In the News

2018 Q2 POPSIG NEWSLETTER

IChemE ADVANCING CHEMICAL ENGINEERING WORLDWIDE

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Palm Oil Processing Special Interest Group

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Editor's Message

The POPSIG committee for 2018/19 is now nearly complete and I am looking for one or two members for my editorial board. The committee members are volunteers who are passionate about the palm oil industry & process engineering. They have day jobs but they are driven to devote their own time to provide a forum for the exchange of ideas, the sharing of experiences and encouraging innovation in the palm oil processing industry. There are many ways in which you can contribute without being on the committee. You can speak and share your expertise at our events or just participate, reach out to undergraduates by showing them why the palm oil industry needs them and invite them see what your operations are like as well as convince the captains of the industry why chemical engineers will improve their operations especially in upstream where abundant opportunities exist.

POPSIG continues to keep in touch with the largest downstream processor trade association PORAM. This time we connected with its chairman D Chandramohan who is also the Director of Corporate Affairs at Cargill. This led Trish Kerin, Director, IChemE Safety Centre, to hold discussions on process safety at the Cargill offices. Shortly after, K S Qua, POPSIG Exco member, followed through with discussions with their Regional Technical Director. In keeping with the tradition ExcelVite, the winner of the 2017 Palm Oil Industry Awards, shared with POPSIG members their prize winning process to extract phytonutrients from palm oil.

Private international universities are now working with the private sector on research targetting significant near term commercialization. Read about how Nottingham University of Malaysia improves the sustainability of the entire value chain of palm oil industry through international collaboration and how Monash University Malaysia through its Monash-Industry Palm Oil Education and Research helps to improve the competitiveness and sustainability of the palm oil industry.

Outside Malaysia we share a story from The Guardian that shows the little known environmental impact of palm oil's competing oil seed, soya bean, in Argentina. The RSPO P&C (Principles & Criteria) are due for a review and in this restructuring is introducing the concept of 'shared responsibility'. We report that it may not be so well received by processors down the supply chain.

For POPSIG the highlight is, of course, the 2nd Regional Palm Oil Processing Seminar on 5th September 2018 to be held in Johor Baru. This is the link http://www.icheme.org/events/conferences/palm-oil-processing-seminar-2018.aspx The seminar is focussed towards value addition in the palm oil downstream sector and will provide insights for improving profitability. Topics covered include contaminants in food, new sustainability initiatives and latest technologies. From POPSIG, KS Qua's paper will envision what palm oil processing will look like in the future.

Register now and don't miss out on the only seminar that is entirely devoted to the processing of palm oil. We hope to see you at the 2nd Regional Palm Oil Processing Seminar.

Editor
Tan Hui Min

When nature says ‘Enough!’: the river that appeared overnight in Argentina

Argentina, a soya bean powerhouse accounts for 18% of global soya bean production. In 2016 itself, combined exports of soya bean products by the nation sums up to a staggering 31% of the total exports. With the country being heavily dependent on soya beans, according to Greenpeace, it has led to widespread deforestation covering 60% of the country’s arable land and loss of 2.4m hectares of native forest over the last 10 years.

This led to sudden appearance of new river networks in central province of San Luis, which is 25km long and as deep as 60m wide by 25m deep. The largest, Rio Nuevo, runs through Cuenca del Morro taking up 373,000 hectares of flatlands. Morro basin which used to be water-absorbing forests and grassland in the early 1990s were replaced by maize and soya beans. It contributes further to the phenomena observed.

An environmental expert, Esteban Jobbagy streamlined the causes for this occurrence to:

i) Climate change
ii) Nature of soils
iii) Over-hosting of agriculture

Soya bean having short roots and short growth cycle – only few months in a year, causes increased speed of subterranean flow and raise of aquifer beneath the Morro basin. This quickens erosion, forming deep trenches and moves sediment thus, changing land geography. Continuous change in river course is another reason bridges or paths cannot be built.

