

A quarterly palm oil newsletter brought to you by  
IChemE Palm Oil Processing Special Interest Group

# POPSIG

IChemE



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Palm Oil Processing Special Interest Group

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## Editor's Message

The year 2017, which marks 100 years of commercial oil palm planting in Malaysia, has been a highly successful year for POPSIG. The highlight was the 1<sup>st</sup> Regional POPSIG Seminar that was held in Kuala Lumpur on 8<sup>th</sup> August 2017. The IChemE's 100 Years Palm Oil Industry Seminar was themed '50 years of process engineering'. The seminar saw 84 participants and speakers covering milling, refining, oleochemical and bio processes as well as a paper on Malaysia's Economic Transformation Programme in the palm oil industry. The forum that followed consisted of distinguished panelists in the palm oil industry and they addressed the question 'Can Malaysia continue to be the global technology leader in processing its Golden Crop?' The outcome of the forum is reported inside this year book. Our keynote speaker was Tan Sri Datuk Dr Yusof Basiron ex CEO of MPOC and DG of MPOB and we are pleased to announce that he was elected Fellow shortly before the seminar.

Inside we feature Mr Samuel Kam who passed away on 30th March 2017 at the age of 102. He was the oldest chemical engineer in Malaysia and find out why this little know man is considered to be the pioneer of palm oil processing. Of the evening talks we report in this year book, the one that stands out is that of Professor Dr Robiah Yunus who introduced MICRONES, an exciting process example of a chemical engineer working with biologists and mechanical engineers to increase the oil extraction from the mesocarp contributing not only to the bottom line but also to sustainability.

Our reach goes beyond the shores of Malaysia and we are pleased to announce that on 1st December 2017 our keen supporter Mohammad Jaaffar Ahmad former CEO of PORAM has moved to Jakarta to join the Council of Palm Oil Producing Countries (CPOPC) as Director of Strategy and Policy. The European Union is banning the use of palm oil in biodiesel and the joint efforts of Malaysia and Indonesia to repeal this has never been more important.

Within ASEAN, our secretary Prof Dr Chong Mei Fong, represented Malaysia to compete for the ASEAN-US Prize For Women in Science and Technology. Her work is in the area of waste water treatment in palm oil mills and she was award second prize in Myanmar in October last year.

Also in October our founder member Qua Kiat Seng went half way around the world on the invitation of the Colombian government to advise their oil palm growers on going downstream including oleochemicals. He had the opportunity to visit the chemical engineering department at the National University of Colombia.

Interest in POPSIG globally continues to grow and this is evidenced by our evening talks which are also webinars. For example the evening talk "Introduction to Oleochemicals" attracted participants from 27 countries.

Our focus this year with the help of the IChemE office is to recruit more members beyond the current 126. Members of IChemE who have not yet chosen your free SIG please sign up for POPSIG and those who are not yet members of IChemE please contact Avanna Tan, [ATan@icheme.org](mailto:ATan@icheme.org). Remember you need not be a chemical engineer, you only need to be interested in palm oil processing.

We hope you enjoy reading these and the full selection of articles in this issues. Follow us on [Facebook](#) and [LinkedIn](#).

Editor

**Hong Wai Onn**

## POPSIG gratefully acknowledges our sponsors



# Re-engineering Current Palm Oil Degumming Process

This evening talk was presented by Muhammad Saiful Nidzam Ismail of Sime Darby Research Sdn Bhd at Monash University Malaysia on Monday 27th February 2017. It was attended by about 35 people.

Saiful Nidzam is a chemical engineer who is a certified Six Sigma Black Belt. A senior chemical engineer in Oils & Fats Refinery Technical Advisory Services Units he has applied his Six Sigma skill rigorously in his work winning him two awards at IChemE Malaysia Awards in 2016 viz the Palm Oil Industry Award and the Sustainable Technology Award.



He shared with the audience the work that won him the Palm Oil Industry Award. Degumming is a key step in the refining of palm oil and phosphoric acid has an essential role to play. Phosphoric acid is not cheap and his work in optimizing its usage has not only saved costs but also improved quality as well as increased throughputs.

The degumming process is really important as the stability of the refined palm oil which we use, for example for cooking, is affected by the traces of

metal and phosphorous left in it. Saiful Nidzam investigated not only the quantity but also the concentration of phosphoric acid used at pilot plant level before taking it to plant trial level. The project took one year and to ensure its success he carefully selected the team and was supported by the head of the company. It was important to sustain the results as well as communicate it. The pilot plant trial was so successful it is being rolled out to other plants in Sime Darby.



Our thanks to Saiful Nidzam for showing us the positive impact that a chemical engineer can have in the palm oil industry.



1. The audience made up of academics, industrialists and undergraduates.
2. KS Qua presenting our speaker with a Certificate of Appreciation.
3. Thank you Dr Wu Ta Yeong from Monash for hosting and making sure the proceedings went on smoothly.
4. Sheela a/p Subramaniam from UniKL found the talk informative and asked about the relevance of RSM method.
5. Christopher See from Life Science was particularly interested in the data analysis and asked many questions.
6. From UCSI University (L to R) Ang Shen Jen, Yap Jane Yee, Ding Shuan Wei and Daswin Kanan.

# Samuel Kam - a remarkable chemical engineer

**Mr** . Samuel Kam Sheung Woo, the oldest chemical engineer in Malaysia, passed away at the age of 102 on March 30th, 2017. He was a visionary who saw the potential of palm oil and set up the earliest palm oil processing facility in the country. As POPSIG puts together its 100 Year Palm Oil Industry Seminar on 8th August 2017, marking at least 50 years of process engineering in the industry, we see him as truly the pioneer of palm oil processing.

As reported by The Star\* Samuel Kam was “Born four years after the 1911 Chinese Revolution, Kam grew up in Hong Kong, served as the governor-general’s de facto foreign affairs officer in Hainan, returned to Hong Kong and taught in a girls’ school, and then sailed 19 days on a ship to America to do a master’s degree in chemical engineering at UC Berkeley (where some lectures were conducted at night because a professor was involved in top-secret research work related to the hydrogen bomb during the day!).

He stayed on to work as a chemical engineer in the United States before a varsity mate extended an invitation to go to Singapore to help develop Lam Soon Cannery, a family business started by the friend’s father in the 1930s.

Today, Lam Soon produces many household brands – Knife cooking oil, Daisy and Naturel oil and margarine, May and Fruitale soap, Drinho beverages and Zip detergent, just to name a few.

But back in the 1950s, the company was not doing well. Initially a producer of soy sauce, it envisioned being a jack-of-all-trades and added cooking oil, laundry soap, canned food and coffee to its product repertoire.

