

Department of Chemical Engineering

DEUS X CHEMICA



MIDAS
SAFETY

Table of Contents

3

Introduction

4

Messages

14

Introduction to
SCHEME

18

Engineering at
Home

19

Research Abstracts

21

Monster Crude

23

Tesla

27

Coal Water
Slurry as an alternative
fuel

29

Emerging
Technologies

30

Nanotechnology

31

Synthesis of
Graphene from
indigenous coal

33

The War of Choices

34

Apprentice's
Institution

43

Unveiling Chemical

35

Microsoft
HoloLens

44

Batch Photos

37

Management of
Heat Transfer Fluids

45

Internship Experiences

39

Low Temperatures,
Big Chills...

40

Production of
Date Juice

42

Final Year Projects

Finito

Introduction

You may have been wondering with just a mere glance at the front cover, what exactly Deus Ex Chemica is and probably how to pronounce it. Let's start with the pronunciation before we discuss the conception of the title.

Deus Ex Chemica pronounced as “day-us eks ke-mi-ka” is a play on the term Deus Ex Machina (day-us eks ma-ki-na).

When we were first brainstorming all possible names for the magazine, our main goal was to find a pun using the word chemical. We failed miserably! It was quite a challenge to work with that word but hey, kudos to us not losing hope. We did eventually find a title the team unanimously agreed on. Even if it wasn't technically from the English language.

The title is derived from the Latin term Deus Ex Machina which literally translates to “God from the Machinery”. This term is used to describe a plot device in plays where something unexpected, usually divine intervention, helps a story move forward after a writer has written it into a corner.



But why choose to use such a term? Well chemical engineers are hired to find solutions to existing problems in the industrial sector. Chemical engineers troubleshoot these problems which are usually overlooked by other engineers. Chemical engineers find solutions to these problems helping the industry, just like the story, move forward. The term is perfect since it defines chemical engineers as game changers.

The title has been discussed enough so its time we delve further into the magazine. The team hopes you enjoy reading the magazine as much as we enjoyed making it.

Sincerely,

Sohaib Saeed
Editor-in-Chief

Message by Dean

Faculty of Chemical & Process Engineering



As the academic year of 2016 comes to an end, I would like to acknowledge the great efforts put by the magazine team and admire them for all the incredible work they have exhibited throughout the year. The efforts they have put in publishing, 'Deus Ex Chemica' is commendable and a remarkable achievement. I appreciate the sincerity, dedication and commitment they have shown throughout the year. I wish to congratulate each member of the society, as they haven't just maintained their studies but also managed to arrange both curricular and extracurricular events throughout the year. Such diversity in their work showcases their capacities and capabilities in different dimensions.

Congratulations and I wish the students of Chemical Department, good luck for their continued success.

Prof. Dr. Mohammad Tufail

Dean

Faculty of Chemical & Process Engineering
NED University of Engineering & Technology

Message by Chairman

Chemical Engineering Department

I am glad to know that our students have come up with another fresh piece of work. These students have put a lot of effort that has shown another great side of Chemical Engineers. This magazine is showcasing who chemical engineers of this department really are. Despite having a hectic schedule, they are equally involved in co-curricular activities and competitions. Such kinds of activities are not just providing a platform to showcase their capabilities but also help them explore their hidden talents. Our challenge is to help engender ideas that will benefit society, and educate our students to work on fields where they will be valued both, for their specialized knowledge, and for their ability to research, communicate and solve problems. I appreciate all the members of the magazine team for 'Deus Ex Chemica' and I wish them all the best for future.



Prof. Dr. Inayatullah Memon

Chairman, Department of Chemical Engineering
NED University of Engineering & Technology

Message by Former Editor-in-Chief

'Good luck finding the content writers', 'The resources are not sufficient, let's go for a newsletter', 'Finding Nemo will be easier than finding a sponsor', just a handful of 'opinions' one hears when coming up with a publication as Deus Ex Chemica. Relating to my experience as the Editor-in-chief of the inaugural publication of the Department of Chemical Engineering, the struggle is real. So it is my greatest of pleasures to scribe this message and congratulate all the stakeholders on this achievement.

Eventually these obstacles are won over. You do get the contributors, you manage enough resources, the finances do get streamlined, but it is all possible if there is a focused and determined 'team'. A good team has a crystal clear understanding of its objectives, is focused, communicates, is open to acceptance of ideas, trusts and is united. Good teams are decisive in organizations succeeding, good teams can achieve anything.

Ask any management guru, more vital than just making a product is making one that lasts. 'Sustainability' is difficult and significant to achieve in any enterprise, which makes Deus Ex Chemica so worth cherishing. And this has come about with the efforts of the magazine team, which has all the traits mentioned in the preceding passage. With active and youthful members, able leaders and mentorship, SCHEME has been remarkable in achieving what was expected since its inception. It is now one of the best student societies on campus and communicates a voice for the Department of Chemical Engineering. Good job guys, we keep track of you on Facebook, and it makes us want to return back to NED.

Yet again, congratulations to all faculty members, Chairperson Prof. Dr. Inayatullah Memon, Editor-in-Chief Sohaib Saeed and everyone associated with this magazine and the magazine team on another landmark.

A final word of advice to all students will be to participate actively in such initiatives by SCHEME, sure it helped me in my career development. Enjoy this part of your life to the fullest, keep learning, and keep celebrating. You are sure to cherish this time and these friendships for years to come.

I also hope this magazine is a source of infotainment to everyone who flips a copy. Happy reading!

Sharoon Gill
Former Editor-in-Chief

Message from the Editor-in-Chief

It's finally here! The magazine that had preoccupied my mind for the duration of the year is finally here.

I could have started with some motivational quote from an author you may never have heard of but that has become quite a cliché. Having said that, I must admit something. Writing articles is much easier than writing a personal message for your magazine. Especially if it has a whole page dedicated to it.

After reviewing the inaugural magazine for the first time, I felt that being in charge of a magazine would be child's play. Boy, was I wrong. It is only now that I feel the struggles my predecessor Sharoon Gill went through and my respect for him grew tenfold.

Let me ask you something. What does it take to make a magazine? Inspiration, hard work, patience and dedication of course. Deus Ex Chemica wouldn't have been a possibility if there had been a lack of any one of those. However, there is one major factor that hasn't been mentioned yet. A magazine isn't just the efforts of one individual. What I have learned is that an Editor-in-Chief is as good as the team that surrounds him and I was fortunate enough to have a team of exceptional individuals. Emphasis on exceptional. There isn't enough praise I could give them.

I would like to express my gratitude to the whole team behind Deus Ex Chemica. Without you, this magazine would have ended up being another idea that would have been left to fade away. First up Directors Aisha Yasmeen and Aiman Ateeq for their continuous support and dedication to the task at hand. Next up editors Zaid Bin Ghazi, Samra Khalid Ali, Tooba Ahmed and Noman Raza. Your impeccable editing made sure that each and every article in Deus Ex Chemica is as magnificent as can be imagined. Last up Faculty Adviser Miss Alia Ahrar for her perpetual support and belief in us. You never gave up on us.

Now let's get back to the magazine at hand. Yes, the magazine team may have been the ones with the notion to create a magazine but it isn't who makes the magazine that makes it special. It is what that is inside that matters. This magazine is a collection of writings from the students of the Department of Chemical Engineering NEDUET. What makes the magazine special is the writers. The responsibilities assigned to me helped me in acknowledging that there are some students who possess an innate ability to write. I feel that there is a relative amount of writing talent available that we should be able to exploit.

I congratulate the whole team at succeeding in publishing Deus Ex Chemica, and would like to thank the writers, without whom there would be no articles for the magazine.

Speaking for the team, we dedicate this magazine to the students of the Department of Chemical Engineering especially the graduating year. We wish you the very best for your future. Godspeed students, Godspeed.

Sohaib Saeed
Editor-in-Chief

PS. Special thanks to Aiman and Zaid, for constantly nagging me to see through the launch of Deus Ex Chemica. I'm pretty sure I would have given up if you did not push me to test my own capabilities. Oh and to the people who thought this couldn't have been possible. Guess we got the last laugh!



Messages from Faculty Advisors



A very famous quote is, “you reap what you sow”. We once sowed a seed of faith, courage, sense of responsibility, and a dream with blessings to provide a professional platform to chemical engineers of NED in 2010 as CHEMESS, which we now call SCHEME, Society of Chemical Engineers. With this success, we saw a dream of publishing a departmental magazine that could serve as a reflection of Chemical Engineers of NED University. We were successfully able to publish the first edition and now with sagacious efforts of the current magazine team, this year we are publishing the second edition of departmental magazine, “Deus Ex Chemica”. As interesting as the name, the magazine comprises of intriguing articles which includes Final Year Project Summaries, thought-pieces and technological abstracts written by our brilliant students.

I feel great pleasure in conveying my best wishes to the team of "Deus Ex Chemica". The magazine itself is showing the brilliance of magazine team and the hardwork they have put in it. I am hopeful that students will contribute more with brighter and more innovative articles for the next issue. I wish SCHEME and the magazine team a huge success in all their upcoming ventures. Goodluck and best wishes for Team Deus Ex Chemica.

Ms. Alia Ahrar
Faculty Advisor

Deus Ex Chemica has highlighted the diversity of chemical engineering, modern trends of chemical engineering research and alerts on ground breaking progress of the chemical engineering department in the last few years. I am very proud of the The magazine team for pulling it off so well. The most important aspect we could derive from this stupendous effort is that it brings out the various technical and analytical skills of the budding engineers. I strongly believe that this magazine rival the new aspects of chemical engineering field which keep the reader interested till the end. I wish them all triumph. Good Luck team!

Dr. Zahoor Ul Hussain Awan
Faculty Advisor



Magazine Team Messages

Talent wins games, but teamwork wins championships! We started off with a small team and a strenuous task in hand. Publishing a 50 page magazine is no child's play. It seemed almost impossible few months back and here we are, celebrating its launch. This is what you get when you blend diligence and creativity with the right amount of teamwork. This magazine team is the real definition of hard work and coordination. As the Director, I would like to congratulate the supportive faculty and each member of the team for battling against all odds and pulling it off so brilliantly.

From this magazine, we hope to delineate the inventive side of chemical engineers at NED University, both, in the fields of research and technology for we are the problem solvers, the Deus Ex Chemical! Happy Reading everyone!

Aiman Ateeq
Director 2016



Hard work and Dedication; I believe these are the two main ingredients which led us to unleash this edition of Deus Ex Chemical. This publication is a piece of today's research side of chemical engineering where it covers all the latest updates on Projects and Research work comprehended by our young chemical engineers and world's advancement regarding the same field.

It was my privilege to be a part of such a capable and responsible team of individuals. I would like to congratulate and thank Chemical Department, its faculty and students for their unconditional support and special thanks to Dr. Zahoor Ul Awan and Miss Alia Ahrar for believing in us throughout the journey. I expect that this tradition to be continued in the upcoming years and the quality of work to be enhanced as well, as one step at a time is not so difficult.

Thank you. Have fun and stay blessed!

Aaisha Yasmeen
Director 2015



Magazine Team Messages



It is with a profound sense of liberation that I am writing this message. Working on Deus Ex Chemica was a thoroughly enjoyable experience but a surprisingly arduous one as well. From the outskirts, one could foolishly think that publishing a magazine is cakewalk. I used to have that naive understanding myself, before I exposed myself to this domain. Now that I've fully experienced this journey, I can positively say that nothing could be further from the truth. There were a lot of hurdles that came our way. I feel like every stumble and each misfire exposed us to the different facets of this project, and ultimately taught us how to effectively handle similar situations in the future. After all the commotion and disarray, when the dust settled, a rather outstanding magazine emerged. In retrospect, the good times far outweigh the more difficult ones, and if I were to go back in time, I would do it all over again.

I feel overjoyed at the thought of being able to share what we as a team accomplished. I hope that Deus Ex Chemica ages with grace, and leaves a path to trace for the ones who will take the helm next year.

M. Zaid Bin Ghazi
Sr. Editor

It was a terrific year working with Team Literary & Publications. As a sophomore, I assure you that "Deus Ex Chemica," the second edition of our Departmental Magazine, will take you on an exciting journey decrypting technical aspect of the science world as well as invigorating the readers with non-technical articles! This magazine was not possible without the continuous commitment and hard work of Team Literary & Publications and significant interest shown by our writers. Lastly, enjoy "Deus Ex Chemica" for the love of science with a cup of tea!

Samra Khalid Ali
Editor



It is a source of immense pleasure for me that Deus Ex Chemica is in our hand, indeed, a big success. This issue is a beautiful emblem of informative articles, final year projects, non-technical articles and much more. It was a great deal to bring efforts into colours. In upcoming years our team will ascend to accomplishments with other issues of Deus Ex Chemica. I wish the readers all the best in their future endeavours.

Tooba Ahmed
Editor



Magazine Team Messages



It feels great to be part of team with devoted and skilled writers. The publication of Deus Ex Chemica was a strenuous task. The standard set by the publication team was high, but we have exceeded our own expectations and produced a comprehensive review of the work for the magazine. The variety and creativity of the articles and events in these pages represent the talents of Chemical engineering students and teachers alike. An intensely personal effort is needed for a publication of this nature. Hopefully this tradition will continue, and all the faculty, students and alumni will be able to look back at the year in a glimpse with informative and technical articles.

I hope you will find this magazine informative and useful. In the meantime, warmest wishes to all the readers.

Noman Raza
Editor



Faculty Messages



Dr.Saud Hashmi

Good things remain good only because they scarce. I am glad to pen for this wonderful magazine as an appreciation of the commendable efforts put forth by the Team of Deus Ex Chemica. The efforts taken to bring about innovative content is remarkable. It is a noble task on the part of the department of chemical engineering and Team Deus Ex Chemica to once again make it with their second issue of magazine Panorama. I wish that this magazine establishes to be a flint to fire the enthusiasm and excite their minds for many intrusive innovations among the students and inspire passion among the members of the faculty. I hope that this publication will be a huge success.

Mr.SyedAli Ammar Taqvi (On study leave)

It gives me immense pleasure to know that the second edition of Departmental Magazine has been published. This magazine is a valuable read for the industry as well as the academia, since it not only provides the readers an insight to the department of Chemical Engineering of NEDUET, but also puts forth the efforts of our people and Chemical engineers all over the world in various fields. The first publication highlighted the pressing issue of energy crisis, and its solutions, that were put forth by the countries all over the world. Now, dealing with the research side of Chemical engineering, this edition brings our readers a whole world of technologies that are currently emerging or are on the verge of it.

Mr.RizwanAhmed Qamar

Teamwork divides the task and doubles the success. This quote fits perfectly on the magazine team who managed to create such an amazing piece of writing, keeping their academics alongside. I wish for the students to move forward a little further every day and accomplish the extraordinary.