Hence, in 2016, an emergency law was published mandating 5% preservation of farms as pasture or forest by landowners. Currently, 60% of farmers abide to this law. However, the problem has compounded due to low incentive for rotational crops or preservation of soil sustainability by agri-conglomerates. This issue must be resolved and corrective actions must be taken as soon as possible because it is a very difficult situation to reverse when nature rears up [*Goni, U. (2018, April 1)*].

This highlights that deforestation occurs not only for palm oil but for soya bean too. In contrast to soya bean being an annual crop, oil palm is a tree with roots that have a life cycle of 30 years which would have a lower impact to soil stability. Another point to be noted is the adoption rate of Round Table on Responsible Soy (RTRS) which is only 0.41% of global harvested area in 2014 and 0.6% in 2015. With reference to The State of Sustainable Markets (2017), increase in uptake rate of RTRS over the years is rather high showing an increment of approximately fourfold in year 2011 to 2015 compared to Roundtable on Sustainable Palm Oil (RSPO) which only shows an area increase in 16% from year 2013 to 2015. But, opposed to RTRS, uptake rate of RSPO is 14% in 2014 and 15% in 2015 which is likely to have a greater impact due to higher adoption rate.

1. Rio Nuevo which appeared suddenly in 2015
2. Canyon carves out from Rio Nuevo

ExcelVite - Novel Process for Palm Phytonutrient Extraction

POPSIG evening talk on Wednesday, 16th of May 2018 was presented by Mr WH Leong, CEO of ExcelVite, titled “Novel Process for Palm Phytonutrient Extraction”. It was held at Monash University Malaysia with a simultaneous webinar.

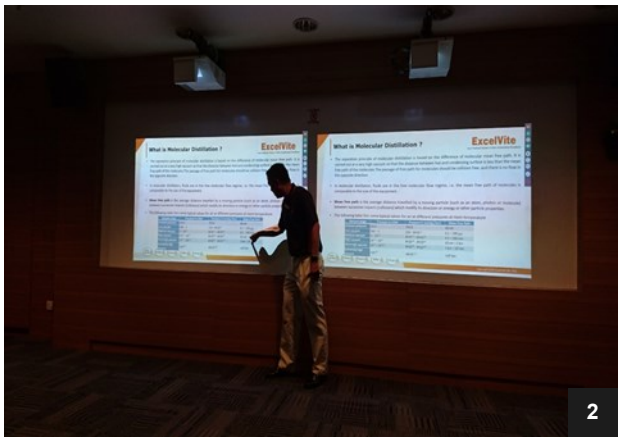
Mr Leong first started his presentation by giving a brief introduction of his company and himself. The only raw material used is crude palm oil (CPO) for the production of 3 phytonutrients and 2 biodiesel through molecular distillation. As quoted from Mr Leong, many may question “Why Palm Oil?” He highlighted the fact that palm oil is the only edible oil in nature, is a rich source of natural tocotrienols, palm oil being a 100% non-genetically modified organism and is supported by the Malaysian Palm oil Board (MPOB) and Malaysian Palm Oil Council (MPOC).

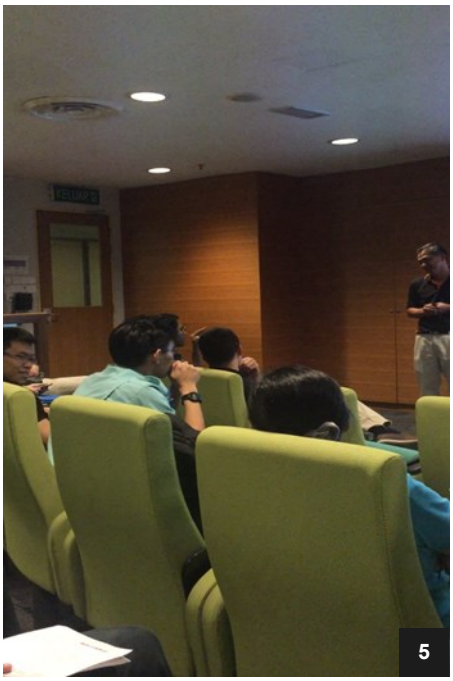
He also provides a general overview on the composition on palm oil and differences between tocotrienols and tocopherols. Mr Leong states that a research was conducted showing the 7 unique benefits of tocotrienols over tocopherols.