Unfortunately, its machines were badly maintained and the unplanned layout of the factory floor resulted in a production process that was far from optimum. Besides, machine operators were untrained. Thus the company could barely keep its head above water even with the help of overdrafts.

“Both the technical and management aspects were in a mess. No one was even able to tell me what the product costs were.

At this time, the main business of the company was cooking oil, but the product was of poor quality. The company marketed the oil, refined from coconut oil extracted from copra, as clear and fragrant. But in reality it was neither clear nor fra-

grant, and retained the copra smell,” says Kam, adding that he made many technical changes, which eventually led to the company improving its financial situation.

Lam Soon had never had a professional engineer before and I was given the post of chief engineer, even though I was really the only engineer there!”

## Lam Soon in Malaya

So that was how Kam started out in South-East Asia in 1955, where he has – barring a stint in the US as an engineer when a former boss secured him an immigrant visa – lived since. He became a Malaysian citizen in 1969.

After three years with Lam Soon Singapore, he moved to Malaya and played an instrumental role in setting up Lam Soon Oil and Soap Manufacturing Company. When the country gained independence in 1957, high import duty was imposed on goods and building a factory here seemed like a step in the right direction for the company. But financial and manpower constraints meant it wasn’t exactly a walk in the park.

“I was sent to Malaya without any budget, without manpower, and I was told to build a modern factory with minimum cost. We had to compete with the multinational Lever Brothers (later known as Unilever), which had well-established brands such as Planta and Lux.

The company had no money; often when the machines arrived, we were not able to pay someone to install it! Creditors chased me for money all the time. It was hard work and I had a really tough time. But I was still young, in my early 40s, and I had courage,” he says. Lam Soon’s new factory, built on a three-hectare plot of land in Petaling Jaya in the late 1950s, was to have an oil mill and oil refinery, a margarine section, a soap section and a glycerine treatment plant.

The factory that I built in Malaya had a United Nations of machinery – the best automatic soap machinery from Italy, efficient German oil press, and other machines from America, Denmark, and England, as well as locally. I sourced machines from all over the world, provided that they were economical and worked well.

Labour in Malaya was cheap, so people asked why I thought automatic machines were necessary. But I said – you have to look ahead. And it is important to have good machines if you want good products.”

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Kam believes that a technical man has to be at the helm during the start-up of such an industry. The accountants and marketing people can come and serve later, he says. "After helping to set up Lam Soon in Malaya, I went to America to work. But my heart was always with Lam Soon and I felt that I could maybe contribute more in South-East Asia, so after a while, I decided to come back. I considered it lucky for me that I could put my skills and knowledge to good use."

And what a contribution it turned out to be. When he returned to Lam Soon in the 1960s, cooking oil was still refined from coconut. Palm oil (from the palm fruit), now commonly used as a cooking ingredient, was not commercially used then. Insufficient local supply of copra (at one time, large quantities had to be imported from Indonesia) and an increasing supply of crude palm oil got Kam wondering whether palm oil might make a good alternative raw material.

"Malaysia produces lots of palm oil every year so I tried to find out how to turn it into cooking oil. I was also looking forward to using palm oil to produce soap. We started with palm kernel oil and moved on to producing cooking oil from palm oil. We bought a centrifugal machine from a Swedish company in the late 1960s and got a two-year exclusive use of the new technology."

Lam Soon built the first oil fractionation plant to manufacture cooking oil in the country and sales of the palm-based oil grew when the Malaysian Medical Association declared in a research report that refined unsaturated palm oil is beneficial to health.

"After all its early troubles, Lam Soon is a huge success today," he says.

Kam adds that he would like to think of the switch from coconut to palm oil as a small contribution to society.

"It is a healthier alternative to coconut oil. Once the country began to know the value of palm oil, the Palm Oil Research Institute of Malaysia (PORIM) was set up to carry out research in this industry. I was one of the advisors for the research programme. Malaysia took a wise step in getting all kinds of oil experts from America, England, Holland. Palm oil is now one of the biggest pillars of the Malaysian economy."

He retired from Lam Soon in 1982, at the age of 67, but stayed on as one of its directors until up to about five years ago."

Source: *The Star*. Wednesday, 28 September 2011 by Rouwen Lin

POPSIG spoke to Mr G C Tan, MD of Pacific Oleochemicals which is owned by Lam Soon. Tan is a Fellow of IChemE and its Senior Ambassador for South Peninsular Malaysia.

"I first met Kam in 1975 when I joined Lam Soon in Pasir Gudang as a young chemical engineer. I had travelled up to Petaling Jaya and I felt very welcomed into the organization as he was then the Managing Director.

Over the many years he has come across as very approachable, a man who was unpretentious, always calm and smiling, showing concern and supportive. I did not get to meet him often as he was very senior.



Tan in animated conversation with Kam.

The last time I met him was in 2010 in Sentosa Island in Singapore at Lam Soon's 60th anniversary dinner. I was honoured to be seated next to him and very touched that he remembered me. He was still very sharp and was keen to know about oleo-

chemical technology. I am not surprised as he has a strong technological background, a lot of which was in palm oil refining, cooking oil, soaps and margarines.

He was daring and led the way in investment in process technology, something not seen in Malaysia at that time. His reputation as a good engineer earned him a lot of respect and trust from the owners to put up the capital. Lam Soon may not be where it is today without his foresight.

He was not only a good engineer but has also written a book about his dramatic life experiences. It is available in English and titled "Through Wars And Peace". Not many people know about him and those interested to find out more should read the book."



Tan helping Kam to his seat at the dinner.

# Challenges in Biodiesel Business

**O**n Monday 10<sup>th</sup> April 2017 POPSIG (& BESIG) scored a first by making the evening talk into a simultaneous webinar. At the live event at Monash University Malaysia there were 35 participants and 22 online from Malaysia, UK, South Africa, Australia and Singapore.

The speaker was Mr U R Unnithan, Founder & CEO of the SUMWIN Group. Unnithan is a chemical engineer with 32 years experience in oils & fats, oleochemicals and biofuels. He was Executive Director at Carotino Sdn Bhd for 22 years with 3 patents in the field of oil and fats. He is currently the President of the Malaysian Biodiesel Association (MBA).

His talk was very comprehensive, covering both technical and business aspects and it was very well received by the mixed audience of business professionals, academics and undergraduates. He covered global energy outlook, global warming & climate change, understanding biodiesel, its specifications, the global biodiesel scenario, the key drivers for biodiesel mandates, the Malaysian biodiesel story, the challenges and the status of palm biodiesel in Malaysia and Indonesia.