Mr.Sajid Muhbat

Engineering is independent of the extent of information you remember or forget. It only deals with the technical approach that you have developed from the information to solve the problems of process industries.

Mr.Ahmedullah Maaz Durrani

I am contented to observe that students of Chemical Engineering Department are issuing the second edition of Departmental Magazine, "Deus Ex Chemica". Logic, practical implementation, creativity and focus are key features in effective engineering learning. In this engineering-based corpus written collectively by brainy mindsets the blend of all these 4 attributes can be spotted. May this department reach heights of triumph and I wish the students good luck for their professional career ahead.

Mr.Abdul Sami

It is a known fact that innovation is an important part of successful engineers but in this modern era, soft skills are equally necessary because this is what makes a business student better and more successful than us.

Ms.Zaha Naseem

Scientists dream about doing great things. Engineers do them. Engineers are the bridge between logic and imagination. Logic gets you from A to B, but imagination is what takes you everywhere. Engineers are both the fuel and the fire - without them, there is no progress, and there is no hope for progress. The projects keep on changing, the faces keep on changing, but the hard work remains same. May the hard work of these students for the magazine prove to be more fruitful than any other, and may this magazine carry with it all the success that is possible for a single publication to carry.

Ms.Hafsa Bano

It feels good to see the potent work done by students for the magazine. I hope that this will influence and strengthen brains of our future engineers to produce amazing ideas. I wish them all the luck for their future endeavors.

Ms.Nadia Ajaz

I am pleased to hear that the magazine team is ready to publish the second departmental magazine 'Deus Ex Chemica'. I hope that this tradition continues for years to come. I wish team Deus Ex the best for their future.

Alumni Messegges

Sumera Rehman (Batch of 06-07)

I am currently a process engineer in Engro Polymer and Chemicals from the first batch of chemical department. Initially, girls faced many challenges on field jobs but after all these years, things have become easier for us. I want to assure all the girls of this department that we have a bright future in chemical engineering. I advise my juniors to be focused and prepared for the new challenges of professional life. Being a successful chemical engineer is tough but not impossible.



Faizan Wajid (Batch of 06-07)

I am working as Production Engineer for IFFCO Malaysia Sdn Bhd, functionally reporting to Production Manager. IFFCO is an Export Oriented manufacturing plant (Integrated Oleo Chemical and Animal Feed manufacturing facility).

In this role, I carry out process improvement, plant modification, production planning, managing and handling day-to-day routine, managing man power, inventory planning & movement, maintenance planning and deputizing Production Manager in overseeing a production team.

I am handling the plant for Palm oil splitting and distillation which results in the production of Distilled Fatty Acid used for soap manufacturing & Rumen-protected fat which is used as Animal Feed (Brand Name Energizer RP-10). Other Plant under my supervision is Glycerin Plant which produces USP grade Glycerin. It is a pharma grade product and mostly exported.

"Deus ex Chemica" is an excellent initiative by our department's young brigade. It is great to see our department flourish. I wish the entire team of Deus ex Chemica all the very best.

Wishing for a very successful publication.



Zubair Ahmed (Batch of 08-09)

Right after concluding your intermediate education (in pre-engineering of course), the most challenging task for anyone is to select which major they would opt for their career. Over the course of many years I have seen students who let this important decision rest with their parents but I was one of the few fortunate ones who knew all along about which field I would be selecting, and it was definitely not Chemical Engineering. I always wanted to opt for petroleum sector but couldn't get enough percentage and decided to follow the backup plan. Go for chemical engineering, get top grades in First year and switch to petroleum. But once getting a flavor of first year (I am a Math Geek), I never looked back. I started enjoying it. Hardly listening to any lectures (sometimes boring) and enjoying books more in the company of some really good friends, the four years went by in a flash. Through NED I was given the opportunity of two internships (POL and Akzonobel ICI) which luckily were enough to tell me that I selected the precise career for myself. After bachelors, I was appointed in National Refinery Limited as Production engineer in Fuel Refinery (CDU Unit). I worked there for almost 09 months when one day I suddenly got a phone call from HR of Engro Fertilizers Limited telling me that they were appointing engineers for their Dharki based plant. Since then it's all about Engro Fertilizers. Took charge as a Urea-Utilities supervisor of the then "World's Largest Single Train Ammonia-Urea Complex".

Engineering can be a real pain sometimes but if you are committed to it, it really pays off. I am currently working in the capacity of a Process Engineer in Engro Fertilizers Karachi and I owe it to NED.



(Proud Nedian).

Asad Muzaffar (Batch of 09-10)



Aspirations, dreams, aims to fly high, that's what makes us. But to become anything in life we all need a supportive environment, some impressive mentors and a bunch of crazy, like minded friends. These and a lot more was provided to me by my Alma mater. Where I am today and anywhere else I go from here is because I had this strong foundation to take my first steps. Books and teachers can only teach you so much. To be an accomplished and proficient professional you need to work on your personality, buff up your leadership skills and learn to be a team player. This is what exactly NED taught us. It incorporates in us such qualities, that our alumni stand out anywhere and everywhere we go.

I, Asad Muzaffar, working as a drilling fluids engineer at Halliburton, world's second largest Oil & Gas Services Company, proudly accredit my accomplishments to this esteemed institution and hope that our juniors will make us and this institution even more proud. Best wishes for Team Deus Ex Chemica for pulling off, against all odds, such a successful publication and adding to the glory of this department.

Faizan Latif (Batch of 09-10)



Life is all about chances and opportunities. Never leave anything to chance and never let an opportunity get away. This is exactly what I did when I got the opportunities of Internships and jobs via NED.

Aiming for the stars? Great! But you have to build a space shuttle first. It is as same as expecting to get a good job without meeting the requirements for it. At NED, I learnt to become a complete package, "the space shuttle" for the competitive job market and managed to get a job in the largest private power production company of Pakistan, HUBCO, where I am working as a Project Control Engineer on one of the biggest projects going on under CPEC's (China Pakistan Economic Corridor) umbrella.

NED Chemical Department brought a huge change in my life, career and personality by giving me exposure to different challenging opportunities to explore and enhance my potential and capabilities.

Last but not the least, I would like to congratulate the team involved in this huge effort that we dreamt of during our days. Hats off to you all in successful publications of Deus ex Chemica.

Long live NED, Long live SCHEME.

Arsalan Ahmed (Batch of 10-11)



Being a part of Chemical Engineering Department NEDUET was one of the finest experiences for me.

I admire those treasured moments, learning from elegant and generous faculty, exploring vistas of Chemical Engineering and getting groomed at every stage; unknowingly enhancing interpersonal and leadership skills. I was hired at LOTTE Chemical Pakistan Ltd and started working as Trainee Engr. in Production Department. There, I was given full opportunity to get streamlined with Engineering Methods and equipment operation which were inculcated in NED. Experiencing Overhaul of Plant and Short Shut-downs, the insight of enginery grew even richer.

Today, I am a proud contributor to 50+ Million man Hours for LOTTE Chemical without LTC and relish my duties as Shift Manager.

Introduction to SCHEME

❖ Society of Chemical Engineers

The Chemical Department of NED University of Engineering & Technology had the inception of its representative society, with the motive of guidance for future engineers, and to fill the gap between the alumni and students.

Society of Chemical Engineers (SCHEME) formally known as CHEMESS started its journey in the year 2009. The society members' ambition binds the people of chemical department on one platform, where they come up with innovative ideas to benefit the people around. The society prepares students for their life ahead by emphasizing on certain aspects encompassed by a successful professional, such as teamwork, confidence building and effective management, among several others.

Students, under the banner of SCHEME, organize different seminars, workshops and symposiums that helps in increasing awareness of the world beyond textbooks. SCHEME, has now grown into a well-functioning body, with a remarkable set of achievements on its shoulders. Our goal is to take it to greater heights and set a precedent for those who will come after.

Mr. Muhammad Owais Dinga is the President of SCHEME for the Year 2016 who is known for his serious approach towards work. A multi-talented person who handles responsibilities with devotion and dedication. He can overcome any obstacle without hesitation with commendable decision making and management skills. He is truly an asset to the society.

Ms. Aiman Ateeq is the Vice President of SCHEME for the Year 2016 who is a perfect blend of ingenuity and maturity. These qualities alone help to lead the society towards progress. She is the first woman in history of SCHEME to reach presidential elections due to her selfless, hardworking and responsible approach to work. Aiman is not only dominant in society-related work but also outstanding academically. Persistence is her motto.



M. Owais Dinga
President



Academic Events



Seminar on Versatility of Chemical Engineering

Team SCHEME organized an informative and enlightening event on the 24th of February 2015 at the Polymer lecture hall, NED UET. The main purpose of this event was to highlight what multi-tasking engineering is and how the field of engineering demands a creatively innovative mind. The guest speakers were Mr. Adnan Sultan, Production and planning Manager at Tri Pack Ltd. along with Mr. Syed Saad Ali, process safety manager at Syngenta Chemicals Pvt. Ltd. and Hamza Ali, assistant manager at Dynea Pakistan Ltd.

Seminar on CV Writing

Another key component of any job is Curriculum Vitae (CV). SCHEME organized a seminar on CV writing held on the 2nd of April 2015. Mr. Mohammad Ali Patel enlighten students in how to showcase their personality, professional skills and knowledge in a respective field in their CV.

IOSH managing Safely V3.1

Institution of Occupational Safety and Health (IOSH) is a UK based non-profit organization and chartered body for health and safety professionals. For the first time ever, SCHEME organized a 4-day international course from the 16th of May 2015 to the 19th under Safety Trends International Pvt. Ltd. Through this course, students got a chance to groom their professional and technical skills.

Engineering Research in Focus

Society of Chemical Engineers (SCHEME) organized a productive 2-hour workshop focusing on the importance of engineering research and how to go about it.

It was held at CIS lecture hall on 16th February 2016. The workshop conducted by two honorable PhDs from the University of Manchester, Dr. Sohaib Zia and Dr. Muhammad Ali.

With a thorough discussion on how to pursue research, the first phase of the workshop aimed at providing guidance for Final Year research based projects. In the second phase of workshop, technical writing skills for research articles and FYP reports were discussed. Along with a substantial number of undergraduates, Masters and PhD students also participated.

Project and Poster Competition

The greatest event of 2015 was organizing the first ever project and Poster competition on an Inter Sindh level. The competition took place at NED UET main auditorium on the 13th of October. Around 45 practical and model based projects were presented and a panel of judges from some of the leading industries evaluated them.

The idea of PNP was to provide an opportunity to students from different engineering universities from across Sindh to bridge the gap between academia and industry. The first position was awarded to NED University's chemical department for their models on co-pyrolysis of waste lubricating oil and waste cooking oil and computational modelling of knee joint using finite element method by final year students. A cash prize of Rs50,000/- was divided between the two winning teams while the teams on 2nd and 3rd positions received a total amount of Rs30,000/- and Rs20,000/- respectively.

Annually Conducted Events

Welcome Party

The New Year started with a bang for freshmen of chemical department. A much awaited event, welcome party held on the 26th of January 2016 at Casamento Hall. The occasion provided opportunities for the first year students to interact with and get to know their seniors. The moments of welcome party will surely remain fresh in our memories forever.

Independence Day Celebrations

A patriotic and spirited event took place at chemical department, NEDUET on the 12th of August 2016 to celebrate the 69th anniversary of Pakistan. The event was graced by the presence of the chairman of the department Dr. Inayatullah Memon. A small ceremony followed by a rally ended with the voices of national anthem sung in high and passionate voices of the students and faculty.

Annual Departmental Picnic

The annual picnic was organized at Al-Taif farm house, on the 31st of August 2015. It was a light-hearted recreation, organized by SCHEME to let off steam from the hectic schedule of studies and provided an opportunity for members to interact.

Industrial Visits

Technical events are also very important, and this year SCHEME organized a number of industrial visits; mainly to BYCO refinery, ENGRO Chemicals and Polymers, PEPSI Co. and Pakistan Steel Mill. The purpose of such visits was to give students an early grasp of what heavy industries are like.

Annual Dinner

The Annual Dinner 2015 was to bid farewell to our graduating engineers. The occasion was held in the university premises, presided upon by the Chairman of Chemical Engineering Department Dr. Inayatullah Memon. Those wonderful moments of cheers and joy will be remembered forever.



Extracurricular Activities

CYBORG 1.0

Following the success of last year's SHOOT ON II, a much larger event was organized by SCHEME in 2016. The main objective was to provide a healthy competition during the academic year. The games included in the event was FIFA 16 and Counter Strike 1.6. FIFA was played on the Xbox 360 unlike Counter Strike, which was played on computers.



BLEED GREEN!

For the 2nd time in the history of NED University, SCHEME proudly covered each moment of this encounter by organizing live match screening of India v/s Pakistan at the fountain area, NED main auditorium on March 19th 2016. The success of the event was reflected by the spectators. Around 450 students attended the event. They enjoyed the whole transmission at raised sentimental level, wickets were celebrated and runs were cherished.

Engineering at Home

Have you ever wondered, how does your kitchen filter work and why distilled water despite being the purest form of water, is not suitable for drinking? Have you ever tried measuring the pressure drop of the pump in your home that draws water from the main pipeline and discharges it into the storage tank? Can you design a control system of the tank so that it will not overflow and gives you an indication when its set point is achieved? Are you inquisitive in knowing how your car radiator exchanges heat? Curiosity is required in every field that deals with chemical engineering. So instead of aspiring to see large filters, heat exchanger or compressor units in industries, put a reverse gear to your engineering and begin exploring new things at home.

Let us have a compendious view of objects related to chemical engineering that one can find easily around. Probably, most of us have water filtration units in our homes. Even in our department we have these kinds of filters. It is usually divided into three sections and arranged in series. The first one removes sand and large particles from water by sedimentation technique. The second compartment, filters water by using activated carbon granules based on charcoal (a very porous form of carbon). Activated charcoal carbon filters are most effective at removing chlorine, sediment, volatile organic compounds (VOCs), bad taste and odor causing compounds. When the water passes through the charcoal filter, the impurities are caught in the charcoal's deep pores, trapping them there until the filter is replaced. The third section purifies the water by using Ultraviolet technology that kills bacteria. Hence, water produced by these filters is mostly free from impurities and germs. It also contains necessary minerals too, whereas distilled water (the water produced by boiling, evaporation and condensation of raw water) cannot be used for drinking neither for cooking because distilled water may pull the minerals out of foods, thus lowering their nutritional value.

