changing needs of society. Our department has been committed to staying at the forefront of these developments, equipping our students with not only theoretical knowledge but also practical skills and problem-solving capabilities. This magazine serves as a testament to our commitment to academic excellence and innovation. Through this magazine, we aim to offer readers a glimpse into the diverse research areas explored by our students and faculty. It will feature cutting-edge projects, sustainable solutions, and novel technologies that have the potential to impact industries and improve lives. "CHEMEVO" will not only inspire researchers and professionals but also engage a broader audience, raising awareness about the significance of Chemical Engineering in addressing global challenges. I would like to extend my heartfelt gratitude to the entire editorial team for their tireless efforts in making this magazine a reality.

Head of the Department

FROM THE EDITOR

S. Supraja

"The joy of discovery is certainly the liveliest that the mind of man can ever feel."
– Claude Bernard

Greetings, my dearest readers,

Chemical engineering has always been a dynamic and ever-evolving field, with its professionals consistently rising to meet challenges head-on. The world around us is a complex web of interconnected processes, and it is the adeptness of chemical engineers that allows us to make sense of it all. From optimizing manufacturing processes to designing environmentally sustainable solutions, the prowess of chemical engineers is indispensable. This edition of CHEMEVO celebrates their unwavering commitment to finding innovative answers to some of the most pressing questions of our time. Let us recognize and appreciate the remarkable contributions of chemical engineers to our society and their profound impact in shaping a safer and more efficient world. Their ingenuity paves the way for progress, and their vigilance ensures that this progress is achieved without compromising safety. From innovative reactor designs to breakthroughs in materials science, CHEMEVO contains enlightening articles that explore cutting-edge technologies, sustainable practices, and collaborative endeavors that are driving chemical engineering forward, standing as a testament to the dedication and brilliance of chemical engineers across the globe.

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ASSISTANT PROFESSOR / CHE

SREE HAREEHARA SUDHAN EDUCATIONAL TRUST AWARD WINNER

Ms. Poojitha Bhaskara

2022 - 2023

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2022 - 2023

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2022 - 2023

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2022 - 2023

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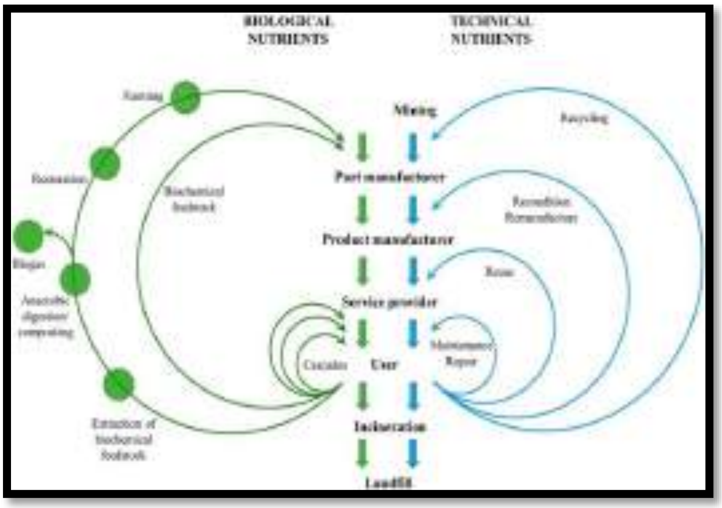
Circular economy

Circular economy is an industrial system that focuses on designing closed loops that are restorative or regenerative in nature. To achieve this, the value and utility of a product, component, or material must be retained for as long as possible. With this approach, waste is reduced to a minimum as everything produced is reused somewhere else continuously

Nothing is lost, everything is transformed.

It is to be noted that the approach doesn't aim to end growth rather it aims to bring industries in harmony with nature. Essentially a circular economy imitates our planet's circular system, where the products andprocesses are designed in a way that all waste becomes the raw material for another. The current paradigm, which follows a"take-make-use-waste" method, is the foundation of the linear economy. This method is both economically and environmentally unsustainable, as we see it destroy ecosystems and contribute to chemical pollution. This practice is no longer compatible with the world's ever-increasing needs. This is why a circular economy is necessary order to ensure economic growth and reduce environmental impact.

