Professorial Lecture UiTM
Professor Ts. Dr Norazah Abd Rahman

Chemical Process Innovation: Paving The Path To Commercialisation

Program

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Dewan Sri Impian, Hotel UiTM Shah Alam

5 Januari 2024 (Jumaat), Jam 2.30 petang

Nama Professor Ts. Dr Norazah Abd Rahman

Tajuk Chemical Process Innovation: Paving The Path To Commercialisation

Jangka masa : 4 jam 35 minit

Transkrip:

3:06:18 : Bismillahirrahmanirrahim Assalamualaikum Warahmatullahi Ta'ala Wabarakatuh. Alhamdulillah syukur kita kehadirat ilahi Kerana dengan limpah dan rahmatnya Dapatlah kita bersama-sama hadir ke majlis pada petang ini Pertamanya saya ingin mengambil kesempatan ini Untuk merakamkan ucapan terima kasih Kepada semua tetamu yang hadir Sama ada secara fizikal atau secara dalam talian Kerana sudi meluangkan masa Untuk bersama-sama dalam majlis syarahan Profesor saya Pada hari ini Untuk meneruskan majlis dan menyampaikan syarahan saya Saya mohon izin untuk menggunakan bahasa Inggeris . Distinguished guests, ladies and gentlemen I am excited to deliver a speech Entitled Chemical Process Innovation Paving Towards Commercialization. This are the ouline of my presentation today. I will walk you through on introduction on Innovation with specific examples of our research work and lastly I will share conclusion and future outlook.

3:08:30 : Before we get into the chemistry process I would like to draw your attention to the chemical compounds around us. In our daily lives, we encounter many chemical compounds, and they are significant in our lives. Have you ever imagined if these chemical compounds did not exist? We use chemical compounds when we want to brush our teeth every day We wear our clothes. We drive our cars to work. We live in our homes. majority of these material start with chemical compound which require the involvement of chemical engineer. Let's take a look at these green clips. Which I think almost everyone is familiar with. Done. Previously, salt and sugar were very important in our lives because without them, our food would be tasteless. But now, times have changed and our needs have also changed. Our approach to with sugar and salt consumption has evolves due to different factors such as dietary preferences, health conditions such as diabetes, high blood pressure, and overall health. As a result, we are now exploring alternatives to traditional sugar, turning to artificial sweeteners like Equal and Stevia, or incorporating supplements into our routine to address specific health needs. This changing landscape prompt us to innovate and seek out new materials that align with this involving Health consideration, ultimately, contributing to an advance quality of life.

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3:11:15 : This dynamic shift in our choices reflects a commitment to healthier living and a proactive engagement with innovative solutions that cater to our individual health requirement. Innovation does not happen overnight, rather it evolves over time. I would like to take the example of the transportation industry a sector familiar to us all. If we rewind the clock many years ago. We find ourselves in an era where steam engine cars were introduced on the roads. Progressing forward, internal combustion cars took center stage. Now as we gaze into the future we anticipate vehicles powered by hydrogen solar and batteries. achieve aligned with our commitment to decarbonization initiative.

3:12:09 : This Evolution underscores our Collective focus on clean and Green Solutions in line with Malaysia's interest in reducing its economy wide carbon intensity of 45% in 2030 compared to 2005 level. This distinguished guest ladies and gentlemen how do you think all of this can be achieved if it is not state started from research and Innovation Innovation starts from ideation, followed by proof of concept, technology formulation, prototype and prototype system. demonstration of system and lastly, commercialization. It is the transformation of a dream into reality where we put our minds into it. Innovation means a lot, it benefits humankind in many ways. This is absolutely a way for us to contribute as a khalifah in this world. It never crossed my mind as a chemical engineer that my team and I could play a role in benefiting communities including Industries and societies through our research.

3:13:30 : The wisdom of prophet Muhammad once echoed in my mind the best of people are those that bring the most benefit to the rest of mankind. This profound saying has become a guiding principle inspiring us to channel our efforts into research that brings tangential benefits to humanity. Over the past 16 years of my research journey, I've had the privilege of collaborating with brilliant minds, delving into diverse research areas and addressing a myriad of challenges. Allow me to guide you through the path of my research endeavors. The pursuit of converting ways to wealth has been a focal point of our research, centering on thermochemical conversion. Technologies like paralysis, storage faction, and microwave paralysis. Our exploration in the extraction process encompasses super critical carbon dioxide extraction, microwave extraction of gaharu or agar wood and microwave sterilization and extraction of palm oil.

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3:14:37 : In the realm of membrane separation our efforts extend to the development of thin film membranes, biocatalytic membranes, and membranes for recycling span lithium ion batteries. Finally our research in advanced materials and particle processing, spans various application in biomedical food technology, oil and gas application, pharmaceuticals catalyst and refrigerant development and liquid fuel additive. Let us begin with the first project which addresses the abundance of tyre, wood and plastic waste, that have been generated annually in Malaysia. Exploring the waste as alternative fuel could be a significant effort especially towards minimizing the impact to climate change. In addition, the need in reducing the reliance on fossil fuel, particularly coal in the power plant for electricity generation has motivated our team to explore the feasibility of co-combustion of selantek coal with this industrial waste. Although it is done using an instrumental analysis that is thermographic analyzer, the results are useful to understand the thermal behavior of this waste.