The live audience at Monash University Malaysia

Global energy demand will continue to grow rapidly and in this the share of renewable in the energy mix will also increase. Biodiesel is now an integral part of the vegetable oils market and hence a key price determinant. Government policies will continue to drive biodiesel mandate globally. Palm biodiesel has come a long way and it has the largest share of global biodiesel production. Indonesia has been highly successful and has increased the mandate to B20. Malaysia and Indonesia will continue to increase the palm biodiesel as a price support mechanism for palm oil. The biodiesel industry can increase its competitiveness through value addition by better utilizing by-products such as phyto-nutrients and glycerine. Palm biodiesel sustainability standards will improve further with mandatory methane capture in mills.



Dr Wu Ta Yeong, lecturer at Monash University Malaysia and second year chemical engineering undergraduates.

Unnithan's talk attracted a number of questions and we took the first ones from the webinar participants. Johan Samad asked about the impact of the offtake of glycerine on the biodiesel business and if waste plastics to biodiesel affected palm biodiesel. For this report the short answers are yes and no.

The live audience wanted to know the extent of phytonutrient stakeholders, the impact of coconut oil, the extent of heterogenous and/or enzymatic catalysis and whether palm oil could be used directly.



Yip Sou Meng, Technical Director and Esther Ang, Project Director from GreenG Gravity Sdn Bhd with our Mr B P Chow, POPSIG committee member.



William Tan, Director, SP Multitech Renewal Energy Sdn Bhd and Dr Chian Wen Chan, Project Engineer, Agridon Manufacturers Sdn Bhd.

# A more efficient palm oil extraction method



Prof Robiah introducing MICRONES.

This evening talk by Professor Dr Robiah Yunus of Universiti Putra Malaysia on 10<sup>th</sup> July 2017 at Monash University Malaysia attracted 31 participants. Another 16 including those from Australia and the UK joined by webinar.

Oil palm milling extraction methods have not changed since the pioneering work of United Plantation’s Tan Sri Bek-Nielsen who was inspired by Unilever’s work at Mongana in the Belgian Congo in the early 50’s. Traditional method of digesting and pressing thereafter by a mechanical screw press has survived in the realm of prices versus robustness and reliability but inherent limitations in the method are a major cause of both Palm Kernel Oil (PKO) and Crude Palm Oil (CPO) loss.

A more efficient method prescribes the decoupling of the traditional digester combination and a reassembly of specific apparatus engineered to optimise the critical steps linked to efficient separation of oil from cellulosic matter. At the second stage pressing, up to 95 percent of the oil is removed by a novel vertical axis single helical spiral screw press by forcing the mesocarp fibre through 3 separate compression zones. Induced maceration, removing kernel nuts before pressing, the introduction of an intermediate hydration process between a second and third stage pressing eliminates kernel oil losses and significantly reduces crude oil lost on pressed fibre.

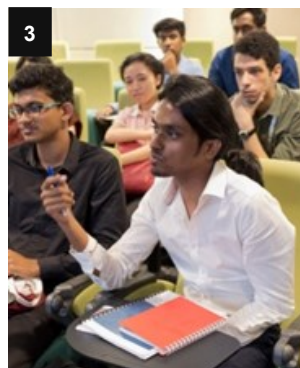


A very well received talk and participants listening intently to Prof Dr Robiah Yunus.

The key is the separation of the kernel from the mesocarp so that all the oil can be extracted without damaging the kernels. This project is a great example of a chemical engineer working with other disciplines, in this case mechanical engineering and biology. After all chemical engineers are the interface between molecular sciences and engineering. Whilst the focus has all the time been on agriculture to increase the oil extraction rate, focussing on the unit operations is new. This is how chemical engineers contribute to sustainability.

Gregory Forster, the mechanical engineer and MD of Fibaloy, who collaborated on this project says, “1 percent of OER unrecovered is causing Malaysia to use approximately 250,000 hectares of land unnecessarily. If land use inefficiency is not bad enough, employing resources (diesel, fertiliser, labour) on fruit from which oil will never be recovered is not only costly it is causing CO<sub>2</sub> emissions and social problems.”

We don’t need more land to produce more palm oil but we need to recover more oil from what we already grow.



1. K S Qua, a founder of member of POPSIG said, “Brilliant! The first time in 35 years since the continuous steriliser have I seen anything so exciting.”
2. Greg Foster, MD of Fibaloy, stressing a key point.
3. Divaan Raj Karunakaran, undergraduate from SGEI University said, “I am looking forward to this revolution for our Malaysian palm oil industry.”
4. Hong Wai Onn, chair of POPSIG, presentation the certificate of appreciation. Thank you very much Prof Robiah!

This was the question the forum panelists addressed at IChemE's 100 Years Palm Oil Industry Seminar themed '50 years of process engineering'. The forum was part of a daylong seminar held on 8th August 2017 at InterContinental Kuala Lumpur, Malaysia. Engineering and processing professionals in Malaysia and neighbouring countries came together to celebrate the first commercial planting of oil palm in 1917 in Tennamaran Estate in Selangor, Malaysia. Speakers and panelists reflected on the history and importance of chemical and process engineering in the industry, and how palm oil has come to fruition as Malaysia's fourth biggest export revenue earner.

The palm oil industry is a significant contributor to the Malaysian economy and in terms of natural resources is second only to oil and gas. The government has an active policy aimed at increasing production and exports. By placing science and technology through PORIM (Palm Oil Research

The current technological wave of the Malaysian government for 2011-2020 is embodied in the Entry Point Projects (EPP) of the National Key Economic Areas (NKEA) in its Economic Transformation Programme (ETP). In midstream, to ensure sustainability and improve productivity, these are increasing the oil extraction rate (OER) and developing biogas facilities at palm oil mills. Downstream the focus is on high value oleo derivatives, commercialization of second generation bio-fuels for power generation as well as expediting the growth of food and health-based products. Bioprocesses are included. To realize these chemical engineers will have key roles to play.

Some of these will carry into beyond 2020 and the future will see even more reliance on science and engineering to address issues of sustainability, food safety, new applications and value extraction.

## 100 Years Palm Oil Industry Seminar

### Can Malaysia continue to be the global technology leader in processing its Golden Crop?

Institute of Malaysia) from 1979 behind the industry it has gained the leadership technology position in the modern day palm oil industry. Today this is the MPOB (Malaysian Palm Oil Board) and some of its important process patents are in the midstream milling sector.

Downstream, in the refining sector high volume demands due to low margins drove technology providers to come up with automated plants of increasing throughputs, efficiency and reliability. These plants, like those of oleochemicals, were built upon process technology for vegetable oils such as soyabean and rapeseed as well as coconut and tallow. In basic oleochemical sector, process technology came with the multi-nationals who invested in Malaysia along with process safety so necessary to protect high value assets as well as people. As with the refineries low margins paved the way for larger and larger plants. Most multi-nationals have exited and locals are now managing the process technology and innovation.

