出國報告（出國類別：開會）

生質生技研討會
-參加 2019 第八屆國際工業生物加工論壇研討會出國報告

服務機關：台灣中油股份有限公司 綠能科技研究所
姓名職稱：陳瑞惠 化學工程師
派赴國家：馬來西亞
出國期間：**108** 年 **5** 月 **1** 日至 **5** 日
報告日期：**108** 年 **5** 月 **21** 日

摘要

2019 第八屆國際工業生物加工論壇研討會 (8th International Forum on Industrial Bioprocessing，IBA-IFIbiop2019) 於 5 月 1~5 日在馬來西亞，砂拉越州，美里城 (Sarawak，Miri) 舉行。本次研討會的主題為 “Bridging sustainability and industrial evolution through green bioprocessing”。議程有論壇、主題演講、口頭報告、海報論文等交流。本組這次發表三篇論文，其中一篇獲得大會「環境生物科技類」最佳海報獎。此外，更與國際學者、專家交換名片，了解對方背景、專長並討論研究內容。本出差報告將就主講、口頭報告、海報發表等三部分進行簡介，摘要一些有趣的主題及投影片，並提出參與研討會的心得與建議。

目次

1. 目的

綠能所生物科技組研究範疇涉及生物科技在工業上的應用，如天然物萃取、微生物發酵生質酒精、藻類環境淨化等，而國際工業生物加工論壇研討會(International Forum on Industrial Bioprocessing，IFIBiop)，今年涵蓋的主題有 Bioenergy/Biofuels (生質能源/生質燃料)、Food technology and Engineering (食品科技暨工程)、industrial biotechnology (工業生物技術)、Environmental Biotechnology (環境生物技術)、Upstream & Downstream Bioprocess (上、下油生物加工)等，結合生物科技在工業、環境、食品上的應用，與本組研究方向相契合，因此，參加本屆的研討會(IBA-IFIbiop2019)。

參加該會議有助於了解目前產業現況，與國際學者、工程師、工業專家進行交流。藉由發表研究成果及聽取與會者的簡報海報，激發新的創意思維，並提升本公司的能見度與建立未來合作研究的可能。

2. 過程

2.1 出國行程

出國行程與時間安排，如表一。

表一 出國行程表

日期	起訖地點	工作紀要
108/04/30	台灣桃園~新加坡	啓程(轉機)*
108/05/01	新加坡~馬來西亞美里城	啓程
108/05/02	馬來西亞美里城	參加研討會議程
108/05/03	馬來西亞美里城	參加研討會議程
108/05/04	馬來西亞美里城	參加研討會議程
108/05/05	馬來西亞美里城~馬來西亞吉隆坡	返程(轉機)**
108/05/06~08	馬來西亞	私人行程
108/05/09	馬來西亞吉隆坡~台灣桃園	返程

* 4/30 自請休假，提前飛新加坡。(5/1 日的本國籍航班太早)

** 台灣無直飛美里城的飛機，須到新加坡(早上，廉航直飛一班)或吉隆坡(下午馬航直飛兩班)轉機。

2.2 議程概述

本次研討會是由 Industrial Bioprocessing Association (IBA) 所舉辦的兩年一次國際論壇。起始於 2004，今年是第八屆（8th International Forum on industrial bioprocessing，IBA-IFIB 2019），也是第一次在馬來西亞舉行，由 Universiti Tecnologi Petronas (UTP，一所私立大學，由馬來西亞煉油公司 Petronas 成立的學校) 主辦，以及美里城的 Curtin University (一所澳洲大學分校)協辦。由於砂拉越州政府有資助本次活動，因此，本次研討會被要求要在東馬(馬來西亞東邊，較不如西馬的吉隆坡繁榮)舉辦，以增進當地的觀光消費。

5/1 日的議程只有安排寫作技巧教學討論會及報到，沒有正式的研討活動，因此，決定這天才飛往美里城報到。完整的議程如表二。

5/2 上午，研討會正式開始，開場儀式介紹了多位與會的傑出專家學者，接著有研討會主席、主辦單位的代表教授、美里城市長的致詞，頒發的 2017-2018 IBA fellow (院士)得獎人。研討會正式開始前，有一場 Industrial Forum (工業論壇)，由馬來西亞的幾位教授、政府代表、研發投資代表進行一場座談會。

5/2 下午開始第一場海報論文展示(poster session 1)，我們有兩張海報**(Poster ID: E-01 及 Poster ID: I-04)** 在此場展出。大會手冊沒有提供海報展示的資料，僅 e-mail 海報編號 PDF 檔給與會者，詳細清單，如**附件 1**。緊接著，舉行第一場主題演講 (keynote session 1)及口頭報告(Parallel/oral session 1)。本次研討會共有五場口頭報告，詳細的報告題目如**附件 2**。每場口頭報告均有四個研究主題類別，同時在四個會議廳進行(parallelly)，因此，只能挑選感興趣的主題參加。