3:15:55 : From that analysis it is learned that the three waste have different thermal behavior with the plastic wave having higher reactivity followed by the wood and tire waste. Selantek coal is known to show low reactivity in which is thermal degradation only started at temperature of 450° C. It is important to note that sadistic behavior during co-utilization of coal and plastic will observed from all the blends especially beyond temperature of 500° C. Having done having done this research, we can conclude that this material cannot be used directly. In order to co-combust with coal. In another research dealing with biomass, we have utilized a tu finesse to explore transforming biomass a high energy, fast growing crop Leucaena Leucocephala or better known as petai belalang and abundant agriculture waste from oil palm plantation which is oil palm farm, into a solid fuel through a process known as torrefaction. Torrefaction is a noble technique that mainly focus on improving the calorific value of the biomass by exposing the samples in the less abrasive atmosphere which is at low temperature less than 300° C. High enough to drive off the hemicellulose and cellulose from the biomass.

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3:17:24 : From the characterization the calorific value of this biomass could be improved from typically 17 to 19 MJ per kilogram up to 26 MJ per kilogram. For your information for the material to be ignite, it must have 21 MJ per kilogram. The samples were reported to be higher than that of Mukah balingian coal which is around 24 MJ per kilogram. The pallets also showed high thermal energy density and high fuel ratio which reflects on having better combustion efficiency and reducing pollutant emission. Hence creating high value for utilization as fuel and alternative to the fossil fuel in a typical coal fire power plant. The derived solid fuel from torrefaction of samples were tested during co-combustion with silantek coal which have a colarific value of 31 MJ per kilogram. This work allow us to understand the thermal behavior during combustion. The efficacy of Lear exploring Innovation techniques in transforming waste into solid fuel, has initiated another basic understanding of transforming oil palm biomass into solid fuel via conventional paralysis technique.

3:18:42 : it was estimated that the oil palm industry in Malaysia has generated approximately 85 to 100 million tons of biomass waste, and 70 to 110 million tons of palm oil meal affluent. This work evaluated the possibility of converting biomass into charcoal as fuel it reveals that the pyrolysis has improved the colarific value typically from 16 MJ per kilogram up to 27 MJ per kilogram much higher than a sub-bituminous coal which is Mukah balingian around 25 MJ per kilogram. It was found that the combustion of the biomass char mimics the profile of the sub-bituminous coal unlike the combustion of the raw counterparts. For application in a coal fired power plant it is advisable to choose char from anti fruit bunch, rather than you use it raw, you have to turn them into char so that you can combust. So it is advisable to choose char from empty fruit bunch and palm kernel shell as compared to Palm Mesocarp Fiber as the former char can be blended with coal due to synergistic behavior that have been demonstrated in this research.

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3:19:57 : Distinguished guest ladies and gentlemen, our prior research has successfully identified opportunities and viable alternative aim at reducing our dependence on fossil fuel. Thereby mitigating, environmental impact in transitioning from energy generated from fossil base into a cleaner alternative such as removable fuel solar wind and hydro. A notable aspect of our research showcases the feasibility of incorporating biomass in its char form as a fuel source. Utilizing the existing Coal Fire plan, you can see on the screen, the existing Coal Fire plan could be an alternative to ensure the current asset could be rejuvenated rather than demolish, abandon by firing this alternative fuel. It means that we still can use all this Coal Fire plan by using our material. We are enthusiastic about fostering collaboration on a larger scale to actively contribute to the ambitious goal outlined in the National energy transition road map Nita. This collaborative effort will ensure that we play an integral role in supporting and shaping Malaysia's energy transition towards a sustainable and environmentally friendly future.

3:21:15 : Based on our previous investigation on plastic pyrolysis we have seen the potential of recovering the hydrocarbon in this plastic waste as liquid fuel. This has been done on a prototype scale to the proof of concept and the innovation has received an intellectual property of utility innovation Under The Institut Kemahiran MARA, Bintulu, Sarawak, and we are in the process of bringing this technology to the local community. Moving forward we are thrilled to have had the opportunity to engage in a collaborative research endeavor with esteem partners from China, both in academia and Industry initiated back in 2019. Securing a generous collaboration Grant of rmb 3.3 million from the ministry of Science and Technology of the People's Republic of China has been instrumental in propelling our joints effort. This funding facilitates a dynamic partnership with Huazhong University of Science and Technology where our Collective focus is on addressing the enviromental challenges arising from open burning practices in agriculture. Our collaborative initiative is driven by a commitment to transforming waste into wealth.

