

**National Institute of Technology,  
Tiruchirapalli**

# **Chemical Engineering Association**

**The Chemie Newsletter!**

**The ChEA Editorial Team**

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## FOREWORD

The Chemical Engineering Association, NITT has flagged off a new initiative, "Chemical Engineering Newsletter" which will be published monthly by the students of Chemical Engineering Association.

The Newsletter will have bulletins of the department, and will be an asset of fascinating articles from staff and students about the research highlights, internships, physical facilities, extracurricular talents and other common items of interest.

The staff and students of the department who have been responsible for making the record of the department, and whose exclusive role in chemical education is dramatically reflected by their achievements will be replicated in the Newsletter. Hence it is a request to all the staff and students of the Department to contribute your articles and pieces of information towards the Newsletter for it to flourish.

I take this opportunity to appreciate the efforts put forth by the team of students in bringing out this Newsletter.

-By Dr. K.N. Sheeba

[Faculty Head, ChEA]

## A little about Chemical Engineering

The Oxford English Dictionary defines Chemical engineering as *"the branch of engineering concerned with the design and operation of industrial chemical plants."* In layman's terms a Chemical engineer is concerned with applying his knowledge of physical sciences, life sciences and mathematics to convert basic input to useful wide ranging products which go toward satisfying incessant demands of the public and play a crucial role in the functioning of the industrial sector.

As a student the fact that appeals the most is that Chemical engineering is one of the most versatile branches of engineering one can find. Chemical engineers can find a niche in any scientific or engineering field. They are continuously driven by curiosity and passion which leads to the urge to learn ceaselessly and foray into newer arenas. It is due to this fact that Chemical engineers are sometimes called 'Universal engineers' as their scientific and technical mastery is so broad. In this modern era, Chemical engineering serves as a principal platform for us to delve into the constitutional traits and utility of science, matter, and nature. The branches such as thermodynamics, reaction kinetics, fluid mechanics, and quantum mechanics, being the bread-and-butter components of this domain, are ceaselessly investigated with such punctiliousness and precision that until now a good number of astounding scientific outcomes have been uncovered and brought in front of the world. Chemical engineering is broader in scope than the other branches of engineering because it draws on the three main engineering foundations:



math, physics, and chemistry-whereas the other branches are based on only the first two

In today's world, where the focus has been progressively inclining towards the field of sustainable development and renewable energy, Chemical engineers are on the forefront, engaging in intensive research and development activities and are striving to push the barrier. The devastating economic recession has showed that the prevalent economic model is no longer viable in supporting the works of the sustainable and continuous economic growth necessary for the world to grow. Hence the onus is on us to transform our current technological scenario into a more proliferant, resilient and productive one. The major areas of concern are safe nuclear energy generation, reducing our carbon footprint and natural conservation. The path to advancement in these areas is nothing more than what is derived from modern Chemical engineering.

With growth of Chemical engineering, innovation, creativity and scientific knowledge have finally found the right combination to produce nothing less than miracles. More cutting-edge findings and developments will turn into reality; and in the end, we will become completely reliant on this realm to make so many other numerous advancements and broaden our perspectives on the alternative dimensions of the world we sense and explore with our hands and eyes.

-By Ashwin C.V

### In so many words

It is no joke to say that everything in our world is chemical. Be it chocolates, trees or even the 'Bermuda triangle'. Here goes.....

#### The alchemy of Chocolate

"**Chocoholics**" everywhere will tell you that eating chocolate makes them feel good, but why?

Chocolate contains more than 300 known chemicals, some of which react within the human brain to alter mood. One of these chemical reactions is the release of endorphins, proteins which occur naturally in the brain to reduce pain, which in large amounts can make you feel more relaxed or energetic.

Chocolate also contains caffeine in very small amounts, but has a lot of the weaker related Stimulant theobromine. Like caffeine, theobromine has been linked to causing migraine headaches, but its positive properties have not been ignored. In the 1940s and '50s, the Hershey company extracted the stimulant from cocoa beans and sold it to Coca Cola, which used the chemical in its soda.

Phenylethylamine is related to amphetamines, and both are stimulants of the nervous system which raise blood pressure and blood glucose levels. Practically speaking, phenylethylamine has been shown to make people feel more alert and gives them a sense of well-being.

In 1992, a new chemical was discovered, which was later found in chocolate. Anandamide is a messenger molecule that plays a role in depression, memory, and pain. The name comes from the Sanskrit word "ananda", which means "bliss". Researchers think the presence of anandamide in chocolate may explain why it is by far the most-craved food.