The Butterfly Diagram



The circular economy system diagram otherwise known as the butterfly diagram is a powerful tool that helps in visualizing how this circularity approach works. It illustrates the continuous flow of materials in a circular system. The system can be divided into two fundamental cycles - the **technical cycle** where products are reused, remanufactured, and recycled and the **biological cycle** where biodegradable materials are returned to the earth through various processes.

Principles of Circular Economy

As said by the Ellen MacArthur Foundation, the circular economy is based on three main principles:

Eliminate waste and pollution.

Around 80%of environmental impacts can be identified during the design process. A mentalityshift is required to see waste as adesign flaw inorder to assure aregenerative process.

Circulate products & materials.

Living on a planet with finite resources, products and materialsthat are constructed must be maintained in the economy for aslong as possible. For the circularity to continue, it is equally crucial to reintegrate these resources into tsystem after use.

Regenerate natural systems

As the most transformative principle of the circular economy, it emphasizes actively enhancing ournatural environment. Rather than trying to do less harm to the environment, it is vital to do good for the environment

The Role of ChemicalEngineering

Chemical engineering focuses on the analysis of chemical plantoperations and designs to improve production. All process industries, including those that deal with chemicals, water, food, polymers, and petrochemicals, utilize this engineering discipline. Chemical engineers deal with raw materialsto create practical, profitable processes that transform them into finished goods. Additionally, this industry contributes significantly to recycling, whether it be mechanical, organic, or chemical, whichfurthers its inclusion in the circular economy.Hence it is natural that the sector that makes products and materials more durable order to extend their lives and reduce waste would contribute to the global shift from a "take-make-use-waste" to a "grow-make-use-restore"paradigm. Therefore, the production processes must be more sustainable in allaspects.

DyeCoo, a Dutch textile company, has developed a process to dye clothes without the need for water or any other chemicals outside the dye itself. It uses highly pressurized supercritical carbon dioxide to dissolve the dye deep into the fabric. The carbon dioxide is evaporated and recycled to reuse it. The process takes half the time, uses less energy, and even costs less.

Conclusion

The road to a circular economy is not a straight one. It will involve a network of businesses, industries, companies, and consumers to collaborate and reach the circular targets. It may seem that the shift to a circular economy is progressing slowly. However, there are many companies that are on the way to developing full-fledged ways to bring about a closed-loop system. Ideally, the planet will transition to a closed-loop economy where all activities are in harmony with the environment.

Jyotsna Sudhi Mithran

1st year

Process simulation and simulation softwares their impact and future in chemical engineering

What is Process Simulation?

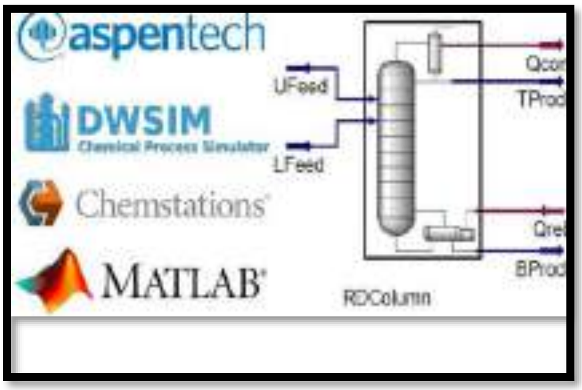
Process Simulation is a methodology used in the chemical engineering field to predict, model, design, understand, and optimize the rate, flow, nature and the input-output of the reactions occurring in industrial scale unit operations and equipments, exponentially increasing the research and testing capabilities for an equipment

Need for Process Simulation

In an era where the volume of industrial production and consumption is rapidly increasing and at staggering amounts, it's integral to be most efficient in performing a process as in chemical engineering, product equals money, and better quality always prevails... It's essential for a production/process firm to find a sweet spot between cost of operations, raw materials and the yield volume, efficiency and profit. This is where we, chemical engineers, also known as process engineers, come into the scene. Over the years of development in processes and process technologies, testing and predictions of the product produced was largely done in situ(in the production plant) and with the target equipment or unit operations, this was mostly inefficient given the sheer volume of raw materials required per running of the industrial scale units. After the advent of computers and computing machines, this testing and research of processes slowly started to shift towards automation and digitisation. Even though direct testing of real life equipment gives details up close on the exact operation, it's often too expensive and inflexible as minor changes require repeated running which again consumes a lot of cost.