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3:22:29 : Presenting a sustainable solution that yields benefit for both the environment and the economy. As the heart of our effort lies the Innovative application of energy regenerative paralysis, in aiming to efficiently and cleanly utilize tropical Agriculture and Forestry waste. This approach align with our shared vision for a greener more sustainable future. The industrial sector recognizing the significant of this initiative has taken a leadership role by as implying corporate social responsibility. In a demonstration of this commitment they are providing a pilot scale pyrolysis unit, a pivotal contribution that significantly enhance our capacity to mitigate environmental pollution stemming from open burning practices. These collaborative efforts will make meaningful strikes in Environmental Conservation and sustainable Waste Management. Distinguished guest ladies and gentlemen, back in 2007 when we first started the research it was driven by the inspiration to address the abundance of biomass and the increase in oil price in which solution that allows the management of Agriculture waste and minimizing environmental impact by minimizing coal should be the alternative.

3:23:53 : The microwave technology is an Innovative solution to conventional heating technique as it has the advantage to achieve fast and volumetric heating and more importantly could be easily manipulated as with the way it interacts with material based on the dielectric properties and penetration depth. We have ventured into different agriculture waste, oil palm industry, and industrial waste, automotive paint sludge. Inspired by the efficacy of the past research we have now also ventured in creating values to the community, to solve the food waste issue and also as an alternative disposal technique of use Mashaf Quran. To date we receive two internal grant, three fundamental research grant, one prototype type research grant, and also industrial grant to support this innovative solution to waste management with a total grant of more than 500,000. Well inspired by the pyrolysis of palm biomass via conventional heating. This project proved that although oil palm biomass is transparent to a microwave. We managed to innovate the process to pyrolized the ways to obtain the biomass char for solid fuel application. The core combustion analysis shows the biomass char combustion Behavior mimics the Mukah balingian coal similar reactivity with a longer burnout time.

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3:25:22 : Synergistic interaction were observed during the co-combustion which shows benefit for reducing the emission. It has been demonstrated that empty fruit bunch is the best ways to co-combust with coal. Beside focusing on converting waste to solid fuel we also managed to handle waste that has approximately 70% moisture content from industrial sludge such as automotive paint sludge. We have demonstrated that with the technology we manage to convert the waste into fuel yet its properties are different based on different types of catalyst used in the process. Apparently with the right ratio of carbon and zeolite the quality of the priority oil improve in terms of its environmentally friendly properties from this research we have successfully obtained utility Innovation, UI and pattern for the prototype use that we have developed. For Industries which produce paint, this process could generate a circular economy where this waste could be turned into three types of material such as solid, which contain more than 50% of titanium and can be used in construction industry. Pyrolytic oil and gas as potential fuel.

3:26:41 : Distinguish guest ladies and gentlemen have you ever imagined that wet food waste could undergo thermal processes in a very short period of time? By using this technology we could process this waste within an hour and without going through any pre-treatment such as long hours of drying. Usually we use sun drying for the pre-treatment. We have shown that the solid product can be turned into charcoal, charcoal briquettes for fuel application with a calorific value of about 23 MJ per kilogram, higher than the commercial charcoal. Our current research is now venturing into upgrading the value of food waste into biographene, which later can be used in electronic and semiconductor, conductor ink, and many more. It is hoped that this Innovation could reduce the amount of food waste send to land field. It would be more meaningful if the community were involved directly by segregating food waste from source. In 2022, we have been approached by a team from Masjid Abdullah Fahim, Penang. To help them to find an alternative solution to dispose of the use Mushaf Quran other than incinerator. We have demonstrated that this technology can be an alternative way of disposing of use Mushaf Quran in which the solid product from this process can be converted as an ink for Quran printing.

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3:28:18 : We are currently working to formulate the ink, by doing so it creates waste circularity for the Quran printing industry. This work has initiated the Majlis Fatwa Penang, to come out with a fatwa and permission and they has declared that this process is “harus”. I cannot translate that into English because “hukum”. We have to speak in Bahasa. So this process is harus. By sharing this research finding I hope that your views toward waste have now changed. Now, you will not see waste as waste, but you see wealth. Now let me walk you through another theme of our research which is extraction process. Recent interest, recent increase of public interest in Herbal Remedies has motivated us to extract red butterfly wing or in Malaysia we call daun rerama oil. Which has various therapeutic application such as anti-cancer, antimicrobial, anti-inflammatory, and other pharmacological activities. By utilizing super critical carbon dioxide extraction. Conventional method of extraction of the oil is by using solvent such as hexane and methanol and this method is not suitable for medicinal purposes because they are toxic unsafe and can contaminate the product.

3:29:53 : Therefore, extraction of daun rerama plant using pure super conductor carbon dioxide without using any cool solvent was used. The effect of extraction parameters such as temperature and pressure of the process on yield solubility and mass transfer of this oil were evaluated. Results demonstrated that the oil and solubility were highly dependent on the extraction pressure analysis on the chemical compound in the oil showed that it exhibits higher content of medicinal compound primary from the class of steroid, turpenoid, esther and fatty acid. Innovation on extraction method in this study have been carried out to reduce it dependence on solvent application and to increase its efficiency. Innovation in the extraction process has shown tremendous improvement with the incorporation of microwave and the microwave assisted extraction update is presented in the following slide. In this method soap, gaharu or agarwood is subjected to microwave radiation and this heats up the mixture when microwave radiation is applied to this mixture the polar water molecules interact with the polar and ionic compounds of the gaharu chips causing them to vibrate and release their essential oil.