Explanation was given on what molecular distillation is alongside a video to give a better idea of the process. There is a total of 3 stages of vacuum in order for the plant to achieve a high vacuum of only 0.001 mm Hg during actual operation. The calibration and balance of rotor is another important factor that must be adhered. By using molecular distillation, which is a process of high vacuum, low temperature with a short residence time, it ensures preservation on integrity of compounds.

Next, Mr Leong emphasizes on ExcelVite’s unique process and unique attributes in contrast to others. Current key research areas being looked into for tocotrienols and carotene were also mentioned. Unique attributes of biodiesel by ExcelVite were described and with B7 being mandated by the Malaysian government, it ensures demand for biodiesel. Mr Leong ended his presentation by showing the product certifications attained by ExcelVite and questions were opened to the floor.

ExcelVite shows promising potential for future development. With this technology, it is the way to go in the future as it shows that besides being used as a raw material for food and cosmetics or even fuel, palm oil can be further streamlined in downstream processing to high-valued products such as phytonutrient which shows substantial benefits to humankind. As quoted by Mr Qua Kiat Seng, AOMG Advisor, founder member of POPSIG and board member of IChemE, “Mr Leong has shared with us in depth the fascinating world of health supplements and the art of molecular distillation. ExcelVite as a global pioneer truly deserves the IChemE Palm Oil Industry Award 2017”.





1. Mr Mohan Balasingam introducing the speaker, Mr WH Leong
2. Mr Leong explaining what exactly molecular distillation is
3. Audiences listening attentively to the talk by Mr WH Leong
4. Mr WH Leong explaining to the audience on the advantages of tocotrienols
5. Dr Nagasundara Ramanan enquiring on the purity of the end-product after the process, when the speaker said its 50%, what are the remaining 50% that make up the total compounds?
6. Mr Qua Kiat Seng presenting the certificate of appreciation to Mr WH Leong

Process safety in the palm oil industry – is it necessary?

Trish Kerin, Director,
Institution of Chemical Engineers Safety Centre (ISC)

Trish is a Chartered Engineer, a registered Professional Process Safety Engineer and Fellow of IChemE. She also holds a diploma of OHS and is a graduate of the Australian Institute of Company Directors (GAICD).
Recent awards include the Engineers Australia – John A Brodie Medal – for best paper at the *Asian Pacific Confederation of Chemical Engineering Congress 2015* (incorporating Chemeca). The award recognises Trish's peer reviewed paper on *Process Safety Competency*.

When people think of process safety they often think it only applies to oil and gas plants or large chemical facilities. But process safety is not just about preventing a loss of containment, it is actually about maintaining control to prevent a catastrophic incident. This means it can apply to almost any industry. So understanding what your possible catastrophic incidents are is an important first step.

Let's look at what could possibly go wrong in the palm oil ~~refining~~ industry, and can these actually be called catastrophic?

Several years ago, there was an incident where a steriliser door blew off and killed four workers at a processing mill. It was suspected that this was due to a faulty door locking mechanism, resulting in a weld failure. The four workers were all near the steriliser at the time. This type of incident could be called catastrophic. Not only did four workers lose their lives in an avoidable incident, but there was also signification damage and production delays. These types of incidents cost large amounts of money to rectify and in some instances, this type of financial impact can end a business.

Managing pressure and temperature are therefore critical in palm oil refining, regardless of the material being processed at the time. Let's look at the steriliser door mechanism. It failed under pressure in this incident. We need to understand was there an inherent fault in the mechanism or the door frame? Or was the steriliser operating over its design limits at the time? Or was it a combination of both?

Process safety looks at all of these factors and helps manage the integrity of the equipment. When the steriliser was designed, was it made to the correct specifications and of the correct material? How is the door mechanism inspected and maintained? How is the door operated to ensure it has latched correctly? Has the equipment has been modified, has a risk assessment been carried out to understand the change? How is the pressure monitored in the steriliser to ensure it does not go above the operating pressure or the vessel? These are some of the questions that need to be addressed to help manage process safety.