A simple analogy of cooking can be given wherein while preparing a new dish for tomorrow's buffet holding 60 people, a chef never makes 60 portions repeatedly and tinkers with the ingredients and quantity or cooking time, rather, they make the dishes in a smaller quantity, one at a time, one change and eventually upscale from there, this is exactly what we try to do in process simulation.

Process design/simulation engineers simulate processes and reactions and optimize the requirements, yield, efficiency and the economics of the production process by trying to replicate real life conditions and factors in simulation softwares and process models and come up with the most reasonable way to run a process, in short, they must idealise the reaction by varying conditions and studying the effects!



Tools of chemical process simulation- Simulation Software

These are few of the most prominent softwares that are used in the field of chemicalengineering and they are mainly of three categories:- Mathematical modelling, Process Simulation and Computational flow dynamics. The simulation factors and condition of theother two depend on the mathematical model ofthe system giving an insight into the key quantities involved in affecting the output. CFD and Aspen work on programmed mathematical models of systems in order to develop and simulate certain conditions. Autodesk is the key provider of such simulation and modelling software like Matlab, Aspen and Autodesk CFD,CHEMCAD etc...

A key question arises here: "Is studying and mastering a process simulation software necessary to be a good chemical engineer?". The short answer is No. The long answer however, is that the process design and simulation are developing and integral domains in chemical engineering that are starting to slowly take over process control and reaction engineering... If one can master one or more of these softwares, they can set themselves up for the developing future of this field, else one can still be a good engineer and have expertise in other developing chemical engineering domains- ex: Energy engineering and fuel cells. Remember, Chemical engineering is the most versatile and flexible engineering degree out there!

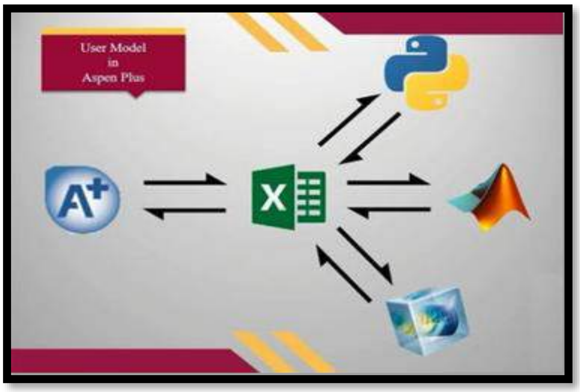
Pros & Cons Autodesk is the key provider of such simulation and modelling software

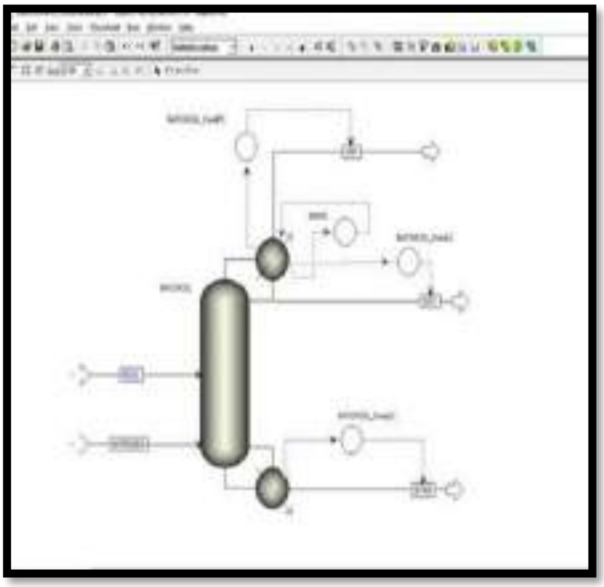
PROs:

- Saves TIME!
- Let us picture the process: size, types, dimensions, duties, utilities, costs, etc... Can be used for "what-if" scenarios
- Saves human error

CONs:

- Will always depend on final decision ofthe engineer
- It will never be 100% accurate
- it bases in several models, iterations andnumerical data which can stil have error within
- Process Simulation is not a GOAL but rather a tool to achieve another GOAL Will still account for RISKS





Methodology of mathematicalmodelling a Process Simulation

Efforts are made to develop new and improved models for the calculation of properties. This includes for example the description of thermophysical properties like vapor pressures, viscosities, caloric data, etc. of pure components and mixtures. Different apparatus like reactors,distillationcolumns,pumps,etc.