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3:31:11 : The heat generated by the microwave radiation also helps to break down the cell walls of the gaharu chips, facilitating the release of the essential oil. It has been found that microwave do improve the process where it enhances the oil production by approximately 50% with a 28% reduction of extraction time and 88% of energy reduction as compared to the conventional methods. From GCMS we found that agarwood oil contain gjin and alloaromadendrene which are the major compound in gaharu oil. Distinguished guest ladies and gentlemen palm oil sterilization is known to generate a large amount of waste water known as palm meal oil affluent. This motivate us to innovate alternative solution which could improve the sterilization process and at the same time extract the oil from the fruit. The results reveal that microwave technology could effectively loosen the fruit from the speculate with minimum water usage within a short period of time. This Innovation renders a single process rather than two separate processes of sterilization and extraction.

3:32:24 : Now Palm oil they have two separate processes but we suggest only one single process. This finding could have an impact on the existing palm oil meal processing. During the extraction process apart from producing crude palm oil, a byproduct with caramel like aroma known as palmitic acid is also produced which can be used as food additive and surfactant for cosmetic. carotenes content of crude palm oil produced from this equipment is much higher than crude palm oil produced from conventional equipment. My team and I have also explored the application of membrane for environmental purposes such as treating waste water, purified glycerol in biodisel production, utilizing carbon dioxide to produce formic acid and recovering precious chemicals such as lithium from lithium based batteries. In treating waste water polymer enhanced ultra filtration method has been used, where a combination of complexation and ultra filtration process are used. The membrane consists of two layers where the top layer is thin film and the lower layer is polysulfone base support. The thin film consists of polyvinyl alcohol, PVA. Tetraethyl orthosilicate and Chitosan as the complexation agent that makes polutan with metal iron becomes larger and easier to be rejected by the membrane.

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3:33:51 : The film effectively remove 90% copper ion and 80% firm ion from Industrial Waste Water. This method has low energy requirement High removal efficiency of metal ions, and high selectivity of separation with selective complexing agent. In a similar manner thin film hybrid membrane has been developed for an application of glycerol purification from production of biodiesel. In the transesterification process, 10% of crude glycerol is produced as a byproduct which contain high salt and free fatty acid with undesirable color of yellow to dark brown. In this research thin film membrane is formulated by using Polyvinyl alcohol (PVA), Polyethylene Glycol (PEG), Tetraethyl orthosilicate as nano precursor and glycerol as organic additive at top layer and polysulfone at base layer. Interaction between chlorine ion include glycerol with the hydroxy groups on the membrane surface rejects the impurities and allow pure glycerol to pass through the membrane. Thus far we have seen that membrane is mainly used for separation and purification application.

3:35:06 : Have you ever accounted that membrane can allow reaction and separation and also purification takes place simultaneously. The present Innovation described a tri functional membrane which is able to capture, hydrate and convert carbon dioxide into formic acid a useful basic chemical precursor at ambient temperature and pressure. A hybrid membrane developed from polyvinylidene fluoride (PVDF) Nanocellulose and metal oxide is used as a metric to immobilize formate dehydrogenase an enzyme which can convert carbon dioxide to formate. The metal oxide incorporating in the hybrid membrane, did in the carbon dioxide absorption readily hydrophilic hybrid membrane could ensure enzyme stability and also aid in the hydrogen of the, absorb carbon dioxide to carbonic acid via Louis acid base theory enhance accelerating enzymatic reduction of carbon dioxide. The system set up is appealing because it could represent triple gain in one reactor. First the membrane provides hydrophilic environment to ensure enzyme stability, two the membrane could capture carbon dioxide in practice and simultaneously hydrates and third the biocatalytic membrane support synchronized redox facilities of carbon dioxide and filtration of formate at the end of the product.

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3:36:38 : The study could derive a new alternative green approach and sustainable technique with regards to carbon the outside capture and conversion in one reactor at ambiance condition. The project is encouraged inspired by the efforts of utilizing the abundant amount of carbon dioxide being emitted continuously from industrial activities which can result in major global warming. I am glad to share with you a ground breaking project that unfolded in 2022, a project that not only aligns with the ITOS of sustainability but also propels us into the future of eco-friendly innovation. In collaboration with Petronas research, my team and I embark on a mission a mission to revolutionize the recycling of lithium ion batteries. A critical endeavor in our pursuit of a greater, of a greener and more sustainable future. Traditionally, the method employed for lithium iron battery recycling use Pyrometallurgy and hydrometallurgy. They have environmental impact, they contribute to gas emission and rely heavily on chemical reagent.