5/3 上午，有第二場主題演講 (keynote session 2)及第二場口頭報告(Parallel/oral session 2)。

5/3 下午，沒有主題演講，由第二場海報展示(poster session 2)及第三場口頭報告(Parallel/oral session 3)開始。我們的另一張海報(**Poster ID: B-07)**在此場展出。緊接著是第四場口頭報告(Parallel/oral session 4)，之後為研討會晚宴(Gala dinner)。

5/4 早上，進行第三場主題演講 (keynote session 3)及最後一場口頭報告(Parallel/oral session 5)。之後便是閉幕典禮，除了頒發優秀口頭報告、海報論文得獎人外，還宣布2021年的研討會在韓國首爾舉行。研討會在中餐後，下午完整結束。

5/5 早上，原本有安排參訪活動，但大會表示參與的人數不踴躍，因此取消。只提供當地的旅行社聯繫資料，供參加會議的人自行聯繫，參加當地的旅遊導覽。

表二、研討會議程表

Wednesday, 1 May 2019		Venue
10.00 am	Technical Writing Workshop	Curtin University
2.00 pm	Registration	Imperial Hotel

Thursday, 2 May 2019		Venue
8.00 am	Registration	Level 5
8.30 am	Opening ceremony • Arrival of Distinguished Guests • Safety Briefing • Doa recitation • Welcoming remarks by Conference Chair • Speech by Conference Patron • Speech by Conference International Coordinator • Officiating Ceremony by Mayor of Miri • Mock cheque presentation • IBA Awards Function • Group photo	Ballroom 1
10.30 am	Morning Break	Foyer
11.00 am	Industrial Forum: Bridging Sustainability and Industrial Revolution through Green Technology	Ballroom 1
12.30 pm	Lunch	Ballroom 2
1.00 pm	Poster Session I	Ballroom 1
2.00 pm	**Keynote Session I** **Prof Dr Duu-Jong Lee** ***Use of Forward Osmosis Membrane in Industrial Applications*** **Prof Dato Ir Dr Wan Ramli Wan Daud** ***Microbial Electrochemical Technology: Green Bioelectricity Generation, Wastewater Remediation, Hydrogen Production, Desalination and CO^2 Utilisation***	Ballroom 1
3.00 pm	Afternoon Break	Foyer
3.30 pm	Parallel/Oral Session I	Level 5
5.00 pm	End of Day 1	

Friday, 3 May 2019		Venue
7.30 am	Registration	Level 5
8.30 am	**Keynote Session II** **Prof Dr Huu Hao Ngo** ***Progresses and Challenges of Algae-based Material for Wastewater Treatment*** **Prof Dato Ir Dr Abdul Wahab Mohammad** ***Biorefineries for Sustainable Economic and Environmental Development in Malaysia*** **Dr Doan Pham Minh** ***From Municipal Solid Wastes to Green Hydrogen Production: Case Study of VABHYOGAZ3 Project***	Ballroom 1
10.00 am	Morning Break	Foyer

續上表。

10.30 am	Parallel Session II	Level 5
12.00 pm	Lunch	Ballroom 2
2.00 pm	Poster session II Parallel session III	Ballroom 1 Level 5
3.30 pm	Afternoon Break	Foyer
4.00 pm	Parallel Session IV	Level 5
6.30 pm	Gala Dinner	Ballroom 2
8.00 pm	End of Day 2	

Saturday, 4 May 2019

		Venue
7.30 am	Registration	Level 5
8.00 am	**Keynote Session III** **Prof Raj Boopathy** ***Carbon Ecology of Termite Gut Microbes and Biodegradation of High Concentration of Phenol*** **Prof Taufiq Yap Yun Hin** ***Catalysis, Green Chemistry & Sustainability: Challenges & Opportunities*** **Prof Christian Larroche** ***Biohydrogen Production by Dark Fermentation: Impact of Spatial Heterogeneities and Modelling of an Anaerobic Bioreactor***	Ballroom 1
9.30 am	Morning Break	Foyer
10.00 am	Parallel Session V	Level 5
12.00 pm	Closing Ceremony • Arrival of Delegates • Arrival of Distinguished Guests • Closing Speech by Pro Vice-Chancellor and Chief Executive, Curtin University Malaysia • Awards Presentation • Lucky Draw • Appreciation Remarks by IBA • Closing Montage • Photo opportunities	Ballroom 1
1.00 pm	Lunch	Ballroom 2
2.00 pm	End of conference	

Sunday, 5 May 2019

9.00 am	Explore Miri* **Please refer page 31 for more information*

Opening Ceremony (開場儀式):

5/2 研討會正式開始，早上的歡迎會很有馬來西亞風格，有原住民式的開場及頒發 2017-2018 (IBA) fellow，頒給每個獲獎人時也披上傳統披巾(如，圖一)。