Businesses in Malaysia are reluctant to this day take on new technology and in the 1970s a pioneering chemical engineer Samuel Kam of Lam Soon did just that for refining, fractionation for cooking oil, soap and margarine. Then many jumped on the bandwagon with overcapacity in refining, later in basic oleochemicals and biodiesel.

A panel of distinguished personalities in the palm oil industry came together to discuss the big question:

**"Can Malaysia continue to be the global technology leader in the processing of its Golden Crop?"**

The panelists were

1. Tan Sri Datuk Dr Yusof Basiron CEng FICHEM. Former CEO of Malaysian Palm Oil Council and DG of MPOB
2. U R Unnithan CEng FICHEM. CEO of Sumwin and President of the Malaysian Biodiesel Association
3. Ku Kok Peng. Executive Vice President & Partner, PEMANDU Associates
4. Mohammad Jaaffar Ahmad. CEO, Palm Oils Refiners Association of Malaysia (PORAM)
5. Dr David Lim. MD, Nottingham Green Technologies Sdn Bhd
6. Prof Ir Dr Abdul Aziz Abdul Rahman CEng FICHEM. IChemE in Malaysia Board Chair.

The forum was moderated by Qua Kiat Seng CEng FICHEM, founder member of IChemE's POPSIG.

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### Opening remarks of panelists

The panelists are upbeat about Malaysia continuing to be the global leader in processing. The keys are marketing, research & development and the ability to solve problems. We must continue to move palm oil from a commodity by value addition through R&D where MPOB is its apex. There are gaps in moving from the laboratory into the pilot plant and finally into industrial scale and this is where chemical engineers come in.

### Sustainability

There are sceptics, Donald Trump included, about climate change and global warming. IChemE's view is that there is scientific evidence that increase in carbon dioxide and other greenhouse gas emissions is the cause of global warming. There is a need to develop strategies to address this and it includes improving energy efficiency. This also helps to reduce costs. IChemE encourages organisations to reduce emissions however small it is.



(L to R) Qua Kiat Seng, Tan Sri Datuk Dr Yusof Basiron, U R Unnithan, Mohammad Jaaffar Ahmad, Dr David Lim, Prof Ir Dr Abdul Aziz Abdul Rahman.

There are gaps in the value chain and because of comfortable margins there is no push. We should not depend on MPOB alone and should ready ourselves for Industry 4.0. Downstream the refinery sector is the biggest player, yet the least understood being caught between crude palm oil and processed palm oil and rewarded with tiny margins. Some aspects of the industry has not changed for 50 years and there now needs to be a paradigm shift in the quality of crude palm oil with growing concerns in food safety.

The mill which has been largely a domain of mechanical engineers are now starting to welcome chemical engineers to address processing issues such as OER, oil loss in fibre and sludge and by-products such as EFB pellet, organic fertilizer and bio-gas as well the reduction of GHG emissions. Millers are not risk takers and need help from universities. We have the ability to control the entire supply chain and the challenges that come with it need young people. Capacity building and encouraging young people to take up science and technology as well as go into this industry rather than O&G are continuing concerns that are being addressed.

Sustainability is not to be treated with disdain as one of United Nations (UN) goals is to take urgent action to combat climate change and its impacts. There are two issues. Firstly on deforestation there is no national stand yet so this needs to be done so as to leave no ambiguity on where Malaysia stands on deforestation. Secondly palm oil millers are slow despite incentives to install biogas facilities to capture methane and turn the greenhouse gas into clean energy. Mills are reluctant to invest.

The mill is seen as a polluter because of POME (Palm Oil Mill Effluent) and EFB (Empty Fruit Bunch) left to rot. This is just beginning to change as POME & EFB are now viewed as another source of income viz energy. Feeding the excess power to the grid remains an issue as many mills are located in remote areas. By 2020 all 447 palm oil mills in Malaysia are required to install biogas systems.

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Malaysia has pledged at COP21 (Conference of Parties, 2015 Paris Climate Conference) to cut its carbon emissions and the government should share its action plans to meet the commitment so that industry is aware of its role.

As the debate on GHG emissions savings of palm oil biodiesel within the framework of the EU Renewable Energy Directive (RED) continues, EU continues to raise the bar, a move seen to be a trade restriction than based on science. However, the usage of palm oil biodiesel continues to grow globally.

**Progress in palm oil processing**

The refining industry has made great strides in processing development. For example in fractionation has gone from wet to dry, crystallization from batch to continuous and separation from decantation to centrifuges to vacuum filters to the current membrane filtration. Oleochemicals too has seen tremendous improvements and now bio-processing gaining prominence.

In the past 50 years there has been improvements in milling. Sterilisation moved from horizontal to vertical, then to continuous in the 1980s resulting in a smaller footprint with safer and cleaner operation. At that time continuous separation moved from rectangular to vertical clarification. In 1990s SFB (sterilised fruit bunch) handling moved from overhead cranes to tippers when the SFB are conveyed. In 2000s vertical sterilization meant no cages were required and it reduce maintenance as well as processing cost. Now there is biogas. The focus is on what millers know eg EFB pellets.

Whilst milling is a mechanical process viz the mechanisation of extraction the attention now is to extract as much oil as possible from the fruitlet and this will need chemical engineers and biologists to help. Whilst everyone speaks of OER we should look at it from the point of view as reduction of oil loss.

Like refineries and oleochemical plants, capacities of mills are increasing from 20t/h in the past to as large as 180t/h to realize efficiencies.

**Encouraging innovation**

In the 1970s and 1980s we saw how Lam Soon pioneered new technology in fractionation by getting Alfa Laval to agree on a 2 year exclusivity, and also Lever Brothers made it a condition that Gianazza who supplied the first physical refiner in Malaysia could not sell another plant in Malaysia. Now there is a great reluctance to be the first. Universities find it hard to get industry to upscale their research successes. Vendors have to set up at their own costs demonstration plants

eg in biogas. There is this wave of caution on the part of industry and we need to overcome this as it is key to continuing to be the global process leader in the palm oil industry.

Traditionally millers are conservative and complacent focusing on what they know eg OER. They are scared of something very different such as biogas and EFB pellet and as they do not understand they prefer to wait and see and then follow. They need to be educated and see there is a market outside of crude palm oil. Researchers and universities should involve the millers at the developing stage to reduce the reservations. There is now less money for research and some universities do an economic impact first which includes finding an industry partner.

The millers want to be "the first to be second". There needs to be a paradigm shift and the mill should be viewed not only as oil but as energy, biomass source etc. There is the push and pull strategy. The NKEA encourages by putting options on the table and when there are enough options including joint venture, the public sector will push eg by not renewing the licence. Chemical engineers can help not only by offering options but also evaluating and implementing them.