To effectively manage process safety, it is necessary to have the right competencies in the workforce and understand how it can impact your business. The IChemE Safety Centre has developed a competency guidance document that defined what specific competencies are needed for each type of role in an organisation. This document is a free download from the following site http://bit.ly/ISCKC The Occupational Health and Safety Body of Knowledge has also released two chapters that discuss chemical hazards and management of process safety. These can be accessed free from the following site http://bit.ly/ISCBoK1 and http://bit.ly/ISCBoK2

RSPO to introduce “Shared Responsibility” to new P&C (Principles & Criteria)

The Principles and Criteria (P&C) Review process has started in April 2017, in line with the 5-year review cycle and is now available for the 2nd public consultation in June and July 2018 https://www.rspo.org/principles-and-criteria-review/2nd-public-consultation-rspo-principles-and-criteria
In this restructuring an objective is the “Integration of concept of shared responsibility (i.e. indication of requirements applicable that may become applicable to other RSPO membership categories as well)”. These pertain to Transparency, Ethical Conduct, Legality, Human Rights Respected, Workers Rights and Conditions, Energy Use and GHG emissions.

Table 1: Overview of Restructured Outcome Focused P&Cs – darker shaded are proposed SHARED requirements

Impact Area ToC	Objectives ToC	Principle or Theme	Criteria topic	Old criterion No	NP	Link to Theory of Change - Intermediate outcom
Prosperity Impact Goal: Competitive, resilient, and sustainable sector	A sustainable, competitive, and resilient palm oil sector ensures long-term viability of the entire supply chain and shared benefits for both private sector as well as the livelihoods of communities where palm oil is grown. Effective planning and management system address economic viability, environmental and social compliance and risk, establishes procedures and systems for ensuring conformance to the RSPO P&Cs, and supports continuous improvement toward sustainable palm oil	1 Transparency and ethics	Information and public availability	1.1|1.2|6.10		Improved Risk Management
			Communication and consultation	6.2		Improved Risk Management
			Commitment to ethical conduct	1.3|6.10		Improved Risk Management
		2. Legal compliance and rights	Legal compliance	2.1|6.10		Improved Risk Management
			Third party contractors legal	NEW TF4		Improved Risk Management
			FBB legally sourced	NEW TF4		Improved Risk Management
		3. Planning procedures and improvement	Long term plan and economic viability	3.1		Improved Risk Management, cross cutting
			Continuous Improvement	8.1		Improved Risk Management, cross cutting
			Standard Operating procedures	4.1		Improved Risk Management
			SEIA and Plans	5.1|6.1	7.1	Improved Risk Management
			System for managing employees	NEW TF4		Improved Risk Management, Safe and Decent work
			Employment procedures	6.4b		Improved Risk Management, Safe and Decent work
			Training	4.8		Improved Risk Management, Safe and Decent work
People Impact Goal: Sustainable Livelihoods & Poverty Reduction	Human Rights Protected, Respected & Remedied. The palm oil sector contributes to reducing poverty and palm oil production is a source of a sustainable livelihoods. Human rights are respected. People participate in processes that affect them with shared access and benefits. Everyone engaged in palm oil production has equal opportunities to fulfill their potential in work and community with dignity and equality and in a healthy working and living environment	4. Community Rights and Benefits	Human Rights Respected	6.13		human rights upheld
			Complaints and Grievances	6.3		human rights upheld
			Land Use: FPIC	2.3	7.5	human rights upheld
			Land Use: Compensation	6.4	7.6	human rights upheld
			Land Use: Conflict	2.2		human rights upheld
			Contribution to local sustainable develop	6.11		inclusive access, communities
		5. Smallholder Inclusivity	Fair and transparent dealings with SH	6.1		inclusive access, SH
			Improved livelihoods	6.11		SH
		6. Workers rights and conditions	Pay and working conditions	6.5		safe and decent work
			Freedom of association	6.6		human rights upheld, safe and decent work
			No child labour	6.7		human rights upheld, safe and decent work
			No discrimination	6.8		human rights upheld, safe and decent work
			No harassment	6.9		human rights upheld, safe and decent work
			No forced or trafficked labour	6.12		human rights upheld, safe and decent work
			Occupational Health and Safety Plan	4.7		safe and decent work
Planet Impact Goal: Conserved, protected and enhanced ecosystems that provide for the next generation	Impact Goal: Conserved, protected and enhanced ecosystems that provide for the next generation. Ecosystems and their services are protected, restored, and resilient including through sustainable consumption and production and sustainable management of natural resources [sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss (SDG 15)]. Climate change is addressed through continuous GHG reductions and air and water pollution are controlled.	7. Natural Resource Management and biodiversity	Effective Integrated pest management	4.5		resource use, pollution, productivity
			Pesticide Use do no harm	4.6		resource use minimized, pollution
			Waste management	5.3		resource use minimized, pollution
			Soil health|fertility	4.2	7.2	productivity optimized, Ecosystems
			Soil conservation (erosion|degradation)	4.3a	7.4a	reduced pollution
			Peat	4.3b	7.4b	pollution, ecosystems
			Water quality and quantity	4.4		resource use, pollution, ecosystems
			Energy Use	5.4		resource use minimized, pollution
			Pollution and GHGs	5.6	7.8	reduced pollution
			Fire	5.5	7.7	reduced pollution
			No deforestation (incl. HCV)	5.2	7.3	ecosystems protected