Urea, the leading fertilizer among all is produced on a daily basis in the human body: about 25 grams per day. Let us have a comparative look of how urea is produced in the industry and how it is produced in the human body. In the industry, urea is commercially produced by using ammonia as a main reactant. Natural gas is first purified to remove sulphur by de-sulphurization, and then methane gas is removed in a reformer by passing oxygen through it and finally carbon monoxide is converted to carbon dioxide by shift conversion and then removed, which results into Ammonia after compression. From Ammonia, either by once through process or by total recycle process, urea is formed. Relatively, in our bodies, urea is produced by breakdown of excess amino acids, which takes place inside the liver. First step is deamination that is, removal of amino group. In the second step, amino group is converted into ammonia. Ammonia

is highly toxic to cells so it must not be allowed to accumulate. Hence, ammonia is supplied to urea cycle in which it combines with carbon dioxide and converted into a less toxic substance i.e. urea. Urea is released in the blood stream which carries it to the kidney from where it is excreted out. In healthy adults, only 1-2 grams of Nitrogen, equivalent to 6-12 grams of protein, are lost in the feces on a daily basis.

To reduce carbon emissions, we mostly see heat pumps as a source of heating and cooling in public places. Heat pumps are self-contained, complete packages that serve as both heating and cooling mediums. An electrically driven heat pump uses Freon gas as a working fluid. When heat pumps work in cooling mode, it absorbs heat from the surroundings. A refrigerant which is a low pressurized gas is heated by absorbing energy from the surroundings, which causes the refrigerant to boil. This low pressure gas is then pressurized, and after exchanging heat with cool air, it condenses and cools down. It can then be used again as a continuous process cycle. For heating mode the cycle is reversed. Both cycles use two heat exchangers at a time.

Coming to the automotive world, we notice that Chemical Engineering is indeed applicable in this field as well. A radiator serves to transfer heat from the engine coolant to the air passing through it by means of forced convection. Mostly ethylene glycol, comprising of 93% Ethylene Glycol, water and additives is used as coolant in automobiles. An internal combustion engine creates enough heat to destroy itself. Heat dissipation is probably one of the most important considerations in engine design. Two systems are used generally; one is the air cooled system, while the other is the water cooled system. Air cooled system is generally used in small engines (best example is a motorcycle). In this system fins or extended surfaces are provided on the cylinder walls, cylinder head, etc. Heat generated due to combustion in the engine cylinder is conducted to the fins and when the air flows over the fins, heat is dissipated to the air. In water cooled systems however, a coolant such as ethylene glycol, or simply water is used as a cooling medium. It usually has a thermostat attached to it. The thermostat's main job is to keep the engine at a constant temperature. It does this by regulating the amount of water that flows through the radiator.

There is a lot more that can be brought to the light. We are surrounded by a number of objects that are related to several phenomena involved in chemical engineering process. So engineers, try to dig into the core of engineering and broaden your horizons. Start exploring things at home, so you can bring new innovations in this world. Exploring is not that difficult, now is it?

Written by:
Tooba Ahmed
Batch 13-14

Research abstracts by esteemed faculty

Graphene oxide/carbon nanotube composite hydro gels - versatile materials for microbial fuel cell applications

Dr. Saud Hashmi

Abstract

Carbonaceous nanocomposite hydrogels were prepared with an aid of a suspension polymerization method and were used as anodes in microbial fuel cells (MFC). PNIPAM hydrogel filled with electrically conductive carbonaceous nanomaterials, graphene oxide (GO) and carbon nanotubes (CNTs) exhibited significantly higher MFC-efficiencies than the unfilled hydrogel. The observed morphological images clearly show the homogeneous dispersion of CNT and GO in the PNIPAM matrix. The complex formation of CNT and GO with the PNIPAM was evidenced from the observed structural characterizations. The effectual MFC performances were influenced by combining the materials of interest GO and (CNTs) and are attributed to the high surface area, number of active sites and improved electron transfer processes. The obtained higher MFC efficiencies associated with the excellent durability of the prepared hydrogels open up the new possibilities of their applications as anodes in MFCs.



Highly electrocatalytic alpha-MnO₂ nanorods for lithium air batteries

Dr. Zahoor Ul Hussain Awan

Abstract

Manganese dioxide nanorods with alpha phase (alpha-MnO₂) were prepared by a facile hydrothermal route at low temperature. The prepared alpha-MnO₂ nanorods were characterized by X-ray diffraction, Scanning electron microscopy, Transmission electron microscopy and nitrogen adsorption-desorption measurements. The electro-catalytic reduction of oxygen with alpha-MnO₂ nano rods were studied by cyclic voltammetry and rotating ring-disc electrode voltammetry in alkaline media. The MnO₂ nano rods with 2x2 tunnels constructed from double chains of octahedral [MnO₆] structure and found to possess high electro catalytic activity in alkaline media. The highly electrocatalytic alpha-MnO₂ nano rods were then applied as electro-catalyst for cathodes in rechargeable Li-O₂ cells. The Li-O₂ cells exhibited initial discharge capacity as high as 4000mAh/g with the alpha-MnO₂ nano rods which was double the original capacity of the cells without any catalyst. Also we obtained 100% round trip efficiency upon cycling with limited capacity for more than 50 cycles.





Best healthcare within your reach



- Lab Economical Charges
- German Quality Luminar Operation Theaters & ICU
- Latest Japanese MRI, Ultrasound, CT Scan Prices 30% lower
- Sunday Clinics
- Pharmacy
- High Quality Executive Health Checkup

MMIH provides quality healthcare and valuable experience, supported by a team of compassionate & dedicated medical professionals.



Memon Medical Institute Hospital

Hyder Buksh Gabol Road, Safoora Chowrangi, Karachi.

Tel: +92-21-34691147-54, **Fax:** +92-21-34691193

Email: info@mmi.edu.pk. **Web:** www.mmi.edu.pk

LAB COLLECTION POINT ALAMGIR ROAD

National College Chowrangi,
Alamgir Road, Bahadurabad, Karachi.

Tel: +92-21-34893737

LAB COLLECTION POINT (DHORAJI)

Shop # 5 & 6, Kathiawar Square
Opp Kibriya Masjid, Karachi.

Tel: +92-21-34947474

Monster Crude

At approximately 9:45 pm CDT, on 20 April 2010, electrical lights suddenly started to flicker at Deep-Water Horizon's oil rig. The flickering of light was followed by strong vibration beneath the rig. Abnormal pressure started to accumulate in the marine riser, the vertical pipe attached at the bottom of the rig, and the rig started to vibrate again. At the second wave of vibration the crew knew something was wrong. It was only a matter of minutes when high pressure methane gas along with mud and crude gushed out of the marine riser up-to 240 ft. high killing 11 people instantly and becoming the world's largest oil spill.

According to a study, approximately 86.4% consumption of energy is from fossil fuel resources. Interestingly, these fossil fuels were formed around 650 million years ago when dead organisms were subjected to high pressure and heat anaerobically. It is this very resource from which we derive one of the most widely used fuels in the world. Petroleum or crude is essential to human beings. All the processed and synthesized products at your home, from shampoo to your cereal box, come all the way from industries and every industry requires fuel to operate.

Petrol is extracted from crude oil which is found beneath the earth's surface. British Petroleum, the sixth largest oil company in the world, has a total revenue of 225.98 billion US dollars according to recent statistics. Unfortunately, on 20th April 2010, in the Gulf of Mexico near Mississippi river, BP's oil rig platform worth 560 million US dollars named Deep-Water Horizon exploded and sank into the seabed on 22nd April 2010, causing them a loss of approximately 61 billion US dollars. It is considered the largest accidental marine oil spill in the world. The oil spill continued for 87 days until the site was finally sealed on 19th September 2010. According to statistical reports, approximately 210 million US gallons was spilled due to the incident. Satellite images after the explosion revealed that the spill impacted 68,000 square miles of the ocean. That is equivalent to the area of 50 cities like Karachi.

11 people died in the incident and their bodies were never recovered. But what really caused the rig to explode and sink? It is necessary to have an insight on how petroleum rigs work. Deep-water horizon was a mobile rig which could operate up-to 8000 feet. An oil well is created by drilling a long hole into the earth with an oil rig and in Deep-Well Horizon's case, the hole was 18,360 feet below sea level.

A steel pipe (casing) is placed in the hole in order to provide structural integrity to the newly drilled well bore. Holes are then made in the base of the well to enable oil to pass into the bore. A blow-out preventer, a large valve fitted at the top, is used to seal, control and monitor oil and gas wells to prevent blowout, the uncontrolled release of crude oil and/or natural gas, from the well. Cement is used to hold the casing in place from the well. Cement is used to hold the casing in place and prevent fluid migration between subsurface formations. It is the process of mixing slurry of cement, cement additives and water and pumping it down through casing to critical points in the annulus around the casing or in the open hole below the casing string.

There are multiple reasons as to why the rig exploded. It is evident that a series of complex events, rather than a single mistake or failure, led to the tragedy. Multiple parties, including BP, oilfield services company Halliburton and offshore drilling company Transocean, were involved. The following are few of the reasons known to have caused the oil spill

It was considered that not sufficient cementing was done to ensure a seal between the 7-inch production casing and the previously cemented 9 7/8-inch protection casing due to which high pressure methane gas must have escaped deep beneath the seabed.

Drilling mud is usually used to aid the drilling of borehole into the earth. The main functions of drilling fluids include providing hydrostatic pressure to prevent formation fluids, naturally occurring liquids and gases contained in geologic formations, from entering into the well bore. Recently, the crew began displacing the drilling fluid ("mud") in the wellbore and riser with sea water before setting a cement plug and moving off location. Seawater is lighter than drilling mud and so the cement at the bottom of the borehole was not heavy enough to create a seal, and oil and gas began to leak through it into the pipe leading to the surface.

Certain pressure tests were misinterpreted. Also, hours prior to the blowout there was an abnormal rise in mud pit volume, which suggested that surges of gas were entering the drilling fluid from a gas column below the wellhead.

The BP wellhead had been fitted with a blowout preventer (BOP), but it was not fitted with remote-control or acoustically activated triggers for use in case of an emergency requiring a platform to be evacuated. It did have a dead man's switch designed to automatically cut the pipe and seal the well if communication from the platform is lost, but it was unknown whether the switch was activated or not. BOP failed to close during the blowout.

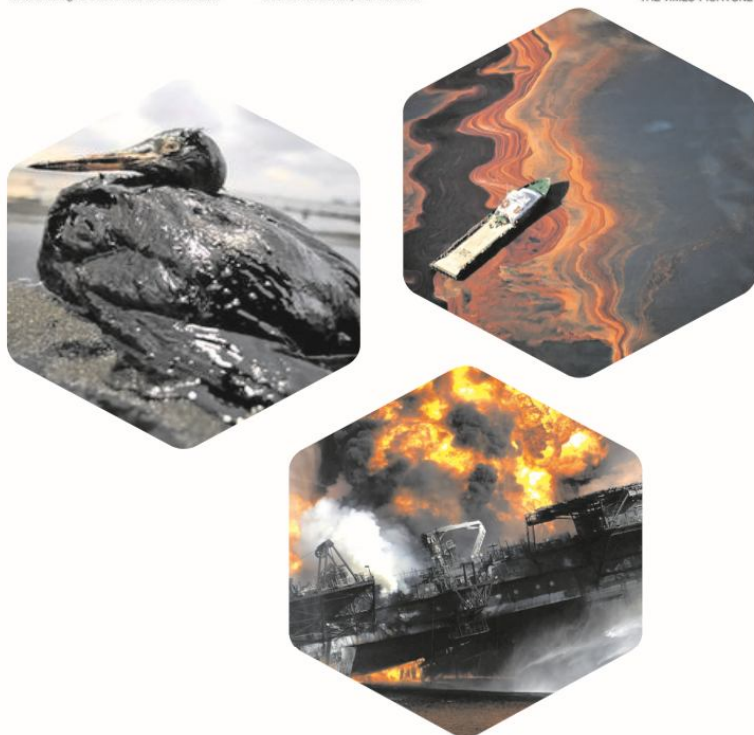
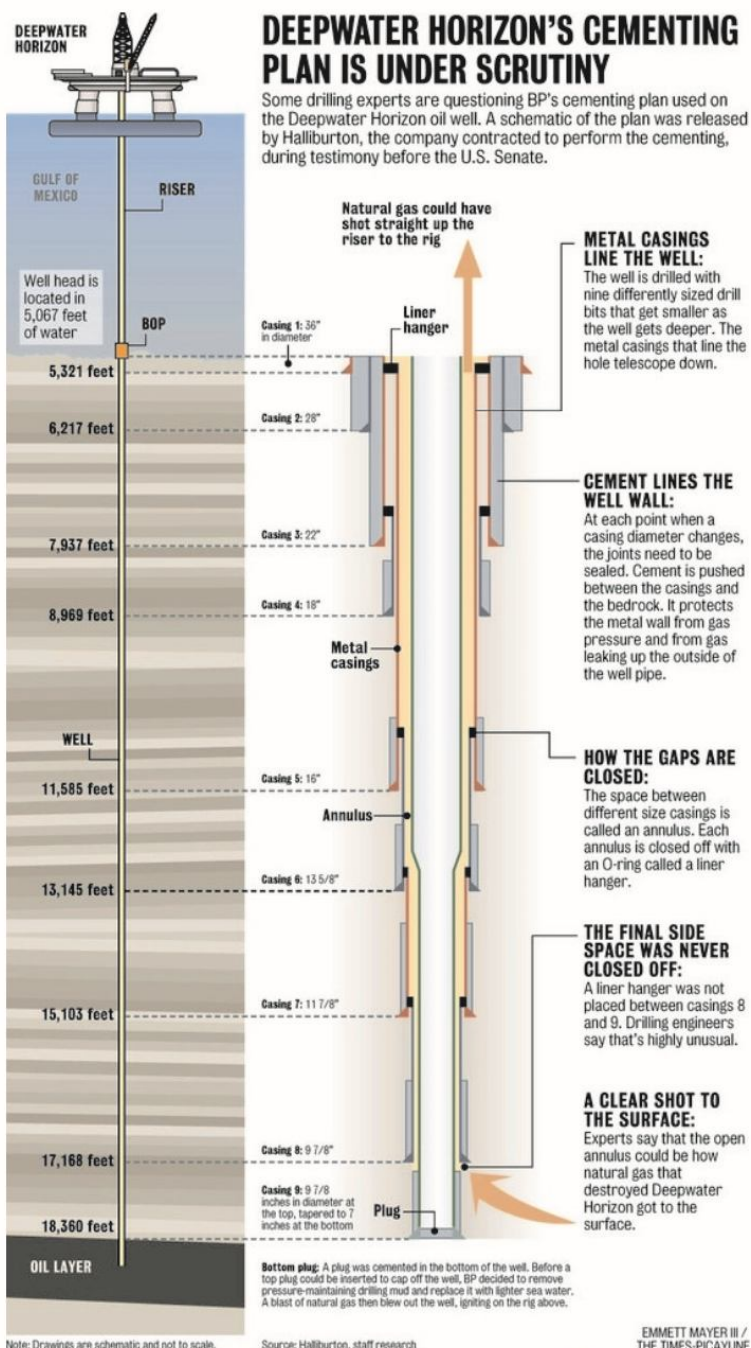
Concerns as early as 2009 that the metal casing BP wanted to use might collapse under high pressure.