**Leading in technology**

In industry R&D commercialisation is not a priority due to the risk involved. So it waits for somebody to pioneer and when a window is opened everyone jumps in. When biodiesel started in 2006, margin was US\$150/t with a two year payback. 92 licences were issued and 34 plants constructed. We need to commercialise the technologies of MPOB and others and the owner needs to have an innovative mindset bearing in mind technical risks and gestation period. At the next level is the technical competence in engineering the scale up. Lastly is application based marketing. Techno-marketing based on application including ones that do not exist offer exciting opportunities for young chemical engineers.

Sometimes organic development is not enough with gaps in the value chain that we are not plucking where the risk is high and investments very large. Here sovereign funds can come in and when established can be passed back to the private sector. What comes to mind is EPP 7 Commercializing second generation biofuels, a project still in gestation.

Whilst we are ahead of the curve compared to other vegetable oils, the palm oil industry could be complacent due to the high profit margin in some sectors. So there is a need to continue pushing the palm oil industry to take a lead in pioneering technology.

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### Food Safety – 3-MCPD and GE

What is the issue? 3-MCPD released from its esters causes ‘organ damage in animal tests’ while GE as free glycidol is ‘probably carcinogenic to humans’.

Many foods contain 3-monochloropropane-1,2-diol (3-MCPD) or glycidol esters (GE), including processed meats such as sausages, and sauces, gravies and almost all vegetable oils. Palm oil, if processed under inferior conditions, can display higher levels of these components. There are today many palm oil producers who can produce palm oil with 3-MCPD and GE contents that are almost non-detectable.

Quite a lot is known today about how 3-monochloropropane-1,2-diol and glycidyl esters is formed and that mitigation requires prevention as well as removal throughout the supply chain. Plantations, small holders, mills, refineries and oleochemical manufacturers tend to operate in silos, looking at maximising revenue in each silo. Setting appropriate specifications in crude palm oil eg FFA (free fatty acids) and DOBI (Deterioration of Bleachability Index) and adding on new ones such as DAG (diglyceride) and chlorine (precursor) content and developing appropriate processing steps & conditions in the mill and refinery will address the issues. Changes in processes will need chemical engineers to realize and optimise.

Interestingly Indonesia crude palm oil does not have DOBI in its specifications. In Malaysia we could revert to 4% max FFA (in 1970s cf 5% max now) and go to the next level of DOBI of >2.99 (now >2.31 fair) which MPOB considers as good. We should look upon this challenge as an opportunity to differentiate our refined palm oil quality from that of the rest of the world. This technological lead will make Malaysia’s refined palm oil the preferred processed palm oil. MPOB as the registration and licensing authority is best placed to effect this.

### Chemical engineers in palm oil industry

Chemical engineers are the interface between molecular sciences and engineering. In dealing with triglycerides and fatty acids there is indeed a lot of chemistry there. Whilst many chemical engineers are employed in the oleochemical industry and less in the refineries, there are very few in the mills. Chemical engineers can certainly play a greater role and contribute to the industry and with 2400 graduates, it is more than the oil and gas industry can absorb. It is a myth that graduates cannot gain professional experience in the palm oil industry to become chartered/professional chemical engineers. In the palm oil processing industry, there are opportunities to gain competence in design, problem solving, sustainability, process safety, leadership and communication.

In the past, there was only one engineer in the mill and inevitably it was a mechanical engineer with steam certificate. The modern mill is with higher milling capacity, generate biogas and power, produces short and long fibre from EFB, organic fertiliser, fibre mat and clear water. Therefore, it employs more than one engineer including chemical engineers, who will complement each other.

In general, chemical engineers will always have a role to play in the palm oil processing industry. Example of these are process improvement, product application (including those that do not exist), process safety, energy, innovation and extracting value from all product streams.

### Conclusions

The prospects for Malaysia to continue to be the global technology leader in the processing of palm oil remains bright. A number of challenges remain ahead.

- MPOB continues to be the apex in R&D and POPSIG offers its inputs in the areas of sustainability, process safety, processing, energy and capability management to keep MPOB’s programmes relevant.
- Millers need to see their contribution as a corporate responsibility in enabling Malaysia to meet its commitment to COP 21.
- Mills have made much progress primarily in mechanical engineering and going forward will need other disciplines such as chemical engineers and biologists to help reduce oil loss as much as possible.
- There needs to be a paradigm shift in the thinking not only of millers, but also of the other sectors and as the NKEA encourages this, chemical engineers have a role to play in offering, evaluating and implement options.
- Where there are gaps of high risk and high investment, sovereign funds can come in initially.
- Comprehensive actions across the supply chain need to be taken to address the issue of food safety and this challenge must be seen as an opportunity for Malaysia to differentiate the quality of palm oil from that of the rest of the world. MPOB is in the best position to take the lead.
- Chemical engineers have an important role to play in all of the areas mentioned.

*This paper was put together by the authors based on the inputs from the forum discussions. The authors are Hong Wai Onn CEng MChemE, chair of POPSIG, Prof Dr Chong Mei Fong AMChemE, secretary of POPSIG and Qua Kiat Seng CEng FIChemE, founding member of POPSIG. Statements and opinions expressed in this paper are the responsibility of the authors. Unless described as such, they do not represent the views or policies of the Institution of Chemical Engineers.*



1. Getting to know our keynote speaker. MC Mohan Balasingam on the far right.
2. Prof Ir Dr Abdul Aziz welcomes participants.
3. Thanking our keynote speaker Tan Sri Datuk Dr Yusof Basiron. He gets his FIChemE certificate.
4. Participants enjoyed the story.
5. David Chiang, R&D Manager, PalmitEco Engineering Sdn Bhd. Speaker milling paper Then Now and Moving Forward Palm Oil Milling for Better Efficiency.
6. Participant from Hong Kong, Anthony Tam, VP, ECO Environmental Investments Ltd, HK.
7. Fredrik Pomrehn, Director Technology, JJ-LURGI Engineering delivered refinery paper: Ready for 3-MCPD Challenges? The Palm Oil Refining of the Future.
8. Francesco Soragno, Technical Sales Manager, Desmet Ballestra delivered oleochemical paper: Technological Advancement in Oleochemicals for Sustainable Competitive Advantage.
9. Martin Rushworth, Commercial Head Palm Oil Platform, Novozymes delivered Bio-processing paper: The Biotechnology Revolution for Palm Oil.
10. Tan Sri Yusof posing a question on the hot topic of 3-MCPD & GE.
11. Thank you to all participants, speakers panelists, sponsors and supporters for making POPSIG's first seminar a great success.
12. Ku Kok Peng, Executive Vice President & Partner, PEMANDU Associates delivered the pre-forum paper: Economic Transformation Programme in the Palm Oil Industry.