AOMG Advisor K S Qua commented, “We welcome any initiative that will increase the physical uptake of RSPO certified PO and PKO through our plants. Whilst it is unclear at the moment how the ‘shared responsibility’ will be implemented we must adhere to the original principle that unnecessary costs should not be added in the process. As the margins in refinery and oleochemicals are very thin it has always been imperative that our operations are as efficient as possible in terms of energy use and emissions. Process safety and integrity is also a given as we cannot afford any outages in our high capacity and capex plants. So I am surprised to see Occupational Health and Safety omitted.”

Any costs that do not go to reward the farmers should be minimized. We should not add to the current administration and segregation costs to process RSPO certified PO and PKO. Additional costs may be detrimental to the physical uptake of RSPO certified PO and PKO. Since 2013 the flow of physical certified RSPO PO and PKO through the manufacturing facilities of AOMG members has been steadily growing and its members in fully supporting RSPO are committed to continue this growth.

Sustainable Palm Oil Value Chain through International Collaboration

By Denny K. S. Ng[1] and David Brown[2]
[1] Department of Chemical and Environmental Engineering/Centre of Sustainable Palm Oil Research (CESPOR), University of Nottingham Malaysia, Semenyih, Selangor, Malaysia
[2] Research and Innovation, University of Nottingham, Jubilee Conference Centre, Jubilee Campus, Nottingham, NG8 1BB, UK

The importance of the palm oil industry to Malaysia can hardly be overstated. Producing a third of the world's output, oil palm plantations cover a high proportion of the country's cultivable land area (more than 5 million hectare). Operating on such a scale, it's not surprising that the industry faces huge environmental challenges (i.e., loss of biodiversity, conflict of big animal and human in plantation; air pollution, greenhouse gases emission, water pollution from processing facilities; carbon emission in transportation) – challenges that unless addressed, threaten the acceptability of the products in some major markets.

Only about 20 - 23% by weight of palm oil fresh fruit bunch (FFB) can be extracted as crude palm oil and crude palm kernel oil. Any moves to increase the value that can be generated from the remaining biomass, or to reduce costs associated with palm oil mill effluent, are of interest to reduce environmental impact and improve profitability. Meanwhile, improvements in labour standards and working conditions will enhance the image of the sector among ethically-conscious consumers around the world. Taken together, the industry will be able to progress towards true 'triple bottom line' sustainability – economic, environmental, social.

Chemical engineers are key to achieving these gains: indeed, it's arguable that they have not only the opportunity but the responsibility, to do so - working with partner disciplines across the physical, biological and social sciences. Researchers at the University of Nottingham, across its campuses in Malaysia and the UK, are doing just that – aided by major new investments the University has announced in a number of 'Beacons of Excellence' in fields that include Green Chemicals and Future Foods along with work to boost labour conditions and ensure workers are being treated fairly.