Series of questionable decisions about a number of technical breakdowns that occurred prior to the accident, prioritizing time and money over safety were also to be blamed. In addition, following a loosening of regulations in 2008, BP was not required to file a detailed blowout plan.

The oil spill affected the eco-system of the Gulf severely by the presence of PAHs in spill water which was 40 times more than before spill and caused mutation in fish. PAHs, poly aromatic hydrocarbons, are often linked to oil spills and include carcinogens and chemicals that pose various health risks to humans and marine life. A study based on effects of the spill on Bluefin tuna, funded by Stanford University, found that toxins from oil spills can cause irregular heartbeats leading to cardiac arrest. Scientists also found that tuna and amberjack that were exposed to oil from the spill developed deformities of the heart and other organs that would be expected to be fatal or at least life-shortening. Dead baby dolphins washed up along Mississippi and Alabama at a rate 10 times greater than statistics before the spill.

Whether it was sinking of the Titanic due to an illusion caused by a mirage leading to misinterpretation of the distance between the ship and the iceberg or "1931 China floods" affecting up-to 4 million people, nature can get ugly. At the time of the explosion it was extremely difficult to control the oil gusher because of enormous amount of pressure being exerted by the fluid. Nature can get fierce and most of the times it cannot be controlled by humans. Some people believe that oil is still leaking from deep beneath the sea in the Gulf of Mexico.

Written by:
Samra Khalid Ali
Batch I4-I5



For the last twenty or so years, Nikola Tesla's name and achievements have been in the process of returning from obscurity to an adoring public eye. He's the new eccentric icon in popular culture, portrayed in movies like *The Prestige* and comics like *JLA: Age of Wonder*. This resurgence in popularity comes from a myriad of factors, but ultimately finds its roots in three reasons: Tesla's new reputation as an underdog, his eccentric mad scientist brilliance, and the bitter rivalry he had with Thomas Edison. The last of these, especially, has had a broader appeal in its link to the theme of the dedicated inventor versus the savvy and corrupt businessman. But we'll go into those details later here.

It is difficult to figure out where to begin Tesla's story, or which of his many pioneering contributions to highlight in a given space. An essay about Tesla doesn't really need any outside aid to be interesting, but for the sake of stimulation, let's move past his early years (although those were also fraught with all sorts of dramatic tension) right up to the point that he met Edison. The Serbian Nikola moved to New York City in 1884, where he would first encounter the man who was destined to play the role of antagonist in his life. Thomas Edison became Tesla's boss at Edison Machine Works, and he would give Tesla the job of improving on direct current generators. If Tesla could make the machines more efficient and less costly, Edison would give him fifty thousand dollars, he said. But when Nikola managed the work, Edison promptly informed him that he had only been making a joke, resulting in Tesla immediately resigning. And thus began the feud of a lifetime.

Tesla would go on to encounter more disappointments in the years following his estrangement with Edison, until in 1887, when he developed the first induction motor that ran on alternating current as opposed to direct current. A patent for this was quickly licensed. However, this meant an escalation of the strife between Edison and Tesla. In what was dubbed the War of the Currents, Edison was trying to promote his direct current system, in opposition to the new-fangled alternating current. Events came to such boil that Edison even resorted to publicly electrocuting neighbourhood cats and dogs using alternating current, in an attempt to prove the dangers of this new and different technique.

Alternating current may be the development Tesla is associated with the most closely, but the inventor dabbled in pretty much everything. That isn't hyperbole; he's



associated with radio, radar, x-rays, the modern transistor, even cryogenics. Tesla was the first person to record radio waves from outer space, and he discovered the resonant frequency of the earth. And yet, despite his revolutionary achievements, he remained relatively unsung during his own time. In fact, when he died, he was destitute and alone, and was found two days following his death by a maid.

As mentioned before, much of Tesla's resurgent popularity is a result of his eccentric nature. His personal life was of peculiar interest. One instance of this would be his strange fondness for pigeons. He would feed them daily, and nurse injured pigeons back to health in his hotel room. Tesla walked to the park every day to feed the pigeons and even brought injured ones into his hotel room to nurse back to health. One such injured white pigeon held such fascination for him that he spent over \$2000 and built a device that would support her as her bones healed in order to fix her broken wing and leg. He even made a curious statement about this pigeon, claiming that she would come when he called her, and that he loved her like a man loved a woman.

Appearance-wise, he was a towering 6 feet 2 inches, and he would maintain a Holmes like fastidiousness when it came to clothing and personal grooming. He believed that clothes were what the world passed judgment on a man by, and so had a positive bias towards the well-dressed man. He had an eidetic memory, and could memorize books completely. He could imagine an object in great detail by only hearing its name. A polyglot, he could speak eight different languages.

Despite being, by all accounts, a good looking man, he remained a bachelor his entire life, and claimed that this chastity had greatly factored in his scientific prowess. Perhaps this position of his was enabled by a stance on women that was, by modern standards, sexist- he believed that the “new woman” was losing her femininity in her quest to compete with men for power, as opposed to being cooperative with them. Modern works have not tended to comment on some others of Tesla's less than politically correct views. For instance, he was disgusted by overweight people, and once even fired a secretary because of her weight. Most shockingly, he was sympathetic to eugenics, and a proponent of deliberately guiding marriages so that only desirable parents could produce progeny.

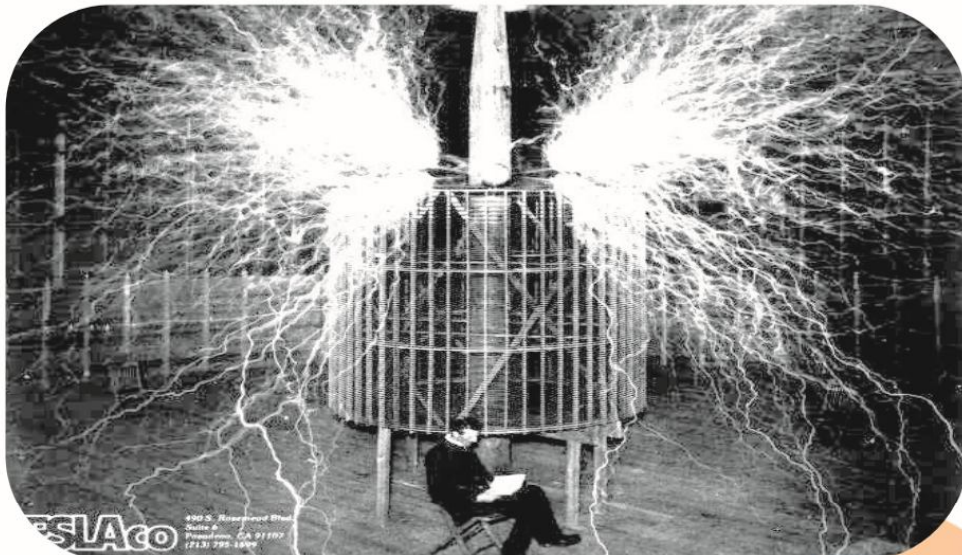
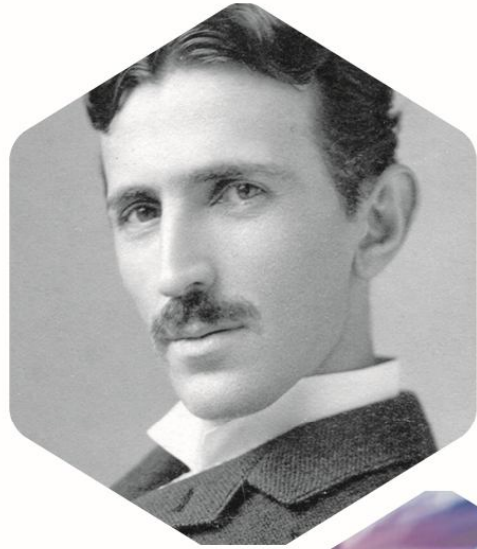
He was asocial and preferred to be secluded from society, but on the rare occasions that he did meet with people, he was described as having “sweetness, sincerity, modesty, refinement, generosity and force.” Tesla made much of having a varied and interesting lifestyle, which can be demonstrated from his contribution to Edison's obituary, where he lambasted the deceased for not having had any hobbies or private amusements. Interestingly, much of Tesla's preferences could be inferred from that obituary, since he also criticized Edison's indifference to hygiene as well as tendency to engage in more labour than thought.

Historical figures have often had the plight of only being portrayed in black and white shades. We can see from this essay, that Tesla was indeed often a sympathetic figure, especially in light of his treatment at Edison's hands and his relative obscurity during his own lifetime. However, he was by no means a paragon of all virtue, and it is important that we critically analyse his life before putting him atop a pedestal, no matter how much we may root for his underdog tendencies.

Written by:

HiraYousuf

Batch 15-16



BIG JOURNEYS BEGIN WITH SMALL STEPS

Midas Safety has more than 35 years of experience as a global manufacturer of Personal Protection Equipment.

We believe in creating a work environment that allows you to achieve excellence at work and happiness in life.

JOIN OUR TEAM



PROTECTING THE WORKING HANDS OF THE WORLD

www.midassafety.com



Coal Water Slurry As An Alternative Fuel

Quenching Pakistan's Thirst For Energy

This Project is Also The Winner Of Dice Virtual Innovation Competition Organized By Ned Entrepreneurship Society And Dice Foundation USA

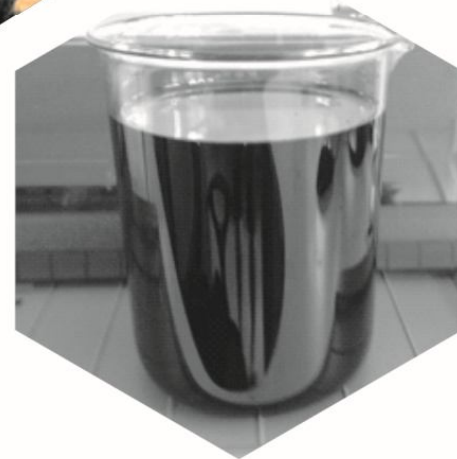
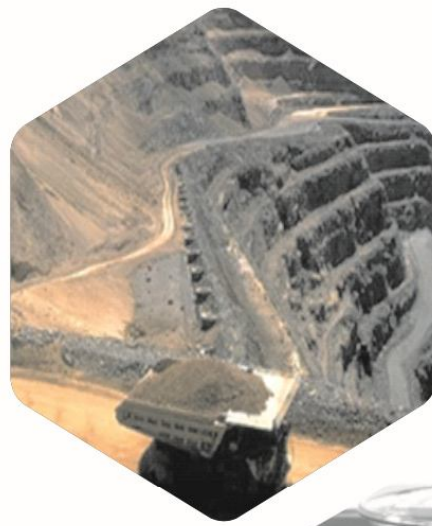
And the poor people of the richest country are still sitting over a resource bank of trillions of dollars while chasing millions to survive. A hard pakistani fact..!

Talking alone of just the energy crisis, this country has the potential to generate power supply for the next 100 years by utilizing just the coal reserves which proudly, is stated to be the 5th largest coal reserve of the world. By now, Pakistan has been quenching its thirst for energy with imports mostly consisting of crude oil and petroleum products. This coal utilization can save four billion dollars by reducing oil import costs which can be concurred by the statement made by Dr Murtuza Mughal of Economic Watch. He states that coal power generation can cost Pakistan Rs 5.67 per unit for power generation while IPPs cost Rs9.27 for the same.

Amid ongoing zest for locating an economically and environmentally viable coal technology to address the looming energy crisis, a student group of Chemical Engineering Department of NED University came up with a viable solution in the form of Coal Water Slurry (CWS) technology which is based entirely on Pakistani indigenous coal that unveils broad contours to mitigate Pakistan's energy crisis. This CWS invention can be used in all the thermal power plants with only a little retrofitting of existing power plants especially the boilers, to make them run in a short span of less than one year!

CWS is something that is not very new to the world, but indeed very new for Pakistan! CWS using indigenous coal runs power plants in USA, Russia, Indonesia and India. In China around 100 power plants are being run using CWSTechnology.

The Coal Water Slurry Fuel Technology is the cheaper, cleaner and environmentally friendly replacement to furnace oil, diesel and natural gas for power generation. The technology converts coal to liquid form by adding certain amount of water and admixtures to it, and is fired just like furnace oil at a highly efficient combustion rate and a lower temperature.



The CWS gives much less SO_x, CO, and NO_x on combustion. Want to know how?

The beneficiation of the coal that involves washing with water causes sulphur and ash to dissolve which is discarded, hence producing little or no sulfur oxides in combustion. Since the overall combustion temperature is much lower to let the nitrogen bonds to break, nitrogen oxide formation is also not possible. Upon testing, CWS combustion efficiency came out to be up to 99%, hence unburnt carbon and CO are also minimal which tends to satisfy the concern of earth's sovereignty to a greater degree.

The coal that was worked upon for the particular case study was Lakhra from Sindh mines. Quality being lignite, which is widely and cheaply available in Pakistan. After crushing, grinding and sieving, the pulverized coal was used over a range of 75 to 250 microns in distilled water suspension to enhance stability. The coal was loaded in 40-60%. Chemical additives used were Triton X-100 as dispersant and carboxy methyl cellulose (stabilizer) as 1% of solution which modifies the suspension behavior and binds coal and water molecules. The additives also tend to lower the viscosity enough that the slurry produced is pumpable, easy to transport and atomize.

A test was performed using DV-E- Viscometer for rheology analysis of the slurry. The test result showed coal-water slurry fuel to be characterized by the following properties: Viscosity-2000-4 mPa.s and an appreciable calorific Value of 36004800 kcal/kg. The coal-water slurry fuel was also tested to be fire and explosion proof. Hence making the CWS a much cheaper, cleaner and environmentally friendly replacement to furnace oil.

To conclude, the only need is to come up with policies that ensure a culture of entrepreneurship in the country by means of facilitating business and converting ideas into returns that can change the economic outlook of Pakistan. CWS technology is one such innovation that has a great potential for commercial use in Pakistan.



PROJECT MEMBERS:

- Kanza Batool Haider
- Bismah Sohail
- Fahad Alam
- Abdul Mateen

Written By:
Kanza Batool Haider
Batch 11-12

Emerging Technologies

A potential threat to International Security

In recent years, due to the impact of modern technology, we have experienced a drastic change in our lifestyle. With the idea of making our lives easier and creating helpful resources, technology seems to grow more and more each day.

On one hand, further advancement in emerging technologies are raising standards of living; but on the flip side, they are also a source of provision of excellent weapons of mass destruction. Such emerging technologies that are a threat to international peace and security include but are not limited to; biological and chemical weapons, UAVs, nanotechnology, the militarization of outer space and so on. Such unconventional weapons don't only affect the state's stability, but also pose the serious threat to both national and economic security, as well as public health and safety.