3:37:51 : Highlighting a gap in our journey towards truly green practices, enter the electrochemical method a paradigm shift in our approach. In this Innovative process, we use only water as the medium eliminating the need for harmful chemical reagent and significantly reduce the carbon footprint. The cornerstone of this process lies in the conductive membrane, a marble of engineering. This membrane not only facilitates the electrochemical recovery of lithium ion battery waste but also capture and efficiently recovers the lithium for future use. What makes this project even more compelling is its futuristic overlook. We are not merely addressing the present, we are preparing for the abundance of span liquid lithium ion batteries in Malaysia's future. Our vision is expensive Imagining the stability and readiness of this project to revolutionalize the way we manage battery waste on a larger scale. This project stands as a testament to our commitment to pushing the boundaries of green innovation. As we navigate the complexities of a rapidly evolving world, it is imperative that we adopt futuristic solution that not only meet current needs but also pave the way for sustainable practices in the years to come.

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3:39:12 : To me, this endeavor is not just a project it is a glimpse into the future of sustainable technology. It is a bold step towards a greener, cleaner, and more responsible tomorrow. Together led us Champion Innovation, that not only solves today's problem, but sets the stage for a harmonious coexistence between technology and the environment. Distinguished guest, ladies and gentlemen. My last research team for today's lecture revolves around the team of advanced material and particle processing. In this research green, renewable, and sustainable material have been the main focuses to produce various high value products with low environmental impact. As we can see on the screen, Nanocellulose, thin film, nanofiber with chondroitin sulfate has been produced as a scaffold for tissue regenerative. Electrospinning has been used to produce this material as electrospun fibers have small pore size, large specific surface area and are biocompatible for culture protein on protein legos.

3:40:22 : Based on molecular dynamic simulation the thin film, nanofiber has nanocellulose and chondroitin sulfate able to attach to protein legos. The attached protein legos indicates that any cell that needs to be culture can attach and grow on the legos. Future research has been conducted on revealing the potential of elephant grass, which is a type of forest grass to be converted into an advanced material component which is nanocrystalline cellulose, NCC. Elephant grass is among the most important fit resources for livestock in Malaysia. Diversifying its application from forest grasses into high value product such as nanocellulose, is a huge opportunity. this is because elephant grass has high amount of cellulose which is around 60 to 65%. There are three steps involved in nanocellulose in nanocrystalline cellulose isolation which are pre-treatment, bleaching and acid hydrolysis. The most important step is pre-treatment process where linen is removed and high personality index material is produced. Microwave assisted pre-treatment has been proposed where it has proven that at microwave heating of 180 wat for 20 minutes, highest personality of more than 60% and half of linen content will removed, and we managed to produce high value of nanocrystalline cellulose from this graph.

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3:41:53 : Nanocellulose can be used in electrical application such as lithium iron batteries and super capacitors. Distinguished guest, ladies and gentlemen. In our academic pursuit, we actively engage in both experimental and modelling research. Planning to colloid and nanoparticles which serve as fundamental constituent for constructing larger customer structures and do with innovative properties. The investigation of colloidal and nanoparticle structure presents a captivating avenue for scholarly exploration. Our endeavors encompass the design and characterization of colloidal and nanoparticle spanning diverse application such as formulation of encapsulated active ingredient within food product and powdered beverages with a particular emphasize on food and beverage application. We maintain a collaborative association with MZ holding Sdn Bhd within the framework of micro industry hub known as MZ nanocore. In agriculture application the development of novel nanomaterial and colloid, couple with an exploration of their stability aim at enhancing seed germination through seed priming techniques and targeted delivery of fertilizers.

3:43:12 : Meanwhile for emitted purposes, the synthesis of hybrid colloidal nanomaterials, the encapsulation strategies and their deployment, in advanced oxidation process designed for the degradation of emerging contaminants. Notably microplastic and per- and polyfluoroalkyl substances (PFAS). Let's look at another type of material which is ibuprofen. Ibuprofen is one of a group of drugs called Nonsteroidal Anti-inflammatory Drugs. It is widely used for its pain relieving and anti-inflammatory effects. Ibuprofen is commonly produced into granular form which consists of ibuprofen and excipient such as alpha lactose monohydrate. This research explores the potential of co-crystal formation of ibuprofen and Alpha lactose monohydrate in a one step cooling crystallization process which in the case which in this case using polyethylene glycol (PEG300) as a solvent. The results showed that the crystal form were mixtures of ibuprofen and alpha lactose monohydrate molecular modelling technique was used to assess the interaction between ibuprofen and alpha lactose monohydrate molecules, and we found that theoretically the formation of a Co Crystal of solid solution formation was possible.

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3:44:32 : We also ventured on the research to preserve our local food resources to support food security, pineapple, banana, and lime tend to have short shelf life and we have introduced an innovative method of preserving them by using a spray dryer. It converts fruit juice into powder with encapsulation of important ingredient in the powder. We have overcome main challenges such as thickness where powder stuck to the wall of the spray dryer during operation. Powder produced can be tailored according to the needs of the customer for example we have successfully combined the fruit based powder with Centella Asiatica or pegaga to take advantage of his health benefit such as improve blood circulation, decrease anxiety, and boost antioxidant of the body. All the spray dry powder fruit base have successfully produced from this research opening for more great opportunities in formulating the mixtures and preserving them in powder form. Another material that has been developed is polyurethane-coated sand where it is used in hydraulic fracturing process process in oil and gas production.