Professor Denny Ng and colleagues at the CESPOR (Centre for Sustainable Palm Oil Research) on the Malaysia campus have developed an integrated Recovery and Regeneration System (REGEN) together with a local industrial partner to promote sustainable production of value added products and bioenergy from palm-based biomass or waste from a palm oil mill. Via such a system, multiple technologies are integrated to convert solid biomass into biofertilizer, pellet, fibre, etc. while wastewater (i.e. palm oil mill effluent, POME) can generate biogas and electricity. Scaling up, they estimate that if the REGEN system were to be implemented in all palm oil mills in Malaysia, national GDP could be increased by 6% to 8 % while saving about 4 million tons of CO_2 equivalent per year.

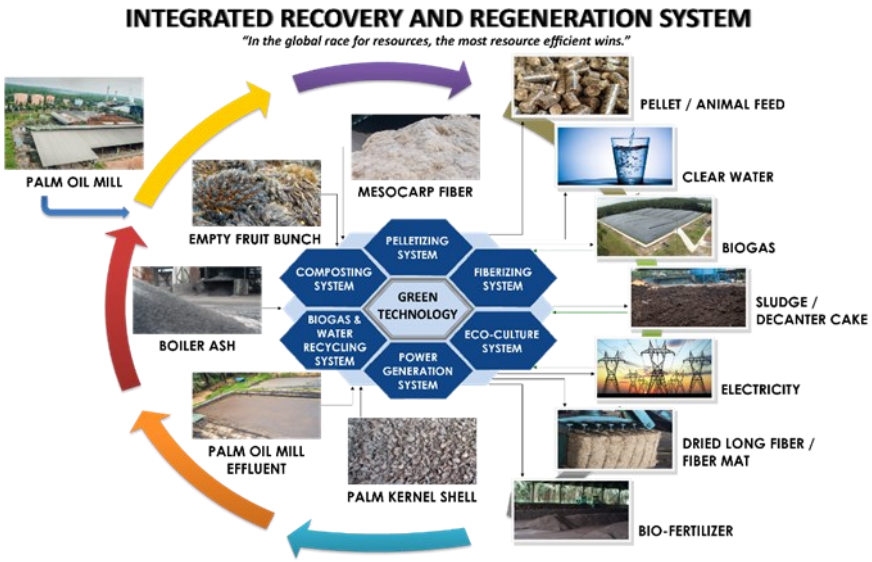


Figure 1: Concept of REGEN system (Ng et al. 2015)

Strategies of Sustainable Production of Value-Added Products

In order to improve the sustainability of the value chain, the recovery of generated biomasses and waste especially in palm oil mills should be maximized. Sustainable production of value-added products from palm oil mill remains a huge challenge, notwithstanding various research and development work in industry, research institutes and universities. However, the absence of a single technology to tackle all the solid and liquid wastes in the palm oil mill led Ng et al. (2015) to develop an integrated method, the Integrated Recovery and Regeneration (REGEN) system. Figure 1 shows the concept.

The REGEN system generates more than enough power and biogas to run the system itself, with a surplus for sale or for other uses on site. The effluent is treated for reuse and recycle, while other material is processed into biofertilizer, animal feed and fibre mat, in proportions that can be varied to match demand and optimize profitability.

By recovering biofertilizer, this approach can reduce usage of imported chemical fertilizer, reduce the carbon footprint of the process and enhance the return of organic compounds to the soil, so improving plantation productivity and reducing demand for land.

Longer term options go further, and seek to recover valuable products from the POME using biotechnology. Via close collaboration between the two campuses, Professor Alex Conradie and Professor Ng have identified the potential of recovering the oil phase in POME into value-added chemicals such as hydrogen, ketones, aldehydes, arginine, etc. Meanwhile, the aqueous phase of POME can be digested to generate biogas which can be used directly as a fuel source for a gas engine for power generation and further purified into biomethane (>95% methane). Biomethane can then be used as a fuel source for transportation vehicles (trucks, buses, trains, etc.). Useful specialty products and platform chemicals can be generated from the palm oil product streams, just as valuable chemicals are sourced from the petrochemical value chain.