Monitoringofchemicalreactionsandkinetics Abidingto environmentalandsafety-related dataand regulations.

Thereare4stagestoaprocessmodel: -

(i) Formulation: The variables, the operation, reaction and its conditions are defined and fixed, a mathematical relation describing the systemiscreated&definesthesystemstate.

(ii) Solution: The mathematical relation is solved for the necessary requirement and the solution is arrived upon and implemented.

(iii) Interpretation: Model is observed, and interpretations are done about the system's changeofstatefordifferentconditions.

(iv) Validation: The physics and outcome has to be validated by the process design engineer

Conclusion

Process Simulation is powerful as it will allow us to save a ton of time, money, resources and even human lives. It allows us to open a new panorama, as now our imagination is not the limit, rather what we input/output in the process simulator, we can test multiple case studies in order to verify the best case or the optimal condition. With the development of Industry and tech 4.0(Second information revolution), the amount of simulations and predictions are exponentially increasing thanks to the anchor of big data, cloud computing and data science. The huge volume of data generated by industrial equipment can be directly linked to cloud via internet and AR & then we can analyse the data to find discrepancies or improvements, but also this data will serve as the precursor to future equipment design.

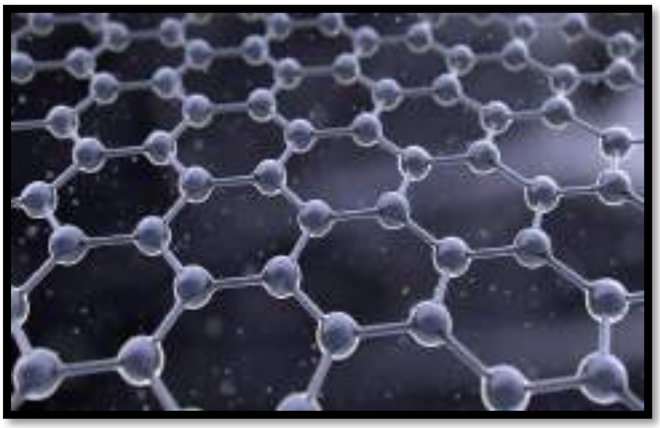
SKY IS TRUELY THE LIMITS FOR CHEMICAL PROCESS SIMULATION

By Santhosh r

2^{nd} year

Nanotechnology: Empowering the Chemical Industry's Advancement

Nanotechnology is an upcoming branch of Science and Engineering. It is defined as the controlled manipulation of nanomaterials with at least one dimension less than 100nm. One of the main research fields right now is nanotechnology, which combines chemistry and material science to produce previously unidentified features that can be used to open up new industry prospects. Commercial uses of nanotechnology are growing in chemical firms that provide lubricants, better catalysts, coatings, filtration systems, and other finished goods. The development of nanostructured catalysts with improved physiochemical characteristics is currently the main focus of study. It has been established that carbon nanomaterials like CNTs, Graphene, and Fullerene are an enabling technology for developing high-performance energy-conversion and storage systems. The field of nanotechnology provides the chemical industry a variety of research tools, new materials, modern fabrication techniques, nanoelectronics including nanoparticle technology, and innovative unknowns like nano-CDs and quantum computers.



Role of Nanotechnology in Chemical Industry

Nanofiltrations

Nanofiltration is a pressure-driven membrane process that lies between ultrafiltration and reverse-osmosis in terms of its ability to reject molecular or ionic species. Membrane processes are considered prime components of advanced water purification, desalination, and remedial technologies. Nanomaterials like carbon nanotubes, nanoparticles, and dendrimers are contributing to the development of more efficient and cost-effective water filtration processes. There are two sorts of Nano technologically developed membranes: nanostructured filters, where either carbon nanotubes or nanocapillary arrays provide the premise for nanofiltration, and nonreactive membranes, where functionalized nanoparticles aid the filtration process.