3:45:43 : This innovation aims to replace the conventional petrol-based polymer propane. The motivation behind this substitution is to address environmental concern as the petroleum-based propane is deemed environmental unfriendly and unsustainable. The polyurethane component in polyurethane-coated sand is derived from polyol source from Palm Oil. The infusion of polyols from Palm Oil not only enhanced the material performance in hydraulic fracturing but also align with sustainable practices by utilizing renewable resources. Polyurethane-coated sand develop is an alternative that may offer more eco-friendly and sustainable properties in the context of hydraulic fracturing. We also had an opportunity to do research on catalyst for hydrogen production. hydrogen rich syngas from carbon dioxide reforming of methane with steam was accessibly produced by using newly synthesized catalyst, namely nickel and cobalt supported magnesium aluminate. The synthesis processing time is short and cheap transition metal as catalyst are used. One single step fusion and facile fusion impregnation which is not only safe but able to produce high yield of hydrogen with minimal carbon deposit, which is of equivalent quality with other expensive and noble metal catalyst was developed.

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3:47:10 : We have found that 25% nickel supported magnesium aluminate has been identified as the best catalyst for producing high feet conversion up to 98% conversion of methane and up to 60% conversion of carbon dioxide. High hydrogen yield up to 58% and minimum carbon deposit. Distinguished guest ladies and gentlemen petroleum based refrigerants lubricants are compatible with Hydrofluorocarbon (HFC) refrigerants however they are not biodegradable. Hence n this research polyolester that are biodegradable friendlier to environment, high viscosity and compatible with hydrofluocarbon (HFC) refrigerant lubricant has been synthesized. Polyolester, Ester is produced from transesterification reaction between palm oil metal ester with pentaerythritol. It has been found that properties of pentaerythritol ester produced in this research are comparable with commercial polyolester for refrigerant system. opening more opportunities to be upscale. In the call of sustainability initiative we have explored the ethyl levulinate chemical which is a renewable chemical derived from biomass and is derivative.

3:48:30 : Its potential users as an oxygenated additive to maximize the use of biodiesel where it is blending with diesel fuel. Ethyl levulinate improve the gas emission of fuel blend and fuel characteristic such as flow properties, lubricity and viscosity. In this study ethyl levulinate is synthesized from renewable levulinic acid, acidification catalyzed by a sulphonated lignin-based catalysts. High yield ethyl levulinate in more than 80% has been produced. The application of ethyl levulinate into biodiesel, diesel plan improve emission profile as low ethyl levulinate loading less than three volume percent is sufficient to minimize carbon monoxide and knock from engine combustion. The addition of ethyl levulinate also reduces the viscosity of the fuel blend is well known for its high viscosity and the challenges during direct use in the engine. The performance of ethyl levulinate as fuel additive shows comparable results with the other evaluable food additive. Distinguished guest, ladies and gentlemen my research team and I have developed Nano Emulsion Petrol, formulated with a unique additive derived from amide methyl surfactant from crude jatropha curcas which is identified as a water in oil emulsion.

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Professorial Lecture UiTM

Dewan Sri Impian, Hotel UiTM Shah Alam

5 Januari 2024 (Jumaat), Jam 2.30 petang

Nama Professor Ts. Dr Norazah Abd Rahman

Tajuk Chemical Process Innovation: Paving The Path To Commercialisation

Jangka masa : 4 jam 35 minit

Transkrip:

3:49:52 : If we have this surfactant we can have petrol mixed with water and the surfactant will mix the petrol. Four stable Nano immersion petrol variants with significant implication for the automotive and energy sectors have been identified. This petrol offer a sustainable alternative to conventional petrol where it reduces greenhouse gas emission. This innovation aligns with global sustainability goals, addressing environmental concern without compromising performance. The commercial viability and reduce environmental impact position this technology as a pivotal advancement in fostering a greener, more sustainable future for the industry. Making a substantial strike in fuel technology towards eco-friendliness and industry wide adoption. Distinguished guests ladies and gentlemen in transforming ideas and conducting the research work we definitely will be facing a lot of challenges and opportunities. As we embark on this exploration of chemical innovation, it is crucial to first identify the challenges that currently impede progress in our field. These challenges may range from team members, environmental concern to the optimization of production process.

3:51:10 : As a deputy Vice Chancellor research and Innovation allow me to share a few points here, first is teamwork. Our team members are diverse, not only in expertise but also in character, mindset and emotion. Embracing these differences becomes a cornerstone of our success, by recognizing and celebrating the unit strength each team members brings to the table we create a synergy that propels us forward. Motivation becomes the catalyst, fostering an environment where inability is not acknowledge but celebrated. Second is protecting ideas. In the realm of innovation ideas are our most precious currency. However they are also vulnerable, therefore we must establish a culture that nurtures and protects this fledgeling concept. This involve creating an atmosphere where every team members feel secure in sharing their ideas knowing that they will be valued, respected and shielded from premature criticism. In doing so, we fortify the foundation upon which ground breaking innovations are built. Third is Golden Circle. Navigating the intricacies of our project requires a clear understanding of the why, behind our endeavors, the Golden Circle.