Through this work, REGEN concept is upgraded into the High Value Integrated Recovery and Regeneration (Hi-REGEN) system which aims to produce high value chemicals as well as energy and material products in the original REGEN system. The newly developed work integrates into the established REGEN system to further improve overall sustainability.

Finally, it's important that improvements in productivity, environmental impact and efficiency are reflected in real benefits for the many people who work in the palm oil sector and for the communities that depend on the industry. Nottingham's social scientists are to deploy techniques developed elsewhere to ensure that benefits really do accrue, and that environmental and other advances – often assessed by certification and audit schemes to which some European and other customers pay a lot of attention – lead to sustainability across all elements of that 'triple bottom line'.

Further research will be continued to improve the sustainability of the entire value chain of palm oil industry, covering microbial activities in the soil, plants, processing, waste recovery, logistic, product development, labour, etc. Each sector will be further optimised to ensure the entire industry moves towards a genuinely sustainable future.

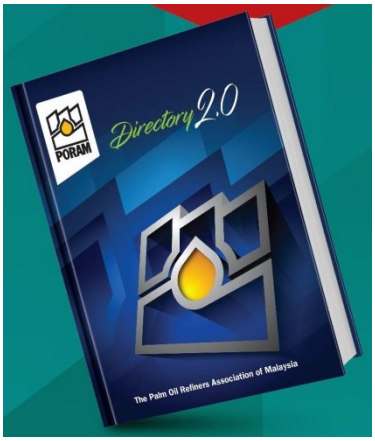
Boosting the PORAM-IChemE ties

The Palm Oil Refiners Association of Malaysia (PORAM) was formed in 1975 and its members are companies involved in the refining and related downstream processing of palm oil, palm kernel oil and other vegetable oils including ancillary services. It has 25 full members and 96 associate members.
The Institution of Chemical Engineers (IChemE),founded in 1922 is the global professional membership organisation for chemical, biochemical and process engineers and other professionals involved in the chemical, process and bioprocess industries. Its membership exceeds 40,000 members in around 100 countries.
What has PORAM and IChemE in common? A lot as we found out when on 5th April 2018 Mohan Balasingam of IChemE and Qua Kiat Seng of POPSIG visited the PORAM offices to meet its chairman, D Chandramohan, its CEO Teoh Beng Chuan and Md Saiful bin Md Hussin, Commercial & Technical Manager. Whilst the relationship goes as far back as 2008 it became stronger from 2013 with the then CEO, Mohammad Jaafar Ahmad, supporting POPSIG when it was formed in 2015. Our members have participated in each other's talks and forums.

L to R. Md Saiful, Mohan Balasingam, K S Qua, Teoh Beng Chuan and Chandramohan.

During the meeting we discussed sustainability, process safety, processing progress, energy usage and capability management. We dwelled on process safety as Chandramohan who is from Cargill shared as an example Cargill's unyielding commitment to safety with a goal of zero fatality. PORAM has a Technical & Educational Working Group (TEWG) that organizes training courses and workshops for its members. IChemE was invited to see how its training offerings could fit into these.

PORAM members can also present at POPSIG's evening talks. Besides the evening talks IChemE encouraged PORAM members to participate in the prestigious IChemE 2018 Awards as well as its forthcoming palm oil processing seminar in Johor.

	IChemE was presented with the latest PORAM's Directory 2.0 which IChemE could use to contact PORAM's members. On its part IChemE shared the POPSIG 2017 Yearbook which featured Samuel Kam, a long-time member of PORAM through Lam Soon, as the pioneer palm oil processing chemical engineer.	

Q3 Diary of Events

Webinar : **Biodiesel production using Liquid – Liquid Film Reactors**

Speaker : Prof Paulo Cesar Narvaez Rincon from National University of Colombia

Date : 24 July 2018

Evening Talk : **Biotechnology and Breeding—An Introduction for Chemical Engineers**

Speaker : Dr Ahmad Parveez Hj Ghulam Kadir,MPOB DDG

Date : 13 August 2018

Time : 18:00 - 20:30 (GMT+8)

Location : Monash University Malaysia, Bandar Sunway, Subang Jaya, Malaysia

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