It is indisputable that nuclear security is essential and has to be regulated on both domestic and international levels, but so far it has been observed that super powers use these technologies for their own state's political stability and border's safety. In the violation of Article IV of the Outer Space Treaty, countries keep using space or celestial bodies for testing weapons of any kind, conducting military maneuvers, or establishing military bases, installations, and fortifications which are another horror of emerging technologies.

Being a nuclear state and a relatively advanced country regarding technology, Pakistan also possesses such weapons of mass destruction for security purposes, but it has not used those weapons against any state. Pakistanis have enough potential to use these modern technologies for useful or destructive purposes, yet, we believe in maintaining peace and harmony; creating an environment that encourages innovation, and economic prosperity while also promoting safety, security, civil liberties, and fundamental human rights.

Written by:
Dania Mansoor
Batch II-12

Nanotechnology

It is a small world after all

Since our species came into being, we, humans, have been on a quest of exploring and understanding this universe. Every new piece of information discovered has highlighted yet another path to new possibilities and perceptions. With these developments the current scale of our universe has been found to be ranging from the maximum observable universe with a radius of 46 billion light years (9.3×10^{26} meters in diameter) to the smallest known object in this universe, the quantum foam with a length of 10-35 meters!

Amidst this scale on a molecular level lies the most popular area of interest these days, the nanoscale. A nanometer (nm) is one-billionth of a meter, smaller than the wavelength of visible light and a hundred-thousandth the width of a human hair. Scientists from all over the world in their mission to understand the world so small have shown more inclination towards this realm because, as Nobel Prize winner Dr. Horst Störmer said that the nanoscale is more interesting than the atomic scale because the nanoscale is the first point where we can assemble something -- it's not until we start putting atoms together that we can make anything useful.

Nanotechnology has emerged as a fascinating mystery. Something this small that we can't even see or feel but having the potential to solve the world's scariest food problems by reducing food contamination for example. It has penetrated consumer products, medical treatment, the food industry and many other areas that are harder to keep track of, but the truth is that the technology's potential is yet to be fully reached.

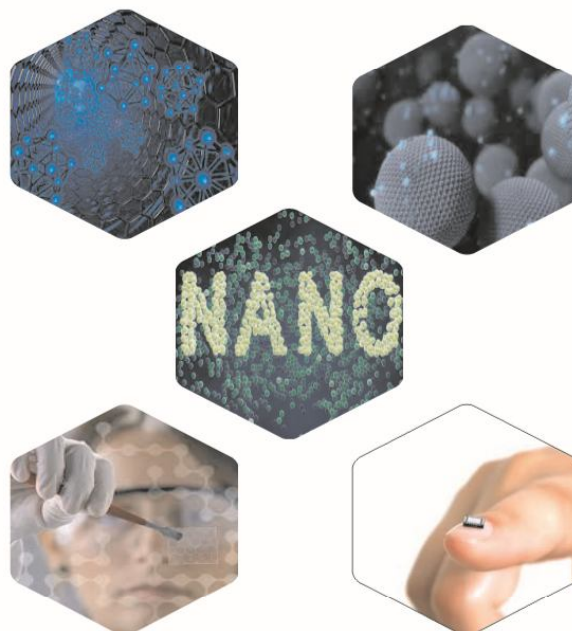
Nanotechnology in engineering is as vast as it can get. From recent developments in dentistry, people undergoing root canals have gained a powerful, yet tiny, new ally in the form of Nano diamonds being reinforced in gutta percha (natural latex produced from the sap of specific trees) to ward off infection effectively with improved rigidity. Some researchers are growing Nano circuitry with semiconducting graphene nanoribbons to revolutionize the world of electronics, while some are busy making Harry Potter fantasy a reality. The Berkeley researchers fashioned an invisibility cloak, meta-engineered with gold nano antennas to reroute reflected light waves so that the object was rendered invisible to optical detection when the cloak is activated.

It is fair to say that the second most famous tube after YouTube is carbon nanotube. A carbon nanotube is a nano sized cylinder of carbon atoms that is hundred times stronger than steel but at the same time, six times lighter!

Building vehicle-body parts with carbon nanotubes means better fuel efficiency and added strength; which in turn translates to increased passenger safety. There are countless other applications of carbon nanotubes that could take up pages to mention! Chemical engineers' most exciting area of interest in this realm is studying catalytic processes on a single nanoparticle with nanoreactors to lay the foundation for a new and sustainable energy technology and chemical synthesis. Professors at Chalmers (Sweden) are working to produce an entirely new type of nanoreactor where it is possible to control the transport of liquid or gas to and from a single nanoparticle. The nanoreactor consists of a sealable channel with a diameter of under a hundred nanometers in which a single nanoparticle, whose size, shape and chemical composition has been analyzed, will be enclosed. When a fluid containing reactant molecules, is injected on one end of the channel, it will interact with the catalyst nanoparticle, and the product molecules will eventually emerge from the other end, having been analyzed. The fundamental understanding that will be obtained in this way can be significant when producing new materials to create a more environment friendly catalysis of industrial chemicals and fuels, which will reduce carbon dioxide emissions and other environmental pollutions.

In closing, there is no doubt that nanotechnology holds the solution to every problem. It is our future. It is a small world after all; enveloping an entirely different, awe striking universe of its own that human beings have so far only gotten a fractional hold of!

Written by:
Aiman Ateeq
Batch 12-13



Synthesis of Graphene from Indigenous Coal

An alternative non-burning solution

A great deal of research has been made into producing graphene or graphene oxide by utilizing graphite as a starting material. An alternate method of producing graphene is by using low-grade coal as a starting material. Due to the abundance of coal in Pakistan, and an increased environmental concern from Government bodies and environmental agencies alike, increased awareness is being made to move over to non-burning solutions to fossil fuels.

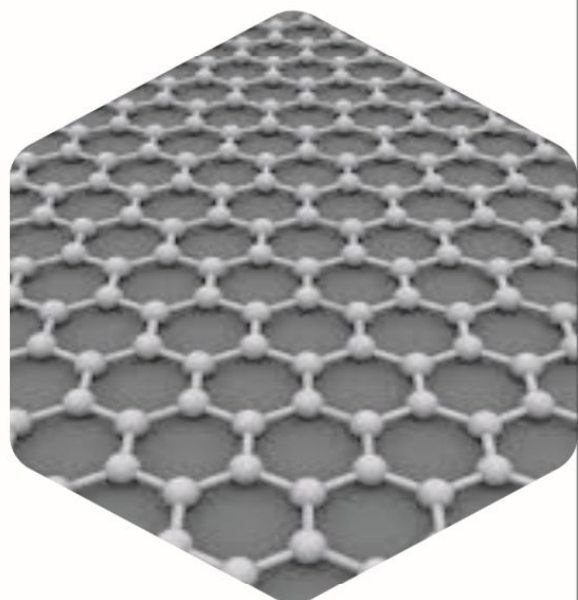
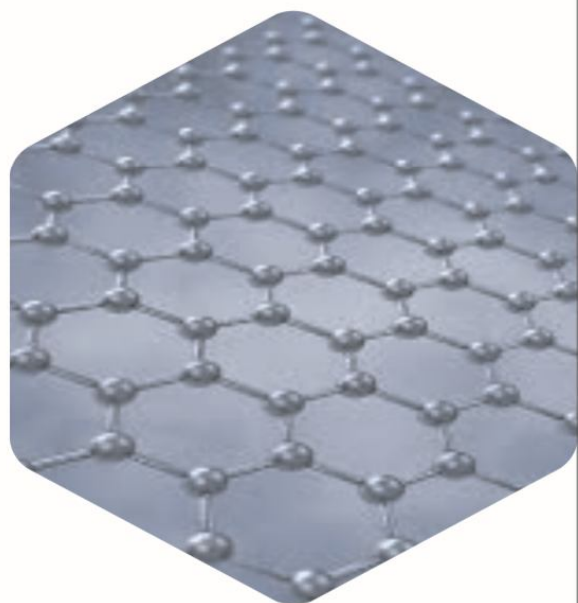
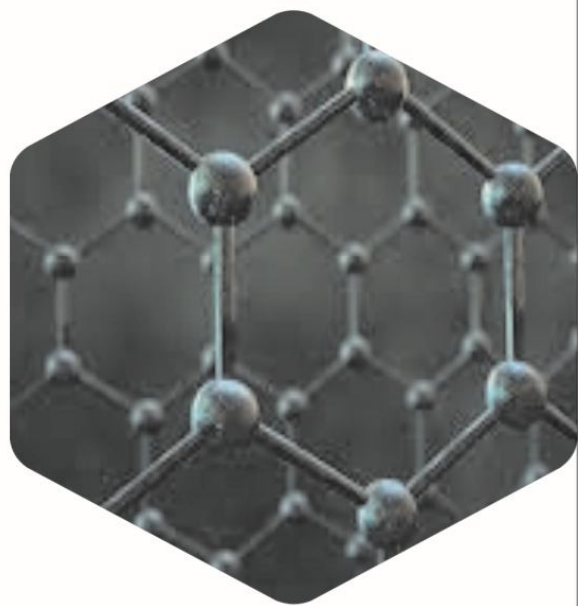
Hence the idea of synthesizing graphene from indigenous coal was born. Though this synthesis has been performed in an experimental capacity, in some countries like India and China, it has never been done before in Pakistan.

Before delving into the synthesis technique used in our project, let us dig deep into what graphene actually is. Graphene is a thin layer of pure carbon; it is a single, tightly packed layer of carbon atoms that are bonded together in a hexagonal honeycomb lattice. In more complex terms, it is an allotrope of carbon in the structure of a plane of sp^2 bonded atoms with a molecule bond length of 0.142 nanometres.

It is the thinnest compound known to man at one atom thick, the lightest material known (with 1 square meter coming in at around 0.77 milligrams), the strongest compound discovered (between 100-300 times stronger than steel and with a tensile stiffness of 150,000,000 psi), the best conductor of heat at room temperature (at $(4.84 \pm 0.44) \times 10^3$ to $(5.30 \pm 0.48) \times 10^3 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) and also the best conductor of electricity known (studies have shown electron mobility at values of more than $15,000 \text{ cm}^2 \cdot \text{V}^{-1} \cdot \text{s}^{-1}$). Other notable properties of graphene are its unique levels of light absorption at $\approx 2.3\%$ of white light, and its potential suitability for use in spin transport. Such properties are reason enough to explore low cost, environment friendly, and scalable means of graphene production.

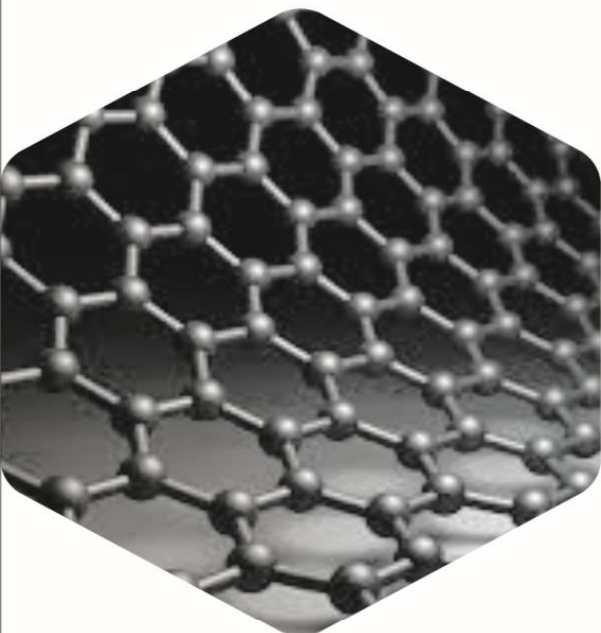
Potential graphene applications include lightweight, thin, flexible, yet durable display screens, electric circuits, and solar cells, as well as various medical, chemical and industrial processes enhanced or enabled by the use of new graphene materials. In the field of medicine, graphene has been investigated for tissue engineering and drug delivery. Due to graphene's high surface area to mass ratio, one potential application is in the conductive plates of super capacitors. Graphene films can be used as a protective layer against corrosion in battery components. Thus, they can prove helpful in creating long lasting batteries.

Moving towards the scheme of synthesis, the route chosen for the production of graphene is the hydrothermal method. This method involves three phases; namely, the pretreatment of coal; followed by

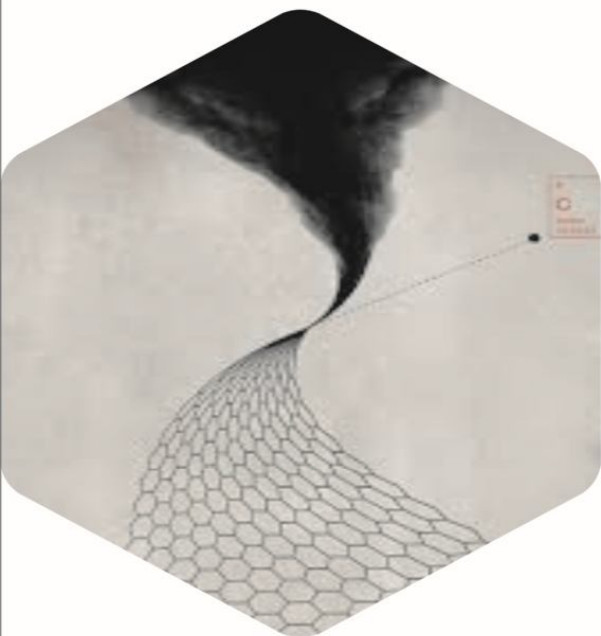


oxidation of carbonized coal using an improved Hummer's method; and the reduction of oxidized carbon source using hydrothermal technique. This technique is environmentally friendly, and industrially scalable.

The structure of coal, used as a raw material, has a paramount effect on the properties of graphene which can be determined by the proximate and ultimate analysis of coal. Hence, experiments were performed on two ranks of coal; lignite and sub-bituminous, to compare the properties of graphene produced by each. The first two phases have been completed, showing promising results. The first phase i.e. the pretreatment of coal was performed to increase the carbon percentage and decrease the ash content of coal. This involved acid washing followed by carbonization of coal in an inert environment. Water washing was performed after each intermediate step. The result was a relatively pure source of carbon, much like graphite.



The second phase, which involves the oxidation of carbonized coal by chemical means, successfully converted pretreated coal into graphene oxide. The oxidation was performed using an improved Hummer's method. In this method, coal is oxidized using specific combinations of acid and oxidizing agents. The reaction is highly exothermic and therefore, special care is taken to control the reaction temperature. The reaction mixture is then washed multiple times to remove all impurities. Vacuum filtration was performed for this purpose. Sonication was also performed to fully exfoliate the oxidized samples, after which centrifuge filtration was performed to obtain graphene oxide. This phase, however difficult to perform is relatively inexpensive. The oxidized samples have been sent for structural characterization testing.