  
**100 Years Palm Oil Industry Seminar**  
*"50 years of process engineering"*  
 8 August 2017  
 InterContinental Kuala Lumpur, Malaysia



# IChemE Malaysia Awards 2017

Malaysia's oil and gas entity, PETRONAS, scooped three out of seven Awards at the Institution of Chemical Engineers (IChemE) Malaysia Awards on 16 October 2017. Held at the InterContinental in Kuala Lumpur, it celebrated outstanding achievements in the Malaysian chemical engineering community.



Chair of IChemE Malaysia Dr Abdul Aziz (fifth from left) and board members.

IChemE Malaysia Chair, Professor Abdul Aziz Bin Abdul Raman kicked off the ceremony with a welcome address, and announced the launch of Professor Dominic Foo's latest work – Chemical Engineering Process Simulation.

The Palm Oil Industry Award sponsored by Sime Darby Plantation, went to ExcelVite Sdn Bhd. The project uses molecular distillation technology to extract five different phytonutrients from crude palm oil. This can be used to enhance a variety of products, from pharmaceuticals to fuel.



Tuan Syed Said Syed Saggaf, Head Sime Darby Biodiesel Sdn Bhd, Head Sime Darby Kernel Crushing Plant, Head Health & Wellness Business giving the Palm Oil Industry Award to Chin Hui Ling and Lim Ching Yee from ExcelVite Sdn Bhd.

Mr W H Leong, Chief Executive Officer of ExcelVite Sdn Bhd said, "I am pleased, honoured and humbled to receive this prestigious award, on behalf of ExcelVite, from IChemE. Our success story is an excellent example of value addition to the traditional oil palm industry in Malaysia by producing palm phytonutrients especially the tocotrienols (super vitamin E) at a reasonable price bringing its health and well being benefits to the general public. In Malaysia we are the early pioneers in this field of process engineering and have paved the way for others to meet the nation's 2011 -2020 aspiration in the food and health based segment. I would like to dedicate this award to my fellow employees for their continued support, hard work and commitment."



Group photo of IChemE Malaysia Awards 2017 winners.

Chair of IChemE Malaysia, Professor Abdul Aziz Bin Abdul Raman, said:

"We have once again celebrated a fantastic night of achievements in chemical engineering. Tonight's winners should be incredibly proud of their achievements. They are helping to advance the profession to provide real benefit to wider society, particularly in Malaysia.

"Chemical engineering matters, because it is a huge contributor to this nation's economy. I'm delighted to see so many dedicated, passionate individuals and organisations making a difference. Congratulations again and hope you have enjoyed this wonderful celebration."

Source: IChemE Malaysia

## Leading in palm oil processing

**P**OPSIG leaders paid a visit on Monday 11<sup>th</sup> September 2017 to the Malaysian Palm Oil Board (MPOB) in Bangi, meeting its Director General Dr A Khusairi Din and other directors viz Dr Ahmad Parveez Hj Ghulam Kadir, Deputy Director General, Dr Zainab Idris of Advanced Oleochemical Technology Centre and Dr Astimar Abdul Aziz of Engineering & Process Division.

Qua introduced IChemE and POPSIG. MPOB is keen to contribute an article to IChemE's flagship magazine The Chemical Engineer as well as encourage its staff to participate in our bimonthly evening talks. POPSIG invited MPOB staff to enter the IChemE Awards 2018.

We then shared the outcome of the forum from our recent 100 Years Palm Oil Industry Seminar. The forum question was "Can Malaysia continue to be the global technology leader in processing its Golden Crop?" Panelists said yes identifying four key drivers viz

- The government puts science and technology behind the industry viz PORIM then MPOB
- Refiners drive technology providers due to high volume, low margins
- Oleochemicals also similarly drive technology providers and owned development
- NKEA ETP 2011-2020 EPP 4 – 8 for palm oil

As MPOB continues to be the apex in R&D, POPSIG offered its inputs in sustainability, process safety, processing, energy and capability development.



(L to R) Ms Liew Siew Lu, Mr Hong Wai Onn, Prof Dr Law Chung Lim, Mr B P Chow, Mr K S Qua, Dr Khusairi, Dr Ahmad Parveez Hj Ghulam, Dr Zainab Idris and Dr Astimar Abdul Aziz.

## Congratulations!

**P**OPSIG congratulates Mohammad Jaaffar Ahmad, CEO of PORAM on his appointment as Director of Strategy and Policy of the newly formed CPOPC (Council of Palm Oil Producing Countries) headquartered in Jakarta. Malaysia and Indonesia have agreed to spearhead the establishment of a Council of Palm Oil Producing Countries (CPOPC), aimed at ensuring price stability, and develop the downstream industry of the commodity. The CPOPC will also promote environmentally sustainable practices in the oil palm industry and improve cooperation in research and development within it to unlock potential across the value chain.

Jaaffar has supported POPSIG activities and we hope he will help us extend into Indonesia. Jaaffar says, "CPOPC is an extension of the works that we have been doing in Malaysia. Certainly CPOPC will have a bigger responsibility to further promote global palm oil as a significant contributor to the economic and social development of palm oil producing countries through generating export earnings, creating job opportunities, alleviate poverty eradication and accelerating regional development. POPSIG activities have been useful and beneficial for the palm oil industry in Malaysia and surely the same contribution could be shared with all palm oil producing countries. I am looking forward for this new responsibility at CPOPC and will ensure that all the good work by POPSIG and IChemE especially in the development and achievement in the palm oil safety and processing sectors can be shared in Indonesia and later with other members of CPOPC."



# IChemE & AOMG assists RSPO

The joint BESIG & POPSIG evening talk on Monday 18/9/17 held at Monash University Malaysia was “Introduction to Oleochemicals” by Qua Kiat Seng, AOMG Advisor and founder member of POPSIG. The talk was attended by 90 with about half of them undergraduates. Participating in the simultaneous webinar were also 73 people from around the world.

30 of the webinar participants were from Certifying Bodies (CB) who conduct audits for RSPO for players in the supply chain who are or want to be RSPO Supply Chain Certificate Holders. They wish to better understand oleochemical processes to carry out a good and informed audit of oleochemical players in the supply chain. The CBs were from Germany, Philippines, Japan, UK, Malaysia, Indonesia, Korea, Netherlands, India, Greece, Belgium, Colombia, USA and France. There were also a few participants from the RSPO Secretariat as well as NGOs.

Webinar participants were also from Australia, South Africa, Austria, Switzerland, Pakistan, Nepal, Singapore, India, Albania, Ireland, Oman, France and Ghana.