Nanocatalystis

The application of nanoparticles as catalysts is a rapidly growing field in nanoscience and technology. The properties of noble metal nanoparticles make them ideal materials for nano catalysis, where reaction yield and selectivity are dependent on the nature of the catalyst surface. Compared to bulk materials, nanoparticles have high surface-area-to volume ratio and thus found to exhibit higher turnover frequencies. Because of their complex physicochemical properties at the nano meter scale, even characterization of the varied active sites of most commercial catalysts proves to be elusive. A key objective of nano catalysis research is to produce catalysts with 100% selectivity, extremely high activity, low energy consumption, and long lifetime. This will be achieved only by precisely controlling the shape, size, spatial distribution, surface composition and electronic structure, and chemical and thermal stability of the individual nanocomponents.

Nano lubricants

The most traditional method of lessening wear and friction on mechanical parts in reciprocal motion is lubrication. However, rising demand and ongoing resource depletion are compelling us to take the essential measures in energy preservation and conservation. An effective way to conserve energy is by nano lubrication. When nanoscale particles are added to lubricants, the tribological properties can be improved, which saves energy. Even a little concentration of nanoparticles may be sufficient to boost the tribological properties of the system. When there is a small load between the sliding parts friction reduction is principally ascribable to the bearing-like behavior of nanoparticles that roll between the contact surfaces keeping their shape intact. For very high load conditions a coating induced by the presence of nanoparticles is deposited on the crests of surface roughness and it can reduce direct contact between the asperities. Thus, minimize wear.

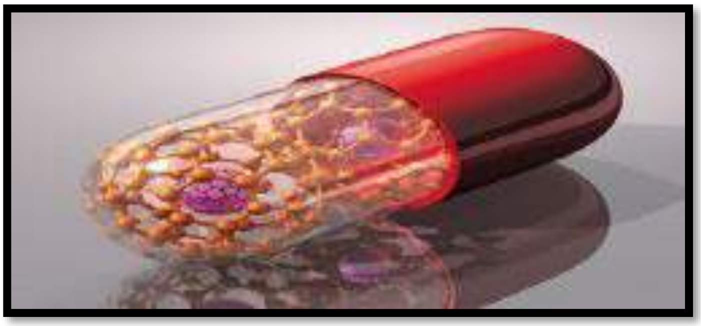
Nano fertilizers

With rapid increase in population, the world would require upheaving the global food production by approximately 70%, this according to researchers can be achieved by using nano fertilizers. A nano fertilizer refers to a product that delivers nutrients to crops in one of the 3 ways. The nutrient can be encapsulated inside nanomaterials like nanotubes or nano porous materials, coated with a thin protective polymer film, or delivered as particles or emulsions of nanoscale dimensions. Attributable to a high surface area to volume ratio, the effectiveness of nano fertilizers may surpass the foremost innovative polymer-coated conventional fertilizers. Slow-release fertilizers are excellent alternatives to soluble fertilizers as nutrients are released at a slower rate throughout the crop growth; plants are ready to take up most of the nutrients without waste by leaching. Fertilizer particles are coated with nanomembranes which relinquish the nutrients slowly and steadily.

Pharmaceuticals

Nanotechnology in medicine is going to have a major impact on the survival of the human race.

Application of nanotechnology into pharmaceutics helps in the formulation of more advanced drug delivery systems and so it is an important and powerful tool as an alternative to conventional dosage form. Pharmaceutical nanotechnology is a specialized field which will change the fate of the pharmaceutical industry in near future. The utilization of various pharmaceutical nanocarriers has become a significant area in nanomedicine. Nanotechnology promises precisely targeted drug delivery of therapeutic molecules to the diseased areas of the body It helps to fight against several diseases by detecting the antigen associated with diseases and also by detecting the microorganisms and viruses causing the diseases. Pharmaceutical nanotechnology consists of two main objects: nanomaterials and nanodevices, which play a vital role in pharmaceutical and other areas. It achieved the dream of delivering a pharmaceutically active molecule to a selected site within the body.