Hummer's method will be followed by a hydrothermal reduction method i.e. the third and the last phase, to prepare graphene in pH value of 11 adjusted by NaOH at 140 °C for 6 h under continuous stirring in an autoclave. Internal Pressure applied will be 400KPa. The product collected will be washed with deionized water and dried overnight. XRD, FTIR and RAMAN analyses will be performed to examine the surface characteristics of reduced graphene oxide. This “water-based” route is advantageous compared to conventional chemical reduction processes based on hydrazine treatment, because it is very convenient to use, environmentally friendly, and industrially scalable and shows the ability to recover aromatic structures via repairing the post reduction defects.

The aim of this project is to apply our knowledge of engineering, along with extensive research under the guidance of our mentor, to discover an innovative tomorrow. It is trusted that this project will contribute to on-going research and production of graphene within Pakistan and abroad.

Project Members:

Written by:
M. Zaid Bin Ghazi
Batch 12-13

The War of Choices

It has always been suggested and emphasized that a student must never be confined to the academic zone only. When he is going through the learning phase, he must divert himself with versatility. This world is for seekers, explorers, and learners.

Initially, a student cannot prefer anything else over his syllabus. His academics come first and above everything because his particular field showcases him to the world. Ignoring one's syllabus and being continuously promoted is nearly a myth. Students essentially have to deal with their course of studies with interest and a will to make better future through it. Our fields are our only resource for earning a respectable life.

It may be taken into consideration that too much study of textbooks may end us to be anti-social individuals of society. This is, of course, a truth and a formal theory as well. So, being socially active and participant of some co-curricular activities makes a student a completely learned person.

Co-curricular activities (CCA) are not- academic activities that enable to supplement and complement the curricular or the main syllabi. They are meant to enhance social interaction, leadership, healthy recreation, self-discipline, and confidence. The prime activities may be drama, debate, art, writing, robotics, entrepreneurship, sports, orchestra and fan clubs.

But, a frequent problem of students is moving syllabus and CCA's parallel. In other words, making our clock tick right i.e. the time management. It is difficult to take two steps together without jumping. But with interest, proper plans and the quest for knowledge, it is possible.

Now, begins the 'War of choices' - the issue pretending to core interest and passion for a skill. What must be inclusive in to do list and what to opt out of it? Well, in this case, students must chase the rhythm of their heartbeats. Whatever comforts them, should be the priority. An artist portrays his perceptions by the language of colour. A writer does the same job but with his pen. He is a writer due to his speedy catchy nature and high imagination strength. A debater uses his oral power. He speaks and shouts a few times. This is to inspire people and to beware them. A sportsman is as good at focusing on his targets and nothing else. As said, "a sound body has a sound mind". The thing is that we need to express, perform, speak, stand up and find the treasure hidden among us.

Then only, we can achieve the true meaning of education. Education, as said by Sir Ken Robinson, is not a mechanical system. It's a human system. It's about you.

But, over all of them, comes leadership. Leadership is an art. It is the art which requires us to satisfy fellows, be through the toughest circumstances, and create the chain of unity. It indulges a fine build-up of confidence, leading skills and conveying of the message in the best expression. In corporate world and even in academic life, leadership keeps a significant weight. Every student must have thought to provoke ideas and a clear perception of his own towards different things. Such qualities make others prefer him over the rest and he becomes worthy of leading.

Moreover, to deal with people around us, we must have command over basic elements of everything out of everything. We must know what's happening around the globe. Because, in social gatherings, for sure we don't talk books.

Even selection of a path/field needs a fine growth of mind to understand choices and then go for them. Our paths must not be dependent on the conditions of today but on the conditions to be generated in the future. We can never fix an engineering oriented mind for the treatment of people.

How long could a mind which is always engaged in a new app development turn the pages of business books and earn it? Certainly, saturation happens and causes destruction.

Whatever the field once chose, should always be meant practically. Studying a bundle of theories, will not be useful unless we get to deal them ourselves. Hence, in order to be familiar with what we have been studying since childhood, we have to participate actively in technical projects too. We could find a new world inside this realm.

To conclude, it must be said that a student desiring success, has to make some smart moves and useful choices. As discussed, choices are plenty in nature - but have always been difficult. Fight this war and shine bright.!

Written by:
Sami Soomro
Batch 15-16

Apprentice's Institution

Deadlines? Endless assignments? Sleeplessness? Professors? Does it ring a bell? Nowadays we call it university. Does a university provide the requirements to help face the competitive outside world? When students enter a university what are they really expecting from that particular institution?

The elements I expected before attending my institution were interactive technology, teacher mentors, innovative approach provided by academic, personality development, healthy teacher-student interaction, stimulating discussions, practically applying theory via designing prototypes and entertainment.

To my astonishment, I experienced most of the elements I expected. Most teachers were able to develop a personal connection with students during their interactive sessions. There were many thought provoking discussion in technical courses which stimulated curiosity and permitted to express our creativity. The teachers always respected their students and most of the time, tried to bring out the best in them. Different societies promoted personality building activities.

However, one thing that was lacking in the university was promoting students to practically apply what they are learning and the lack of project work from preliminary level was not helping at all. Not all teachers are able to understand the fact that not every student in class is brainy; teachers should try to connect with each and every student in class. There are also other concerns like bullying, competitiveness, exam pressure and social issues that one encounters in university life. The university should accommodate more facilities and technology such as 3G/4G networks.

An institution accommodates as much as they financially can. A student should learn how to cope with problems by finding rational solutions and take help from the resources they already have. One thing that a university should emphasize on is research, development and project work from a preliminary level. That way a student will learn real-world applications and enhance their technical skills. As a result, an apprentices' institution is always under a constant development phase.

Written by:
Samra Khalid Ali
Batch 14-15



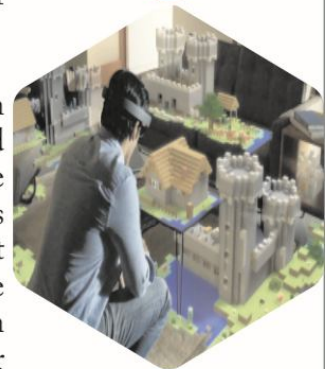
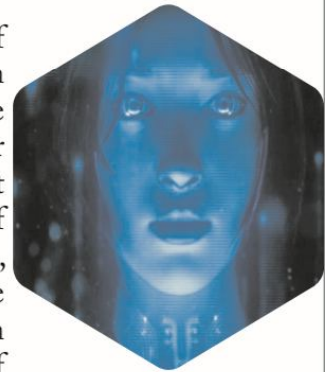
Let me ask you something. Do you know what a hologram is? No? Well technically speaking, a hologram is identical to any other object in the real world, with the only distinguishing feature being that a real object is composed entirely from physical matter, whereas a hologram is generated entirely of light. Just like its real physical counterpart, a hologram can be viewed from various angles and distances. However, since a hologram is basically to its core formed of light, it has no mass i.e. it cannot be felt. It cannot be pushed or pulled. A hologram can either be two-dimensional, like a sheet of paper or a giant LED screen, or it can be three-dimensional, like a sculpture or a miniature house. The study and production of holograms is known as holography

When people hear or see the word hologram, most minds deviate towards the familiar use of holography in science fiction. In the “Star Wars” franchise, long distance communication involved life-sized holograms of characters. In “Iron Man”, holographic displays are used inside the suit. These displays indicated current energy levels and damage status of the suit. The “Star Trek” series involved extensive use of the holodeck which was used for recreational purposes. It was used to create familiar places, participate in interactive stories, and to practice a variety of sports and skills. Holograms have also been used in animations such as “Meet the Robinsons”, “The Jetsons” and “Wall-E”. Holograms have been heavily present in video games such as the “Mass Effect” series and “Half-Life”. A much more popular use of a hologram would be in Microsoft's “Halo” franchise. A number of holographic objects are used to display the avatar of an artificial intelligence construct called “Cortana”.

The many uses of holograms as mentioned above seem far-fetched, beyond the grasp of modern technology. That could be true but people tend to forget the many modern devices did originally originate as plot devices in science fiction. TV shows of yesterday comprised of people having video chats with each other. Nowadays, it is a reality because of computer applications such as Skype. Flat screen displays of substantial sizes were a conception of futuristic tales but you can now find one in almost every household. Innumerable times, portable telephones were used in movies, novels and TV shows of the old days. This notion of portable communication eventually led to the creation of the mobile phone. These examples serve as a constant reminder that a sci-fi idea can eventually become a feasibility. Now the question arises: When are holograms due to appear in the modern world? Scientists predict virtual reality tools similar to the holodeck mentioned above (but without the ability to touch) will become a consumer-ready product by 2024. A holodeck may be the end stage of holograms but on January, 21, 2015, Microsoft announced Windows Holographic at their “Windows 10: The Next Chapter” press event. It is set to be introduced as part of the general rollout of Windows 10, through the smart glasses headset Microsoft HoloLens. The Windows 10 launch began on July 29, 2015 with the release of the PC version, with HoloLens to be released within the next year.

Windows Holographic is a mixed reality computing platform by Microsoft, enabling applications in which the live presentation of physical real-world elements is incorporated with that of virtual elements (referred to as “holograms” by Microsoft), such that they are perceived to exist together in a shared environment. The premier device for Windows Holographic, Microsoft HoloLens is a smart-glasses headset that is a cordless, self-contained Windows 10 computer. It uses advanced sensors, a high-definition stereoscopic 3D optical head-mounted display, and spatial sound to allow for augmented reality applications, with a natural user interface that the user interacts with through gaze, voice, and hand gestures. Codenamed “Project Baraboo,” HoloLens had been in development for five years before its announcement in 2015, but was conceived earlier as the original pitch made in late 2007 for what would become the Kinect technology platform.

As of this writing, a number of Windows Holographic applications have been showcased or announced, centered on Microsoft HoloLens. These include HoloStudio; a 3D modelling application which can produce output for 3D printers, an implementation of the Skype telecommunication application, an interactive digital human anatomy curriculum by Case Western Reserve University and Cleveland Clinic, architectural engineering software tools by Trimble Navigation, a version of the video game Minecraft, the Autodesk Maya 3D creation



application, and OnSight and Sidekick; software projects being developed as part of a collaboration between NASA and Microsoft to explore mixed reality applications in space exploration.

Windows Holographic can be used in making architecture and home designing much more convenient. HoloLens can assist architectural firms and their clients to better envision their projects. Right from the conception of a project, HoloLens could change the scale of modern construction entirely by enabling the projection of life-size plans. An accurate representation of a building that is to be constructed can be made so that each floor can be examined more closely. Clients would be able to look at this building as a life-size model before the building has been completed. As for home designing, people will no longer have to go through the hassle of moving furniture and decorating the house over and over again in order to figure out the best look for their house.



HoloLens can play a vital role in the industrial environment. Just like how it can be used in architecture, engineers can utilize HoloLens in designing plans for a large scale industry. HoloLens can also visualize the processes that occur in the inside of various equipment present in an industry such as reactors. Engineers can turn their rooms into a specific area in a plant. This can be helpful in explaining the plant to trainee engineers before taking them into the real plant. The equipment and plants will be holograms; the chances of an accident will be reduced to zero and the noise that is created is now controllable. Students currently studying engineering can also visit plants without actually having to go to one.



HoloLens can make many advancements in surgery. If a hologram of the heart of a patient is used during an operation, a surgeon can have more information because of that 3D, unobstructed view of the heart. HoloLens can also be used by other surgeons to oversee a surgery performed by another surgeon in a different hospital. They can easily be able to guide that surgeon in case any problem should occur. HoloLens can also be used in medical schools to better train students before they proceed to interact with a real patient.



Developed in collaboration with NASA's Jet Propulsion Laboratory (JPL), OnSight integrates data from the Curiosity rover into a 3D simulation of the Martian environment, from which scientists all around the world can visualize, interact with, and collaborate in together using HoloLens. It can be used in mission planning, with users being able to program rover activities by looking at a target within the simulation, and using gestures to pull up and select menu commands. JPL plans to deploy OnSight in Curiosity mission operations, using it to control rover activities by July 2015.

Sidekick is a virtual aid tool for astronauts with two modes of operation. Remote Expert Mode and Procedure Mode. Remote Expert Mode uses the functionality of the Skype application; voice and video chat, real-time virtual annotation, to allow a ground operator and space crew member to collaborate directly over what the astronaut sees, with the ground operator able to see the crew member's view in 3D, provide interactive guidance, and draw annotations into the crew member's environment. In Procedure Mode, animated virtual illustrations are displayed on top of objects with which a crew member is interacting. This mode can be used for guidance and instructional purposes in standalone scenarios. Sidekick is being deployed for use on the International Space Station. NASA expects Sidekick to be used by astronauts in actual mission operations by the end of this year.



The applications for HoloLens mentioned above is more than enough to emphasize the fact that this device will end up making mind-blowing advancements in scientific and medical applications. The biggest downfall for the HoloLens is that the device is required to see the holograms; anyone who wants to see the holograms must be wearing it. This problem should be expected as HoloLens is still in its early development phase. We are only scratching the surface of an idea so ambitious that it may take a few more years of research before the use of a headgear to perceive holograms would become obsolete. Currently, a developer edition is available for \$3,000. With this technology available to consumers just around the corner, it would not take long before other science fiction technologies such as FLT (Faster than Light) travel, teleportation, human augmentations, and self-tying shoes to appear in development. Only time will tell what the future has in hold for us.

Management of Heat Transfer Fluids

Optimal Management of Heat Transfer Fluid

In a liquid-phase system, a heat-transfer fluid carries thermal energy away from a heat source to a different location within the system. Most fluids contain additives that prevent components and piping from corrosion, fouling, scaling, etc.

These systems may have either an open or closed design and will have an impact on the selection of the heat-transfer fluid.

Open systems In an open heat-transfer system, the heated fluid comes in direct contact with the atmosphere. To ensure safe operation, the fluid selected for this type of unit must have a flash point, the lowest temperature at which the heat transfer fluid can vaporize to form an ignitable mixture in air, higher than the operating temperature. It is suggested that the operating temperature of the system be at least 30 °F lower than the heat transfer fluid's flash point. Open systems are small and need frequent fluid replacement because of the high rate of oxidation.

Closed systems In a closed system, the fluid does not come in direct contact with the atmosphere. Closed systems must have an expansion tank to accommodate the significant volume expansion of the heat-transfer fluid. The expansion tank may have blanketing gas in its headspace; despite this, it is still considered a closed system. Oxidation is also a factor in a closed system and will be discussed later in the article.

Bulk-oil temperature vs. skin-film temperature

It is important to know the difference between the bulk-oil temperature, T_{bulk} , and the skin-film temperature T_{film} , in a heat-transfer fluid application to be able to keep the system operating safely and more efficiently.