Qua covered a lot of ground and spoke on the vegetable oil market, oleochemistry, oleochemicals and oleochemical market. During the oleochemistry section he also covered health aspects related to the various fatty acids. In the oleochemicals section he used a shower gel as an example, starting from palm kernel oil to the final product. He touched also on new processes with a focus not only on bioproducts but on bioprocessing as well as new catalysed processes such as metathesis which use and produce both oleo and petro chemical products. Qua views oleochemical processes as versatile rather than complex.

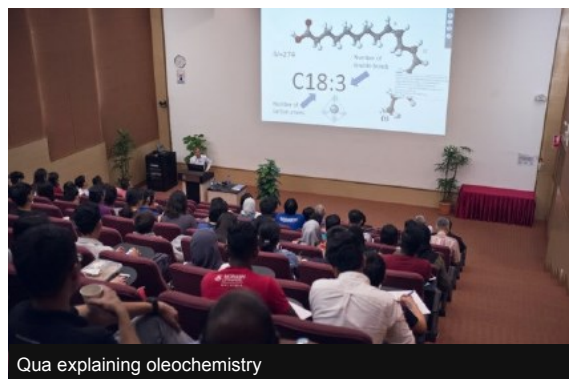
Some comments were

“The presenter is excellent. He made a dull topic very interesting.”

“Useful as an introduction. Thanks”

“Perhaps a little too short, with contents being too simplistic.”

“Participants wanted more information on the challenges, processes and market, faced by the industry which unfortunately the speaker went through quickly due to lack of time.”



Qua explaining oleochemistry



Abdelrahman Elfar, intern at Mewah, wanted to know why bio-diesel is considered an oleochemical when it has a petrochemical component.



Haliza Abdul Aziz, Research Officer from MPOB, clarifying epoxidation.



Anthony Tam, VP ECO Environmental Investments Ltd, HK asking about oxidized palm oil.



Dr Nagasundara Ramanan (R), chair of BESIG in Malaysia, presenting Qua the certificate of appreciation.

## POPSIG members present at PIPOC 2017

ChemE POPSIG members gave oral presentations at PIPOC 2017, the MPOB International Palm Oil Congress & Exhibition (PIPOC) on 14-16 November 2017 at the Kuala Lumpur Convention Centre. The theme was “Treasuring the Past, Charting the Future” in commemoration of 100 years of commercial planting of oil palm in Malaysia.

At the Chemistry, Processing Technology & Bio-Energy Conference on 15<sup>th</sup> November in Session 1 Milling and Processing

- Robiah Yunus, Universiti Putra Malaysia was the speaker for “Micrones – A More Efficient Oil Extraction Method.”
- Hong Wai Onn, Novozymes Malaysia Sdn Bhd was the speaker for “Enzymes to Improve OER in Palm Oil Extraction.”

At the Oleo & Speciality Chemicals Conference on 16<sup>th</sup> November in Session 4 Technology for Realizing a Better Future

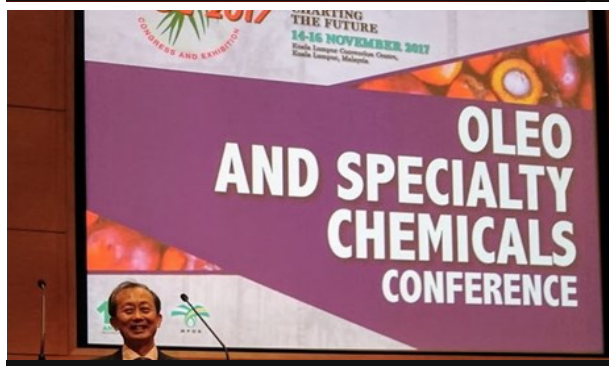
- Qua Kiat Seng, ASEAN Oleochemical Manufacturers Group was the speaker for “Oleochemicals Process Engineering & Innovation : Past, Present and Future.”
- Mohd Rizza Othman, Universiti Malaysia Pahang was the speaker for “Application of Dividing Wall Column for Improved Oleochemical Fractionation : from Conceptual Design to Pilot Plant Validation.”



Prof Dr Robiah Yunus (middle)



Ir Hong Wai Onn



Ir Qua Kiat Seng



Dr.-Ing. Mohamad Rizza bin Othman

Ir Qua said, “This is great support for PIPOC by POPSIG members. As this is an opportunity to showcase what chemical engineers can do for the palm oil industry I hope more POPSIG members will come forward to present at this prestigious event. The next POPSIG 2019 is from 19-21 November 2019.”

Other POPSIG members also presented at the Global Economics & Marketing Conference. On 15<sup>th</sup> November in Session 2 “Sustaining Palm Oil Economic Competitiveness and Environment” Tan Sri Datuk Dr Yusof Basiron spoke on “Palm Oil Economic Sustenance in An Increasingly Competitive Environment.” On 16<sup>th</sup> November in Session 3 “Economic Challenges in Sustaining the Future for Palm Oil” U R Unnithan spoke on “Prospects and Challenges of Biodiesel Industry.”



# RT15

**Bali 28 - 30 November 2017**

This was an eventful RoundTable with the possibility of Mount Agung erupting since 22/9/17. In particular Bali Airport Denpasar started to close from 7am on 27/11 preventing many participants from arriving. This left the 477 participants (as reported by RSPO) who had arrived earlier wondering when they could leave with a number evacuating to Surabaya by ferry and overland. The first day of the conference was cancelled and the subsequent days proceeded with a modified programme as a number of speakers and panelists were unable to attend.



Activity at Mount Agung on 25/11/17.

At the RT the release of the 2017 Impact Report was announced. Here we saw that total CSPO sales in 2016 had decreased to 5,632,731 MT, down by 549,963 MT from 2015. At RT 14 we heard the oil palm growers co-chair of RSPO, Dato' Carl Bek-Nielsen in his welcome address hitting out at RSPO members who were using the "no palm oil" label on their products. We were looking forward to the consumer goods manufacturers co-chair of RSPO, Biswaranjan Sen of Unilever, deliver his welcome address and touching on the decrease in sales. Unfortunately he was one of the speakers who could not make it.

This left the CEO of RSPO, Datuk Darrel Webber, to welcome participants. He said, "We must realise that to have real and long lasting change, we need to include everyone and start by helping them to become above average. We need to allow for change, transformation, and conversion and cannot expect that those who are at the start of their sustainability journey should become superstars overnight" in line with the conference theme of Inclusivity and Accountability.

During a panel discussion No Deforestation, No Peat, No Exploitation members remarked that NO is negative and should be replaced by a positive connotation. Dr Simon Lord of Sime Darby observed that RSPO had plateaued and said, "It's not about beyond certification. It's about certification and beyond" indicating there is a lot more work ahead for RSPO to get to its vision.