Chemical Sensors

A chemical sensor is a self-contained analytical device that may provide information about the precise chemical composition of its environment. The information is available in the form of a measurable physical signal that’s correlated with the concentration of a specific chemical species. Nanotechnology can allow sensors to detect very minute amounts of chemical vapours. Due to the tiny size of nanoparticles, some gas molecules are sufficient to alter the electrical properties of the sensing elements.

nano-based coatings are widely used today, for example, to functionalize surfaces, for protection against corrosion and dirt, to forestall biological soiling and graffiti, or to form attractive designs by special color effects. Nanotechnology-based functional coatings typically contain the subsequent substrate. "Smart coatings" or "Nanocoatings" are coatings with additional functions like thermal insulation, self-cleaning properties, controlled release of active ingredients, or self-healing functions. Novel nanomaterials: Carbon black, titanium dioxide, silicon dioxide, iron oxide, zinc oxide, and silver

Nano coating

Coating is a coherent layer formed from single or multiple application of coating material to a nano-ceramic coating on car's surface

Advantages

- Significant advancements in technology Revolutionized many industrial sectors.
- Environmental, food safety, and energy sectors are evolving quickly.
- Able to manipulate objects at the atomic level and self-replicate using materials available.
- Can detect identify and neutralize harmful chemicals from air, soil, and water.

Disadvantages

- Possibility of unemployment in industrial sectors
- Unknown environmental, health and safety risks
- It could make conventional energy resources obsolete

Conclusion

Every field of science, technology, and business is significantly impacted by nanotechnology. This will only increase new ways for development in the future. Thus, nanotechnology will be the chemical industry's future

TR BHARGAVI

2ND YEAR

FORWARD OSMOSIS

INTRODUCTION:

Forward osmosis (FO) FO uses osmotic pressure to move water spontaneously through a semipermeable membrane from the feed saline water to the draw solution (DS) . The FO method is regarded as an effective desalination treatment. It can help to decrease membrane fouling and scaling issues at the RO stage and consume less energy when FO is used as a pretreatment for the RO process. A seawater desalination facility could be established utilizing a FO-RO hybrid technology. The FO-RO Hybrid Desalination Research Center (FOHC) has investigated this with the intention of building a FO-RO hybrid pilot plant with a 1000 m3/day capacity and consuming about 35% less energy than a standard SWRO plant.

REVERSE OSMOSIS vs FORWARD OSMOSIS

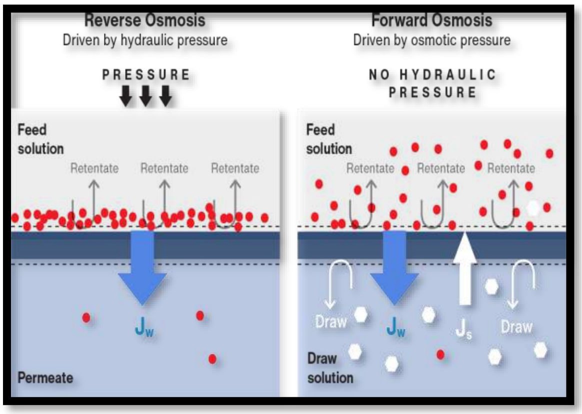
In reverse osmosis, the osmotic pressure of the water is overcome by using hydraulic pressure to drive it through the membrane. More pressure is required the more salty the feed solution is. Because of this, high-pressure pumps and tanks are needed, which consume a lot of energy. Additionally, brackish water membranes, seawater membranes, high-pressure or ultra-high-pressure membranes with an operating pressure range between 1,000 and 1,740 psi and the ability to deliver brine with Total Dissolved Solids (TDS) of up to 75,000 ppm are needed for reverse osmosis. Due of the pressure requirements, the viability of reverse osmosis typically begins to diminish at brine TDS values beyond 75,000 ppm.

On the other hand, forward osmosis runs a highly saline draw solution on the other side of the membrane to promote the flow of water through the membrane using natural osmotic pressure. This means that low pressure hydraulics are not necessary because the feed solution passes through the membrane at a relatively low pressure. The primary distinction between forward and reverse osmosis is this.

Why forward osmosis?