The bulk-oil temperature is the heater outlet temperature (set by the user), whereas the skin-film temperature is the temperature of the fluid that is in contact with the pipe wall. It is imperative to keep the flow rate high enough, while keeping the heat flux reasonable, resulting in T_{film} being slightly greater than T_{bulk} . However, if the flowrate decreases or if the fluid has high viscosity, the energy requirement to maintain the necessary T_{bulk} will cause the T_{film} to be much higher than T_{bulk} . This can cause the fluid to undergo thermal cracking (later discussed in detail). If T_{film} approaches the fluid's auto-ignition temperature, this could create a safety hazard.

It is, therefore, preferable to select a heat-transfer fluid based on the application's T_{film} rather than its T_{bulk} .

Fluid chemistry and degradation

It's hard to generalize the characteristics of the various types of heat-transfer fluids, because formulas that are alike in chemistry may have entirely different characteristics. However, the three degradation factors that most affect the useful service life of heat-transfer fluids are:

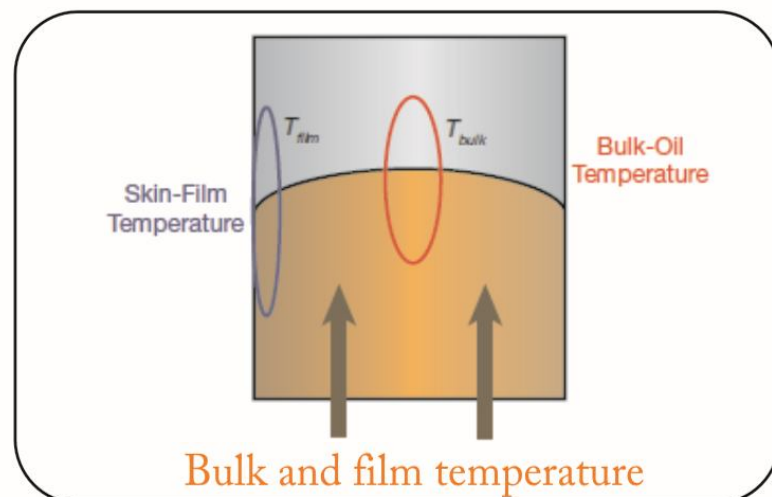
Thermal cracking - Fluid oxidation - Contamination.

Thermal cracking

Thermal cracking typically occurs when the oil molecules receive more thermal energy than they can absorb during their short residence time in the heat source. This excess energy causes the fluid molecules to crack. This type of degradation is a function of both the oil's inherent ability to absorb heat and the heat flux inside the heat source. Because of cracking, the shorter, newly formed molecules, have lower flash points than the parent molecule. With time, the concentration of these smaller molecules increases, resulting in an overall decrease in the flash point and fire point of the fluid, which is indicative of reduced heat-transfer efficiency. The cleavage reaction also causes the formation of high-carbon molecules that tend to agglomerate and obstruct pipelines and elbows. The accumulation causes the carbonaceous residue to form a layer that acts as an insulator.

To maintain the set-point temperature, additional heat must be supplied to account for the extra layer of carbonaceous buildup. This extra heat raises T_{film} which enhances thermal degradation.

In industrial practices, startup and shut down account for many instances of thermal cracking.



Operators are pressured to start up processes as quickly as possible. However, raising the temperature of the fluid from ambient conditions to 200-250 °C in a short span of time can be disastrous due to increased heat flux. This should instead take place over several hours to minimize heat flux and ultimately, fluid degradation.

Shutdown can also have a destructive effect on the oil if the circulating pump is turned off too quickly. Furnaces contain refractory material that can retain heat for several hours, causing any stagnant oil in the piping to undergo thermal cracking. It is, therefore, imperative to maintain fluid circulation for several hours after the heat has been turned off, to prevent the fluid to excessive heat. The following tips can help ensure that thermal degradation will not occur in your system:

- Monitor and control system's heat flux.
- Maintain the pump, heater, and fluid through preventative maintenance and oil analysis.
- Clean the system periodically to maintain its efficiency.
- Adopt best practices for startup and shutdown.

Fluid oxidation

Heat transfer fluids react with oxygen and degrade. Oxygen is related to temperature the greater the temperature, the faster oxidation occurs. The oxidation can cause various changes in the fluid. They include:

1. Gradual discoloration: The degradation effects are minimal.
2. The increase in viscosity: Reduced efficiency.
3. Increase in acidity: Fluid is more corrosive toward sensitive materials.
4. Formation of varnish: Causes valve sticking, resulting in heating problems.
5. Formation of heavy insoluble compounds: Reduced system efficiency through obstruction of small lines and elbows, and deposits on cool heat heat-exchanger surfaces.

The possible solutions or remedies to these problems include:

1. Removing the heavy deposits caused by oxidation that fall out of solution and is no longer carried by the fluid, by either manual removal or circulation of a chemical cleaning agent through the system to restore its initial efficiency.
2. Minimizing exposure to air. This is impossible in an open heat-transfer system. So frequent fluid change-up is required, and system cleaning is recommended after a few fluid change-ups. However, in a closed heat transfer system, the only place where the fluid comes in contact with air is in the expansion tank. To minimize oxidation

here, we ensure that the fluid temperature in this part of the system is significantly low, as oxidation is a function of temperature. Furthermore, an inert gas (usually nitrogen) can be used to install a gas blanket in the headspace of the expansion tank.

Contamination

Contamination can result in two ways; namely, internal contamination and external contamination.

Internal contamination. Newly commissioned systems may contain hidden contamination. New systems are sometimes pressure tested with water but not drained completely. Similarly, they may also include welding fines or pieces of wood. For this reason, flushing new systems with virgin fluid is crucial.

Process leaks are also a recognized threat, as the material being heated can leak into the heat-transfer fluid stream through cracks and pinholes. Routine oil analysis is thus performed to check for possible contamination. Figuring out the source of the leak is also an expensive and time-consuming task. In a case of strong chemicals, a process leak generally requires immediate shutdown and subsequent system cleaning and fluid replacement. If a different fluid or cleaner was used in the equipment previously but not properly removed from the system, it could quickly contaminate an entire batch of new fluid.



Progressive discoloration over time due to fluid oxidation

External Contamination. This sort of contamination occurs before entering the system. It occurs mainly due to improper storage of heat-transfer fluid. For instance, water that collects on the top off an oil drum due to improper outdoor storage can contaminate fluid before it is pumped into the system. Containers that carry the fresh oil to the system must be dedicated solely to this fluid to prevent cross-contamination.

In closing

Optimal heat-transfer fluid management is a vital part of a safe, efficient, and productive operation. Heat-transfer fluids are prone to degradation, but there are several ways you can reduce the risk.

The cost of using these fluids goes beyond just the purchase price. Other aspects such as handling, maintenance, and safety considerations should be kept in mind.

Written by:
M. Zaid Bin Ghazi
Batch 12-13

Low Temperatures, Big Chills....

Cryogenics is a branch of Physics that deals with the production and effects of very low temperatures and the behavior of materials subjected to these temperatures. The word originates from Greek words “kryos” meaning “frost” and “genic” meaning “to produce”.

The U.S National Institute of Technology has chosen to consider the fields of cryogenics as those involving temperatures below -180°C or -292.00°F or 93.15K . This dividing line is based on the fact that the normal boiling points of the so-called permanent gases such as Helium, Hydrogen, Nitrogen, and Oxygen lie below -180°C while those of other refrigerants lie above it.

According to the third law of thermodynamics, the lowest temperature achievable is the absolute zero. Molecules are in their lowest energy states. On reaching temperatures close to absolute zero, materials behave very differently than they would under ambient conditions. When liquid helium is cooled to 2.17K or below, it becomes a super fluid with very unusual properties associated with being in the quantum mechanical ground state. For example, it has zero viscosity and produces a film that can creep up the walls of a container.

The production of cryogenic gases involves several stages of compression and expansion. Air, for example, is compressed, causing it to heat, and then cooled to room temperature and below while still under pressure before being allowed to expand to atmospheric pressure. The liquid portion of the air is distilled to produce liquid oxygen, nitrogen and argon.



Cryogenics find numerous industrial and medical applications. Large Hadron Collider uses the largest cryogenic system in the world. LHC's functioning is based on the production of large magnetic field (8.33 tesla) using electromagnets that operate at $11,850\text{ amps}$ of current in magnetic coils. The only way to avoid overheating in these coils is by using them under cryogenic conditions where they act as superconductors. Another important application is in the production and transportation of Liquefied Natural Gas (LNG). Other applications include fast freezing of food and preservation of biological material such as semen, blood tissues and embryos called Cryopreservation.

Preserving an entire human body in the hope of later reviving it is called Cryonics but it is not a widely accepted idea and continues to be a bone of contention among researchers; both in terms of feasibility and ethics. Cryosurgery, the method of freezing portions of human body to destroy malfunctioning tissues, is being used to treat cancer, and abnormalities of skin, cervix, uterus, prostate gland and liver.



Written by:
Umer Abid
Batch 14-15

Production of Date Juice

Energize and Recharge

Extraction of natural fruit juice is being carried out since ancient times. People mostly prefer natural drinks, because of their healthy and nutritious qualities.

Why Date juice?

A few countries like Iran, Africa, Italy and some others are producing date juice on an industrial scale. Pakistan is self-sufficient in the production of one of the best quality dates in the world, and every year earns a huge revenue by exporting them. Unfortunately, date juice has never gained attention in our country even though Pakistan is the 4th largest producer of dates in the world.

Our prime motive was to initiate an approach towards the industrial scale production of date juice by designing and fabricating a pilot plant so that it could be implemented at a national level.

Process Scheme

There are 4 basic steps which constitute the production of date juice.

- Extraction
- Enzymatic treatment
- Clarification and filtration
- Evaporation/ Concentration

Heating and Agitation: Blended mixture of dates and water are mixed with a ratio of 1:3, heated and agitated for about 10-20 mins at 60-70°C. It is done in a heating tank of volume about 10 liters. The pulp and water mixture is then treated with an enzyme Rapidase TF for maceration purpose in order to break the date flesh by its action and make the extraction easy. In the same tank, pasteurization is done to stop the enzyme activity used for maceration at 90°C for 5 min.

Enzymatic Treatment: After maceration, the pulpy macerated mixture of dates and water is treated with 3 different enzymes for different purposes; namely Rapidase Smart Clear for lowering viscosity, Rapidase Optiflux for easy filtration, and Hazyne DCL for maximum yield. The incubation time for enzymes varies from 30-120 min. This is also done in the same heating tank in order to reduce cost of separate equipment.

Clarification: Clarification of pulpy mixture is done in a separate clarifier in which screens of different mesh sizes are used so that heavy and big particles of pulp can be separated. It helps in easy filtration and enhances juice clarity. This is self-designed equipment due to limited budget and ease of fabrication.

Micro Filtration (MF): For filtration we have used cartridge filter of 5micron sieve size. A centrifugal pump of less than half Hp is installed between clarifier and filter in order to pump the mixture from clarification unit, so that the pressurized mixture can be filtered easily.

Evaporation/ Concentration: To concentrate the final juice after filtration it is heated to evaporate extra water present as well as to achieve desired brix level of 70 to 72° Brix for date juice. It is done in a container of about 4 liters, in which juice coming from the filter is heated at 100°C for about 15 minutes. For this purpose, we have used again a self-designed container of 4 liters and covered it with a lid in order to prevent any environmental contamination. A vent was also provided to release pressure.



Scope of our work and its significance

There are many ways to convert dates into value added products, such as syrup, jam, vinegar and many other derivatives. Govt. of Sindh has claimed that date processing plants must be installed in order to generate revenue that would definitely promote economic stability.

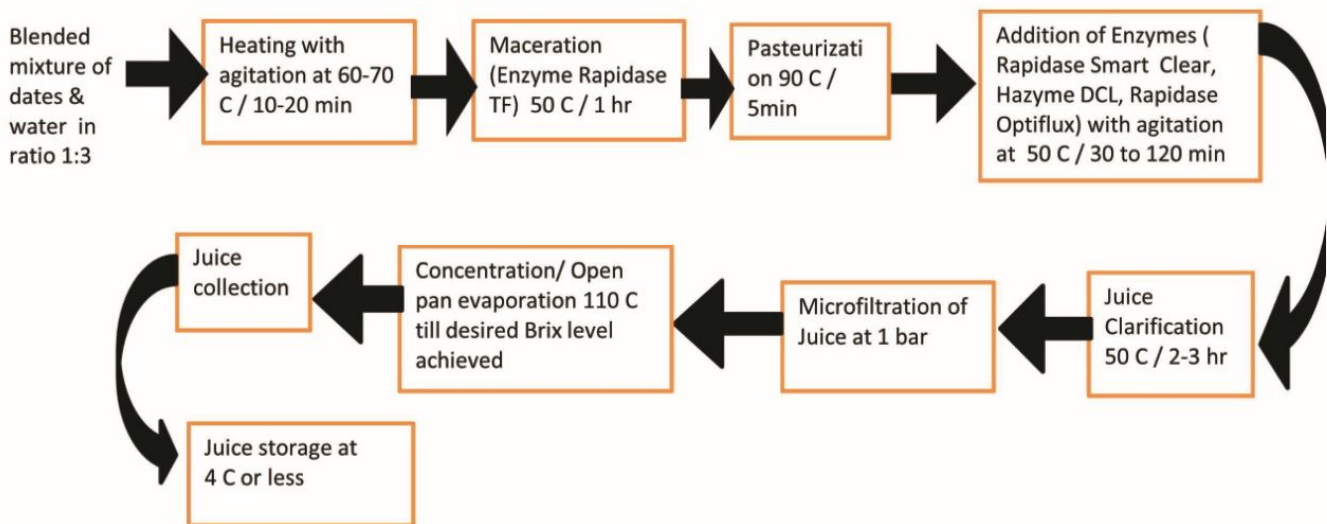
This work has never been carried out at a national level. As the awareness of the project is negligible, it will surely take time to implement this on an industrial scale, even when positive results are guaranteed.

The many benefits of date juice are reason enough to invest in its industrial production. Below are some of the benefits listed:

Date juice contains antioxidants which prevents the body with cancer. It is rich in dietary fibers which decrease LDL i.e. bad cholesterol level. It contains Vitamin B in date juice makes our hairs healthy. Due to the high iron content in date juice it fights anemia. Presence of nicotine in date juice prevents intestinal disorders. Date juice, if take continuously inhibits the growth of pathogens which results in growth of friendly bacteria making digestion easy and quick for boost of energy. Daily intake of the date juice adds glow to the skin. The presence of vitamin A in the date juice prevents night blindness in the growing ages.



Block Flow Diagram (BFD)



RESULTS

Different runs were performed in order to get best results concerning about maximum juice yield, taste, TSS, aroma, shelf life and no use of preservatives.

Samples were tested from PCSIR (Pakistan Council of Scientific and Industrial Research) and it was found that the juice manufactured is of good quality and has a shelf life of about 1 month without any changes in properties if stored at -4°C or less. The Brix level of 69°Brix is achieved which is near to standard value of 70 to 72°Brix.