RSPO recognised DAABON Group and United Plantations for achieving RSPO NEXT certifications, with DAABON Group being the first in the world to achieve RSPO NEXT earlier this year; and United Plantations being the first Malaysian grower and first in the region.

RSPO's General Assembly GA 14 saw many casting their E-votes and only 4 out of 9 resolutions were approved reflecting perhaps a more representative voice of members.

Bali Airport Denpasar reopened at 3pm on 29/11 much to the relief of participants and they were able to leave once the conference ended the next day.



**Left:** A very Balinese opening ceremony.

**Right:** RSPO Commitment for Smallholders session.

## POPSIG participates in SOMChE

The 30<sup>th</sup> SOMChE (Symposium of Malaysian Chemical Engineers) was held from 6-7 December 2017 at Monash University Malaysia in Kuala Lumpur. The theme was Bridging the University-Industry Divide. There were 99 participants and 70 papers were presented in 3 parallel sessions. The papers covered bioprocessing, energy, environmental protection, food and natural processing, miscellaneous and palm oil processing.

The four keynote speakers from IChemE were Dr Christina Phang who spoke on “Addressing the Process Safety Divide,” Robert Bruce on “Is there a need for a First Principles Curriculum?”, U R Unnithan on “Palm Oil Processing & Products” and Prof Ir Abdul Aziz Abdul Rahman on “Business and Research Opportunities in the Environmental Field.” Unnithan and Prof Aziz paved the way for the palm oil session. Unnithan gave an overview of the palm oil industry with examples of how lab scale proof of concept work is commercialized. Prof Aziz after defining the environment as covering all possible activities gave examples of business opportunities for academia

There were 11 papers in the palm oil session with two papers from industry viz Jens Eulitz from PolyGreen Chemicals on “Polygreen’s Natural Polyols – How to introduce a new, green and sustainable product into a commercial production” and POPSIG’s “Can Malaysia continue to be the global technology leader in processing its golden crop?”.

POPSIG’s paper was based on the forum at its 100 Years Palm Oil Industry Seminar of 8<sup>th</sup> August 2017 and was co-authored by Qua Kiat Seng, Hong Wai Onn and Chong Mei Fong. Qua presented for POPSIG. The paper stressed for a mindset change particularly in upstream and the need for the role of chemical engineers in the industry to be made known to the industry by academia and professional institutions such as IChemE and IEM as well as for the industry to attract and retain them. POPSIG through its activities has started to facilitate this dialogue. Qua ended his presentation with an attempt to understand the mindset differentiating margins from value addition in the processing of palm oil.



Qua with Prof Aziz on day 2 of SOM-ChE.

## Congratulations!

POPSIG congratulates Prof Dr Chong Mei Fong, from Nottingham University (Malaysia campus), on being awarded the second prize for the Asean-US Prize For Women, in the Science and Technology Awards Ceremony held during the gala night of 17th Asean Ministerial Meeting on Science and Technology in Nay Pyi Taw, Myanmar on October 2017. Prof Dr Chong Mei Fong, who is honorary secretary of the IChemE Palm Oil Processing SIG, has worked to improve workplace retention and safety in urban areas by increasing the efficiency of wastewater treatment sites at palm oil mills.

Prof Chong said she was grateful to the Government for supporting her research projects throughout the years with various grants, the first being a RM202,000 grant given by the Science, Technology, and Innovation Ministry under its Science Fund.

Saying that she was glad to be recognised, Prof Chong added that she wanted to be a role model for young women who want to pursue a career in science, technology, engineering, and mathematics (STEM) fields.

The theme of the 2017 awards ceremony was the use of bio-technology, microelectronics and information technology, or material science and technology on issues such as rapid urbanisation with a focus on health such as disease spread and mutation, counterfeit medication or healthcare access and on improving transportation and infrastructure as well as workforce development and retention with focus on safety in the workplace.



# Colombia, a country to watch

Colombia produces more palm oil than any other country in Latin America, and is the fourth-largest producer worldwide after Indonesia, Malaysia and Thailand. Colombia had 512,000 hectares of oil palm planted in 2016 – but as much as 16 million hectares of land is regarded as suitable for cultivation. After 52 years of guerilla fighting the Revolutionary Armed Forces of Colombia (FARC) signed a peace agreement with the Colombian government, potentially opening up 7 million hectares for cultivation. Oil palm has been proposed as a voluntary crop substitution for coca cultivation, an illicit crop which is the main ingredient of cocaine.

In 2016 Colombia produced 1.5 million tonnes of palm oil of which a third was channeled into biodiesel. It is now looking to go downstream and value added products with a long term of view of producing 10 million tonnes of palm oil. With this in mind the Government of Colombia through the Colombian Presidential Agency of International Cooperation, APC-Colombia invited POPSIG member Qua Kiat Seng and another Malaysian Azuddin Rahman to advise FEDEPALMA (National Federation of Oil Palm Growers of Colombia) on downstream activities including oleochemicals.

During their week long stay Qua and Azuddin also visited the National University of Colombia in Bogota where they were briefed on the research work on palm oil being conducted there. This public university is the largest in the country with six campuses and 44,000 students. It is widely known as the best Colombian university and one of the best universities in Latin America for its high degree of education and research achievement.

Qua and Azuddin were briefed on research in the palm oil sector covering nano materials, mechanical (biofuels and internal combustion), foods, oleochemicals and environment. They were also brought to the laboratories. Qua said, “We are very impressed with the quality of the research conducted as well as the well equipped laboratories and pilot plants. The university is well placed to support value addition as Colombia’s palm oil industry takes off rapidly in the coming years.”



Outside the laboratories of the National University of Colombia chemical engineering department (from Left to Right):

Qua Kiat Seng, formerly GM Uniqema Malaysia

Azuddin Rahman, MD AZR Consulting

Paulo César Narváez, Professor Chemical Engineering Department, Universidad Nacional de Colombia

Luis Felipe Gutiérrez, Professor Food Science and Technology Institute, Universidad Nacional de Colombia

Néstor Algecira Enciso, Professor Chemical Engineering Department, Universidad Nacional de Colombia

Oscar Piamba, Professor of Mechanical Engineering Department, Universidad Nacional de Colombia

## Diary of Events

Webinar : **Four Decades in ASEAN : Process Engineering and Innovation in the Oleochemical Industry**

Speaker : Ir Qua Kiat Seng

Date : 26 February 2018

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

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

Evening Talk : **Novel Process for Palm Phytonutrient Extraction- Locally Produced, Internationally Recognized**

Speaker : WH Leong

Date : 2 April 2018

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

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

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