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3:52:53 : We dive into the core purpose, values and aspiration that drive our project. This not only serve as our guiding light but also align our team with a shed sense of purpose, amplifying our collective efforts towards a common goal. The fourth point is mentoring. Amidst the challenges mentoring emerges as a powerful solution creating a culture of mentorship within our team fosters, knowledge transfer, skill development and personal growth. Through mentorship we bridge the gap between experience and innovation, ensuring that insights gained from senior experienced professional are passed down to the next generation and reaching the collective intelligent of our teams. Finally closing the gaps. Every project encounter gaps whether in understanding, communication, or execution. Identifying and closing the these gaps is pivotal. It requires a proactive approach where we analyze the root causes, communicate transparently, and implement strategic solution. Closing these gaps not only enhance efficiency but also fortifies the resilience of our projects against potential setback, and I would like to say here that as we confront these challenges, we recognize that each one presents an opportunity for growth innovation and collective achievment.

3:54:15 : By celebrating our differences, protecting our ideas, understanding the golden circle embracing, mentoring and diligently closing gaps. We navigate the intricate path of our project with resilience and shared purpose. To the best of my observation there are some potential solutions and opportunities for improvement. But fear not, for challenges often present opportunities for growth and improvement. We will dive into potential solution and strategies to overcome this hurdles, fostering a more efficient and sustainable chemical innovation process. Now I share with you some value advice solution and opportunities for improvement that can significantly impact the landscape of commercialization, bridging the gap from seat to market. First, unlearn. Unlearn, learn and relearn. Current knowledge initiative in commercializing innovative ideas. In the ever evolving landscape of innovation, we must adopt a dynamic approach. Unlearning traditional methods, learning from current knowledge and initiatives, and relearning in light of emerging trends is imperative.

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3:55:28 : This paradigm shift is the foundation for successfully commercializing innovative ideas from the lab to the market. Encompassing the entire spectrum of the journey. Number two, planning of research from Lab to Market. Completing the loop, a similar transition from Lab to Market requires meticulous planning we must complete the loop ensuring that research initiative align with market demands. By integrating a comprehensive plan that considers market dynamics we enhance the probability of successfully bringing our Innovations to function. Number three, commercialization grant. Encouraging market studies, validation and clinical trials. To fuel the engine of commercialization, it is essential to make commercialization grants readily available. This grant should support crucial activities such as market studies, validation, clinical trials and product development at the business readiness level. Allocating funds for these pivotal stages propels innovation towards market readiness. Which I think Business Innovation and Technology Commercialization Centre, BITCOM. a unit under Pejabat TNCPI has pick up brilliantly.

3:56:59 : They have allocated 200,000 for product market in innovation and commercialization fund promise grant. Initiated micro industry heart program where both UiTM and industries can have mutual benefits on lab spaces and problem solving. Today we have eight companies who work with UiTM closely to address industrial challenges. Other than that, we also have 11 start-up and two spin-off companies which showed positive progress indicating that we are now doing quite well, although more work has to be done this year. Number four, introduction of specific bonus. Introduction of specific bonus incentive for commercialization achievements, recognizing and rewarding commercialization achievement is a powerful motivator. Introducing specific bonuses and incentive type to commercialization process can be a game changer. Such rewards reflected in yearly appraisals and promotion exercise, create a tangible link between individual efforts and organization success. Number five, once again mentorship. Enhancing product marketability. Mentorship plays a pivotal role in shaping the trajectory of innovative products, by appointing mentors from relevant agencies and industries, we tap into expertise that enhances product marketability.

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3:58:29 : This collective approach nurtures a culture of guidance and support, propelling innovations toward successful commercial outcome. Number six, facilitation by University management. Providing clear guideline policies, University's management support is important in facilitating commercialization activities. We at the office of Deputy Vice Chancellor Research Innovation are now providing clear guidelines, policies and circular are essential tools that can assist researchers engaged in commercialization. Please come and see our officers, if any staff would like to get some advice. We also have travel to campuses and faculties colleges to disseminate the information. On another note, a creative and flexible approach including teaching flexibility and addressing lecturers commitment also has been enforced to streamline and encourage commercialization efforts. Number seven, professional training for technology transfer office, staff. BITCOM as one of the PTJ under the office of Deputy Vice Chancellor of research and Innovation, always work to empower academic staff in technology transfer officers.

3:59:40 : Providing a platform for technology transfer office staff to receive professional training including certification such as Technology Commercialization Associate (RTCA) and Registered Technology Transfer Professional (RTTP) enhances their knowledge in the field of commercialization. This investment in skill directly contributes to the effectiveness of commercialization endeavors. This piece of advice, solution and opportunities for improvement for a robust framework for navigating the complexities of commercialization. Therefore let us collectively embrace these strategies to unlock the full potential of our innovative ideas and drive them toward successful market outcome.