Project Members

- Talha Khan
- Shahar Bano
- Noman Ali
- Imtiaz Ali

Final Year Projects

Continuous Pyrolysis of Waste Lube Oil Into Lighter Hydrocarbons

Team members:

Salman Khan
Adeel Ahmed
Umais Naseem
Ahmed Maqbool



Fabrication of Non-Woven Fiber

Team Members:

Hammas Ali Khan
Talha Hassan
Osama Jamal
Muhammad Raza



Pyrolysis system for the production of fuel oil from waste plastic

Team Members:

Ahmer Dad Khan
Rana Bilal
Arslan Saleem
Adeel Desai



Synthesis and Characterization of Transition Metal Oxides as Low Cost Catalyst

Team Members:

M. Asad Patel
Obaid Khan
Shafaat Hasan
Jahanzaib Khan



Unveiling Chemical

Among the many fields offered by NEDUET, chemical engineering is considered to be the toughest one available. The Chemical Department, with its reverent reputation demands an intrepid demeanor from most of its students. It is a fully accredited program approved by the HEC of Pakistan.

Professor Dr. Inayatullah Memon is the chairperson and Professor Dr. Muhammad Tufail is the dean of the department, both holding their Ph.D. degree from England. Besides that, the department consists of 3 assistant professors, 6 lecturers, a senior I.T manager and up-to 30 non-teaching staff. The teachers work hard bringing creativity into prevalent teaching methods to assuage the level of difficulties students face in academic courses.

The solution to augment one's technical skills and knowledge and question what the books have taught you lies within the rooms where you can test what you have learnt. The department is well equipped with 8 labs namely Chemical Reaction Engineering, Chemical Process Control, Fluid Mechanics, Heat and Mass Transfer, Particulate Technology, Separation Process and a computer lab.

Scholarly charm is not the only adverb for a chemical student. In today's world academic excellence is not the only criteria on the hiring checklist. Although most of the students leave no stone unturned in their quest to maintain their GPA, they actively participate in non-academic activities that nurture growth and boosts communication skills. The Chemical Department boys were able to snatch the Football competition's finale title 2016. Apart from this there have been notable events organized by students via the departmental society.

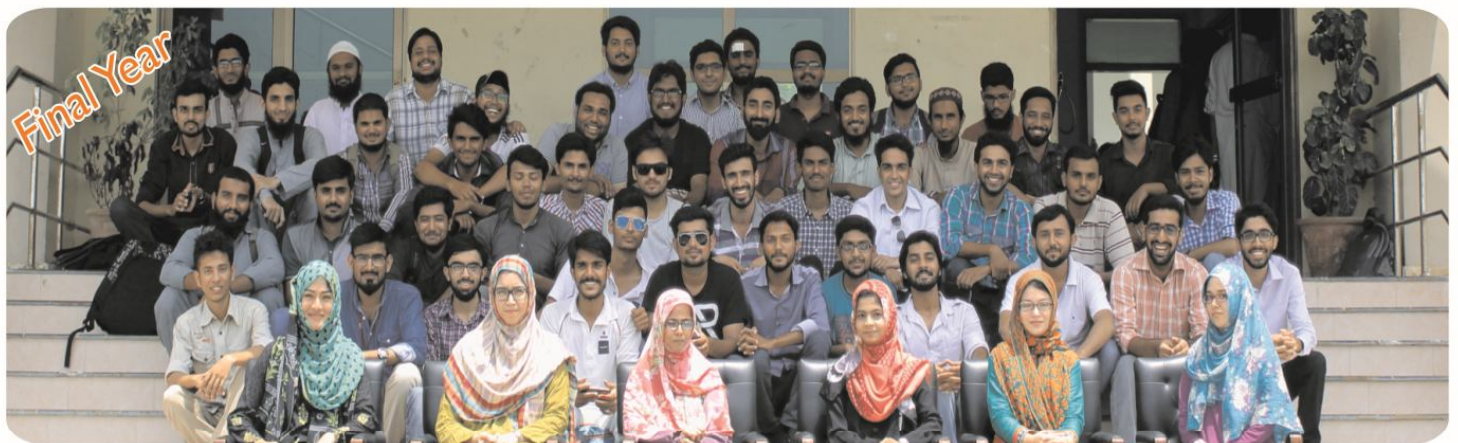
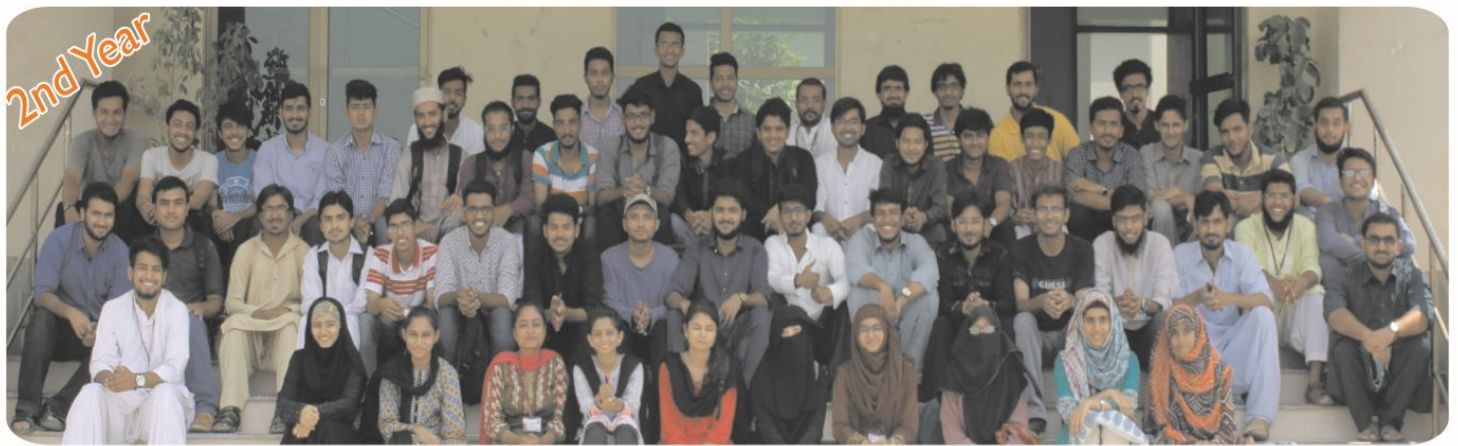
SCHEME, Society of Chemical Engineering, helps students organize educational events that enable them to bridge the gap between students and the industry. One notable event was last year's PNP '15, where students from different technological institutions in SINDH participated by presenting their engineering based projects. The winning position was secured by chemical students for their project "Co-Pyrolysis of Waste Lube Oil and Waste Cooking Oil". SCHEME in collaboration with the Department of Material Engineering was able to organize the first International Conference on Advanced Materials and Process engineering '15. Intellectuals from all over the world participated in this event, discussing their research papers. In the year 2016, the society has been able to come up with events like CYBORG, a gaming competition, and Research in Focus, which dealt with

This program is replete with students belonging to different backgrounds, which makes the learning environment quite diverse. Sometimes even the most ingenious can go down in flames but the lecturers are always supportive in providing advice, help and counseling. Students enter freshmen year as amateurs and they graduate from their senior year as versatile and skilled engineers, along with innovative ideas in their hearts, ready to face the challenges in the realm of technology.

Written by:
Samra Khalid Ali
Batch 14-15



Batch Photos



Internship Experience

Owais Ahmed (Batch of 2011-12)

The internship opportunity at ENGRO Polymers and Chemicals Ltd has been a great learning experience. The best feature of the internship program was that it was project-based. While working on the projects in a dynamic work environment, you taste the challenges and demands of professional life. You feel like a part of ENRO when you know that your work on the given project has its value for the company. It is also challenging and competitive because your performance is evaluated at the end by highly qualified professionals. I can truly say that it was a rewarding experience which has prepared me proficiently for the professional life.



Ma'arij Naveed (Batch of 2011-12)

It was a matter of great honor for me to work for a period of two months under the M/S Linde Group Pakistan, the world's largest multinational industrial gases and engineering Company. I had the opportunity to work at the gas plants, producing atmospheric gases, Carbon dioxide, hydrogen, dissolved acetylene and nitrous oxide. I received extensive training at the Air Separation Unit and Claus plant process to improve the carbon foot print removing SOX and NOX to increase the ammonia conversion.

In short, this opportunity made me step out of my comfort zone and work with sheer determination and commitment.



Sabih Bin Riaz Siddiqui (Batch of 2011-12)

I did my internship in GlaxoSmithKline (GSK) and International Center for Chemical and Biological Sciences (ICCBS) and to be very fair, it was an eye opener. The internship makes you realize your strength and weaknesses in the practical field. On the other hand, it also allows you to explore the versatility of areas available for your professional development.

You also need to extract the relative information from experienced people in the industry and then filter out the required content. The most important thing about internship is that you should be able to enjoy the exposure and learn alongside.



Asad Patel (Batch of 2012-13)

My internship at LOTTE Chemicals has taught me more than I could have imagined. Earlier, I had no idea where my career was going and I lacked confidence in what I am really good at. My internship has definitely given me a better understanding of my skill set and where my career may take me. Being my first experience in an industrial atmosphere, I didn't know exactly what to expect. The environment here at LOTTE is quite congenial, yet it taught me how to behave in the workplace. Observing the day-to-day activities has taught me more about teamwork and how people come together to get things done.

Also, LOTTE Chemicals provided me a platform to realize how I could use my skills in practical life. I was able to apply the theoretical knowledge I gained at NED, while developing my communication and organizational skills alongside. If given the opportunity, I will definitely consider a career at LOTTE as the people and the work environment are exactly what I am looking for.





Shahina Siddiqui (Batch of 2012-13)

BYCO gave me a unique and memorable experience with excellent co-operation from the management and staff. On-hand experience about refinery, including frequent on-site visits and full support from the supervisors, made one month at BYCO, truly unforgettable. This internship provided me the opportunity to gain practical experience that I cannot get in classroom.



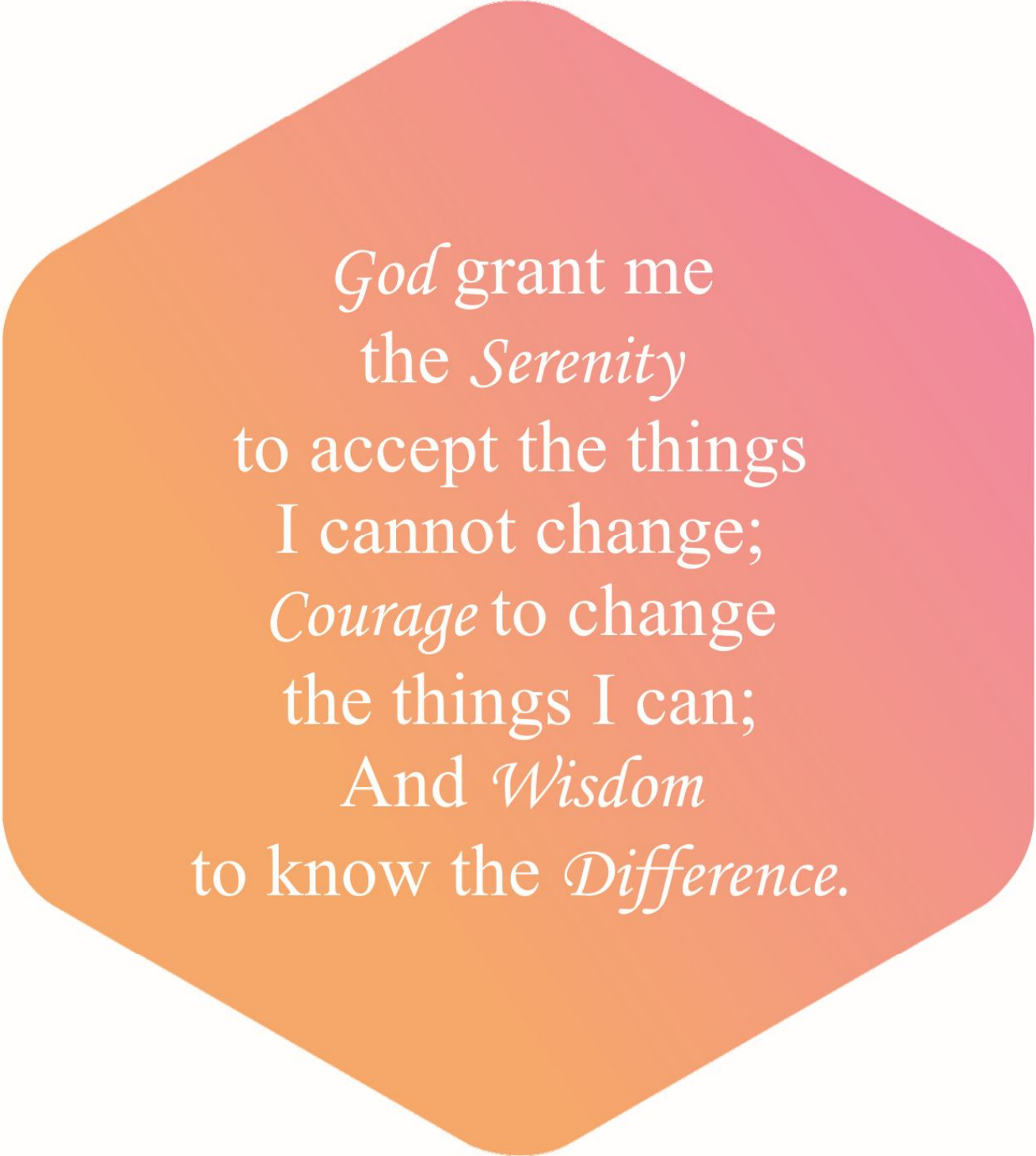
Yasir Ahmad Shaikh (Batch of 2013-14)

The first three days were mainly our orientation, where us interns were acquainted with the duties and working of the company's departments. From the fourth day, we were allocated to different plants, four in total, where we had to spend four days on each plant. Our job was mainly to study the process flow diagrams and observe the working of different units and sections of the plants. Exploring around however, was no easy task due to the sweltering heat of Ramadan.

Life at FFBL was as disciplined as could be. One of the many good things which I found worth appreciating was that safety was a top priority and everyone abided by the rules. All the operators and engineers were extremely cooperative, and not once did they show any reluctance whenever we asked them to show us around despite the torrid summer days.

Overall, I had a really good time there thanks to the great learning environment. It doesn't really matter how prestigious or reputed the company is. So if you are seeking an internship, don't just look for big companies, try considering smaller ones too.





God grant me
the *Serenity*
to accept the things
I cannot change;
Courage to change
the things I can;
And *Wisdom*
to know the *Difference*.



Edition 2016