Anandamide is found naturally in the human body, and acts as a molecular key to receptors on



nerve cells. The anandamide key attaches to a receptor and allows ions to flow into the nerve cell, equalizing charges both inside and outside the cell. These molecular keys help alleviate pain and aid in relaxation. Pain-killing drugs like morphine and codeine mimic naturally-occurring key molecules. But scientists hope the mood-enhancing qualities of anandamine will have more benefits than just a chocolate craving. They are hoping it may contribute to finding the cure for mental diseases.

**Now you know some of the reasons why chocolate makes you feel so good. It only takes a little bit of chocolate to curtail a craving and get that cheerful chocolatey feeling! 😊**

### **Amber: Prehistoric Preservations**

Did you know that amber isn't a fossil but cross-linked polymerized terpenes? Amber is the result of sticky plant secretions (resins) that harden when exposed to air and then undergo the slow process of cross-linking and polymerization. Consequently, these resins are extremely resistant to environmental influences. Resin isn't sap but rather a mixture that consists mainly of terpenoid compounds which are both volatile and nonvolatile.

Terpenoids are molecules that have structures based on the linkage of isoprene units (C<sub>5</sub>H<sub>8</sub>). Amber containing small animals such as insects, small lizards (geckos), and small frogs has been found. In these cases the animal became stuck in the resin which has then continued to flow over it. As the resin hardens, the volatile terpenes and other vapours in the resin penetrate the animal's tissue and gradually replace the water and kill bacteria. Air, light and heat from the sun induce chemical reactions in the resin resulting in cross-linking of the terpenes. Thus, the animal is embalmed and preserved. The animal is so well preserved that in some cases

the DNA preserved has been removed and studied. **If not for amber, the world wouldn't have had a 'jurassic park' 😊**

### **The Bermuda Triangle Mystery Solved?**

**"The mysterious loss of a ship and all of its crew." "The disappearance of aircraft and the pilots as well."** These mysterious phenomena have been reported over a certain area of the Atlantic Ocean near Bermuda. While studying gas hydrates, the late Dr. Donald Davidson, a Canadian physical chemist, proposed a theory that may explain these mysteries.

At enormous pressures and low temperatures (as at the bottom of the sea), water and gas molecules form gas hydrates. These compounds resemble ice but, unlike ordinary ice, the water molecules form cages that trap gas molecules such as methane. The solid hydrates retain their stability until conditions, such as higher temperatures or lower pressures, cause them to decompose. This decomposition releases enormous amounts of trapped gas.

The disappearance of ships and aircraft may be the result of these natural gas blowouts. This could turn the sea, very briefly and without notice, into a mass of froth that could sink any ship in the area. As the methane gas rises, an airplane flying through the gas would experience engine failure, or worse: a spark from the engine could turn the aircraft into a flying fire ball.

-By Shreeja Narayanan  
& Vanadana Swaminathan



## 'My Summer Internship @ Schlumberger Technology Center, Tokyo, Japan – Summer 2011'

It was one of the Dream time experiences that I got to live, when I interned at one of Schlumberger's most prestigious Technology Centers, in Fuchinobe – Tokyo, Japan.

To give a brief introduction, Schlumberger is an Oilfield Service company, which provides solutions to the various Oil Firms around the globe. Schlumberger provides services in terms of Drilling, etc. Oil Firms need Schlumberger, because they have the best Technology in the world, to bring out the oil located deep beneath the earth's surface, at low costs, as well as to provide integrated solutions to the various other problems that an Oil firm might face. The work climate here defines the term Multinational! It was truly amazing. One gets to work with people all around the globe. I got to work with a Team of 14, comprising of 8 Japanese, 2 Malaysians, 1 South African, 1 Russian and 2 Americans. If one has the potential, sky is the limit in this kind of a company. But work is tough, and demanding. Everything is SPEED here! Nothing is delayed. Parallel processing is one of the most required skills for a person to survive here. For a starter, Schlumberger does not look much for the soundness in technical skills. It rather looks more at how smart a person is, giving solutions at ones best, to real time problems .

During my internship tenure, I was assigned to the Methane Hydrates Research& Development (MHRD), team. Methane Hydrates (Methane Gas trapped within chunks of Ice deep underground), is one of the prospective Natural Resources, apart

from Oil & Gas, and it is a resource which has recently been discovered. Methane Hydrate reservoirs across the globe have been found to be 3 times as large as the Oil & Gas reservoirs, that have ever been discovered till date! That means, we are talking about a potential energy source for the world that would last for the next 600 years easily. These hydrates are found mostly under the sea bed, and also under the permafrost land regions (Arctic areas such as Canada, Russia). Research has been going on for the past 10 years only, and an efficient system for the extraction of Methane Gas from beneath the earth's surface is yet to be found. Various problems have been faced with the currently used extraction methods, and alternatives are being discovered. It is not as similar as the drilling operations for extraction of Oil & Gas.