Distinguished guests, ladies and gentlemen. We have reached the concluding remarks of today's lecture. In conclusion let's summarize the key takeaways from our journey through the chemical Innovation process. We have identified challenges, explore solution, outline commercialization, strategies glimpse into the future and now it's time to distil the essence of our discussion.

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4:00:49 : Let us not view innovation as a sporadic event, but as a continuous journey. Let us not fear change, but welcome it as a catalyst for growth, and let us not follow the curve, but strive to stay ahead of it shaping the future of chemical innovation with every step we as we explore these emerging trends and technologies. Let us do so, with a sense of anticipation and responsibility. The future is not a distant abstraction it is the result of our collective efforts ingenuity and commitment to progress. As stewards of the chemical industry let us embrace the challenges and opportunities that these cutting age developments bring. Let us be pioneers, not just in our laboratories but in our mindset. The exciting realm of emerging trends beckon Earth to be proactive, to adapt swiftly and to be architects of a sustainable and innovative future. Together, let's us shape the destiny of chemical process innovation and in doing so, contribute to a world that is not just advanced but also sustainable and harmonious. above all let us emphasize the pivotal role of chemical process innovation in shaping the future.

4:02:05 : It is not merely a scientific endeavor, which is a force that propels industries forward contributing to the betterment of our societies and economies. Distinguish ladies and gentlemen as we stand on the precipice of the future let s turn our gaze to the horizon of chemical process innovation. The path forward is illuminated by emerging trends and cutting age technologies, and it's crucial that we pioneer the latest advancement, understand the global development and anticipate shift in the industrial landscape and society needs. The landscape of chemical innovation is ever evolving, shaped by emerging trends and cutting age technologies. It is incumbent upon us to remain vigilant and curious, always seeking to understand the current that propel our field forward. Let us therefore encourage a spirit of exploration and inquiry as we navigate the emerging trends. Explore the realms of advanced material that promise unparallel strength flexibility and sustainability from self-healing polymers to Next Generation Catalyst. These material are the building blocks of a more efficient and environmentally conscious in future.

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4:03:17 : From artificial intelligence to data driven insight, the integration of technology is reshaping how we approach experimentation, analysis and even the design of chemical processes. The digital revolution is not a choice, it is a fundamental shift that we must actively engage with. Bio-technology holds the key to innovative solution from bio inspired materials to the use of enzyme in catalysis. The marriage of this discipline open doors to sustainable and biofriendly processes. We should be paving the way by pioneering the latest technology advancement, stay at the forefront of innovation, exploring new tools and methodologies that redefine the boundaries of what is possible in chemical processes. The innovation we explore are not confined to laboratories, they reverberate across industries and economies. Let us now delve into the potential impact and consider how these advancement may reshape and enhance various sectors. Let's anticipate a transformative wave sweeping across industries, from manufacturing to healthcare, the repel effects of chemical innovation will redefine processing production processes product design and supply chain dynamics.

4:04:34 : Those who adapt swiftly will lead the change in the era of Industry transformation. Another important point is that we need to consider the broader economic implication. Innovation in chemical process have the power to drive economic growth, create new markets and redefine global competitiveness. Understanding and harnessing these economic forces will be crucial for navigating the future landscape. We also need to align with global development goals to anticipate chiefs in the industrial landscape. Stay informed about global sustainability initiative, advancement in artificial intelligence, data analytics and the broader movement towards decarbonization. As we envision the future, let us not merely be spectators but active participants in shaping it. It is important to instilled a forward looking mindset and a commitment to continuous innovation. Let us embrace the following principles let cultivate a mindset that anticipate change rather than reacts to it. The future belongs to those who can foresee strengths, adapt to shifting landscape and seize opportunities before they fully materialize.

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4:05:46 : Innovation is not a one-time event. It is a continuous cycle, hence we should be encouraged to have a culture where learning experimentation and Improvement are woven into the fabric of our daily activities. Only through continuous innovation can we stay ahead of the curve. We should be working in good knowledge and alignment with government policies and direction. Understand the global sustainability initiative, the integration of artificial intelligent data analytics and the push towards decarbonization. Ensure that your research align with the broader goals of sustainability and societal wellbeing. We need to be versatile researchers diversify your area of expertise, break down the silos between discipline and collaborate in multi-is research among global scientific combination. Cross pollination of ideas, accelerates innovation and leads to holistic solution. We should work diligently in your specific area but remain open to exploring opportunities beyond the interconnecting nature of advancement often presents unexpected avenues for collaboration and breakthrough. Seize these opportunities to broaden the impact of your work.

4:07:00 : I would say that the future of chemical process Innovation is a canvas awaiting our collective brush strokes. Let us explore, discuss and encourage a mindset that not only adapts to change but thrives on it. The horizon beckons and it is our collective individuality that will shape the masterpiece of tomorrow.