Fouling and scaling, where oxidants, scaling ions, and organic and chemical waste accumulate on the membrane surface, is a well-known problem with reverse osmosis membranes. The membrane becomes less effective as a result, necessitating periodic maintenance and backwashing. Reverse osmosis membranes should, in theory, only be able to process pure water and salt, however due to the complicated makeup of industrial wastewater effluent, this is rarely the case. The low feed solution pressure of forward osmosis makes the FO membrane less vulnerable to scaling and fouling problems. This increases the membrane's lifespan and lessens the necessity for cleaning the membrane.

In short, there is a lower possibility of scaling and fouling in forward osmosis unlike reverse osmosis



ADVANTAGES

The treatment of industrial effluents containing a variety of pollutants as well as the treatment of salty waters can both benefit greatly from forward osmosis (FO).[35] The FO membranes are highly effective and flexible in that they can be adjusted to the appropriate water quality when these draw effluents have moderate to low concentrations of removable agents. When paired with other types of treatment systems, FO systems are also very helpful since they make up for any shortcomings the other systems may have. This is beneficial for processes like the manufacture of biogas when the recovery of a specific product is necessary to cut costs or increase efficiency.

INDUSTRIAL USAGE : Few FO membrane techniques (and membrane technologies in general) are now used in industry due to their complexity, expense, and extensive cleaning requirements. Additionally, they occasionally only function at specific conditions that aren't always guaranteed in industry. The goal of membrane technology going forward is to make it more adaptable and suited for widespread industrial use. This will be accomplished by making research investments and gradually bringing these improvements to market, lowering production costs as more membranes are made. If the current trend continues, membranes will be widely used in a variety of industrial processes (not just water treatment) within a few years.

APPLICATIONS

Emergency drinks:

One example of an application of this type may be found in "hydration bags", which use an ingestible draw solute and are intended for separation of water from dilute feeds. This allows, for example, the ingestion of water from surface waters (streams, ponds, puddle)that may be expected to contain pathogens or toxins that are readily rejected by the FO membrane.

Desalination

Desalinated water can be produced from the diluted draw , using a second process. This may be by membrane separation, thermal method, physical separation or a combination of these processes. The process has the feature of inherently low fouling because of the forward osmosis first step, unlike conventional reverse osmosis desalination plants where fouling is often a problem.

Food Processing

Although osmotic treatment of food products (e.g., preserved fruits) is very common in the food industry, FO treatment for concentration of beverages and liquid foods has been studied at laboratory-scale only. FO has several advantages as a process for concentrating beverages and liquid foods, including operation at low temperatures and low pressures that promote high retention of sensory (e.g., taste, aroma, color) and nutritional (e.g., vitamin) value, high rejection, and potentially low membrane fouling compared to pressure-driven membrane processes.

DISADVANTAGES

The main disadvantage of the FO processes is the high fouling factor that they may experience. This occurs when treating a high saturated draw effluent, resulting in the membrane getting obtruded and no longer making its function. This implies that the process has to be stopped and the membrane cleaned. This issue happens less in other kind of membrane treatments as they have artificial pressure forcing to trespass the membrane reducing the fouling effect. Also there's an issue with the yet to be developed membranes technology. This affects to the FO processes as the membranes used are expensive and not highly efficient or ideal for the desired function. This means that many times other cheaper and simpler systems are used rather than membranes.

RESEARCH

Direct removal of draw solutes, in this case using a magnetic field, is a current study topic in FO. When tiny (nanoscale) magnetic particles are suspended in a solution, osmotic pressures are generated that are strong enough to separate water from a diluted feed. After the FO water flux has diluted the draw solution containing these particles, they can be removed from it using a magnet (either against the side of a hydration bag or around a pipe in-line in a steady state operation).

CONCLUSION

Forward osmosis is already an highly efficient process of filtration. However, with proper methods and technology I am sure that we can benefit very efficiently and eliminate all kinds of disadvantages from the process. And I truly believe that this process could be a gamechanger considering the rising water crisis. We must be able to filter the ocean water and make it drinkable/usable. And by forward osmosis, with enough time, we will achieve this goal somed.

Akash S.S

3rd year

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