Schlumberger-Japan is developing Monitoring Tools for deployment in the Nankai Trough Seabed located along south western coast of Japan, which was found to have a lot of Methane Hydrate Reserves. As a chemical engineer, I was given responsibility, for conducting experiments to determine the corrosion effects on O-Rings (used as Sealants in the Monitoring Equipment) under the Ocean, as well as determining the appropriate power source for the Equipment, in order to stand alone on the Seabed for a period of two years. I was treated like a proper employee, being given equal responsibilities like the others. This made it stressful, but it was fun and totally worth it! I handled equipments, which were the best amongst the lot in the world. Most importantly, I was allowed to make mistakes, provided I learnt from them, and delivered. This is some equation which I bet many other places wouldn't have.



Being a sophomore student, I couldn't have expected a better internship experience, anywhere else in the world.

-By Harish [3<sup>rd</sup> Year]

### HEALTHY LAB PRACTICES

Many a time, even the most cautious and the well behaved entities of the classroom take the laboratories for granted and exhibit a level of unruliness which may not always end up in a pleasant scenario. Establish and follow safe chemical storage procedures in laboratories to maintain an accident free zone

- While working outside normal hours ensure that information about your presence in the laboratory is available to another person.
- Avoid all skin contact with toxic and corrosive chemicals through minimum usage and use of personal protective equipment..
- Ensure good housekeeping, adequate spacing between experimental setups.
- While handling flammables ensure that no ignition sources are available in the vicinity; in case highly flammable substances are in use consider use of sensors to detect leakages if reasonable amount of inventories are available
- Use signage to demarcate work areas subject to non-chemical hazards such as noise, temperature, radioactivity, microwave exposure, etc.
- Document any known hazardous properties of new chemicals, nanomaterials, toxins, etc

- While using a chemical ensure that information on other chemicals which are incompatible with the former.
- Segregate and avoid simultaneous use of all incompatible chemicals
- Maintain adequate number and type of personal protection equipment and first-aid kit
- Maintain adequate type of equipment and devices to manage accidental spills and releases of hazardous chemicals
- Investigate all 'abnormal occurrences' that lead to (or potentially may have led to) impact on a laboratory personnel / external environment
- Document lessons from abnormal occurrences and publicize them to prevent recurrence
- Ensure that there is an emergency exit in the laboratory and always keep it clear.

-By Vandana Swaminathan  
& Shreeja Narayanan. [3<sup>rd</sup> Year]



## The TUM Experience

Hello everybody. Guten Tag! Mein name ist Smriti Gupta und ich ein WISE scholar 2011.

I spent 70 days at the Technische Universität München, under the guidance of Prof. Dr. Johannes A. Lercher, at the department of Technical Chemistry II. It was an amazing research experience with the state-of-art facilities, fully equipped laboratories and the gentle, kind and humble attitude of the faculty and research staff at my institute.

I worked in the field of heterogeneous catalysis under the topic '*Catalytic technology for carbon dioxide reforming of methane to synthesis gas*'. This project was being carried out by a Ph.D. candidate, Linus Schulz, and my work comprised of carrying out synthesis of catalysts and testing them on the experimental setup. I had access to most of the instruments in the lab as and when required. TUM München follows the *Central Institution Facility*, wherein every department has access to all the laboratories and the instruments in the campus premises. The labs are under the control of the central administration and time slots are allotted for every individual who wants to avail the facilities. There is a shop in the basement of the chemistry department which provides easy purchase of chemicals at the spur of necessity. Each Ph.D. has a shopping card which can be used for the same. There are many other basic amenities in the campus itself which promote a lively and scientific attitude amongst the students of the university.

The freedom given to pursue research in your own area of interest makes work more interesting and enjoyable. I had to present my work every Monday and report to my guide on the progress made in the project. I worked on the BET surface area analyzer and the XRD for characterization of the catalysts. I also got acquainted with the data processing software for GCMS (Gas Chromatograph Mass Spectrometer). I made a couple of friends in the laboratory who helped me at every stage of my experiments and readily attended to my doubts. At the end of my internship I was asked to submit a report of the project work. TUM has industrial collaborations with many renowned companies like Bayer, GlaxoSmithKline and others. All the partner industries carry out their research with the help of the students pursuing their Ph.D. in the institute. I also characterized some of the samples for an industry and that came out quite well 😊

Well, some of the many qualities I found in Germans were punctuality (count of time), easy going life (happy-go-lucky kind) and an innovative work culture. They are very sincere and devoted, trying to accomplish their tasks set for the entire week. They are highly organized with proper planning and execution strategies.

On the whole, this summer was the best of what I had seen till now, and DAAD had done a great job in giving us this precious opportunity of experiencing life and work in Germany. Truly said, Germany is 'A land of ideas'! 😊

-By Smriti Gupta [Final Year]



CHEMICAL ENGINEERING  
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