圖一、(左) 原住民的吹箭儀式象徵研討會開始。(右) fellow 得獎人也授贈金色披巾。

此外，開場儀式還有穿著傳統服飾的工作人員，充分展現馬來西亞的多元種族及文化特色，以及東馬特有鳥類“犀鳥”的布偶也出現，添加了在地特色及輕鬆的氣氛(圖二)。


圖二、(左)穿著馬來西亞的傳統服飾的工作人員。(右) 「犀鳥」布偶

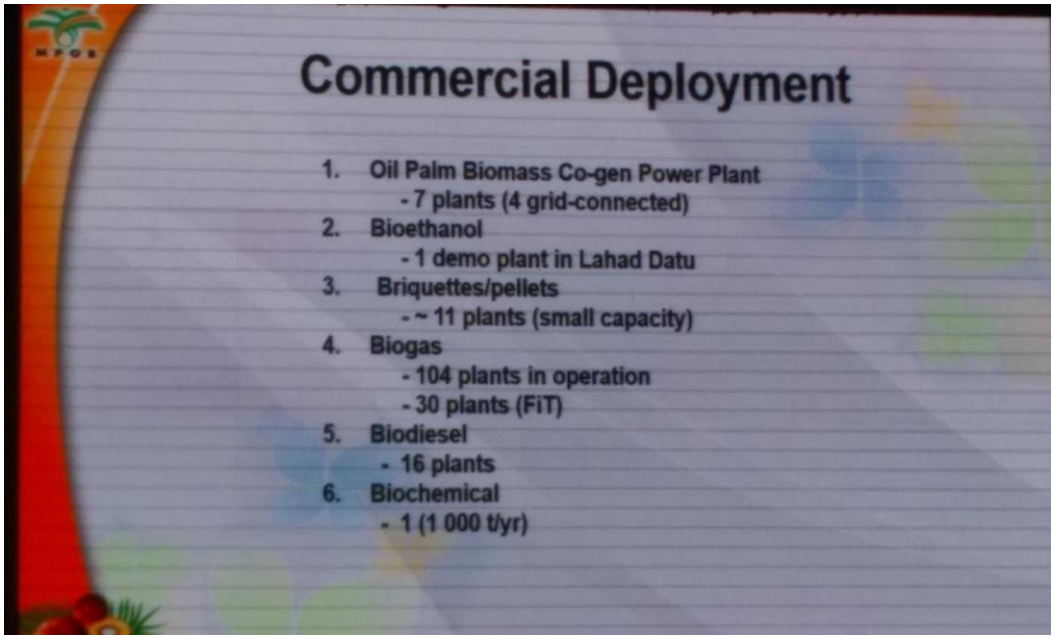
未來若我們有機會舉辦類似國際性研討會，可以參考如何有組織又不失活潑的籌劃活動。

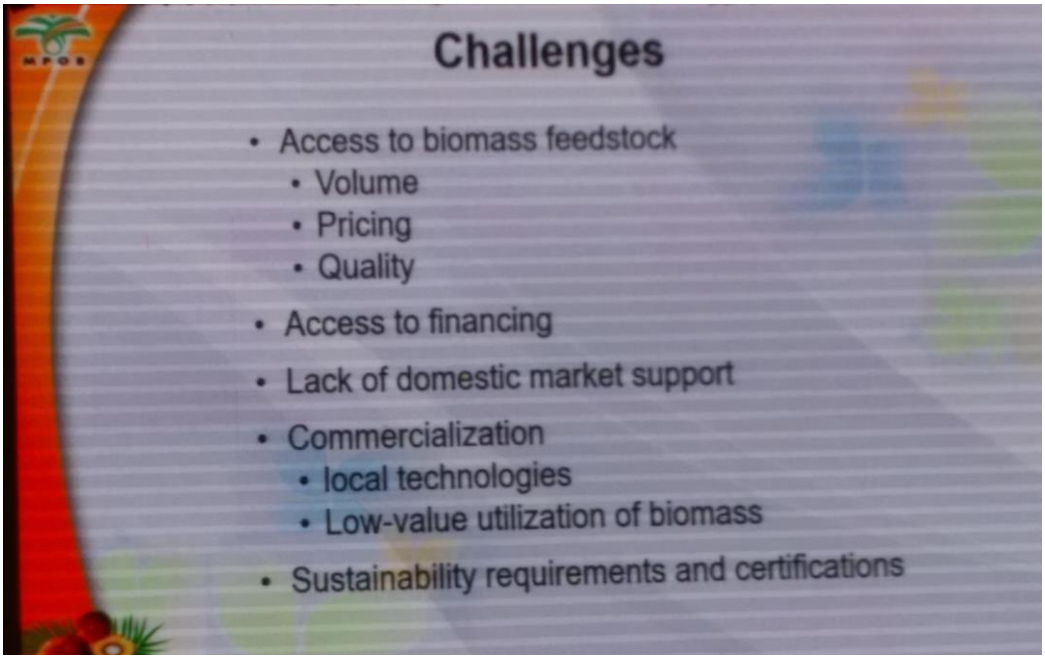
Industrial Forum(論壇)：

「Bridging sustainability and industrial revolution through green technology」

主要聚焦在棕櫚油(palm oil)的產業，例如，因為伐木及影響動物棲地等問題，歐盟計劃禁止從馬來西亞進口 palm oil,，若真的將 palm oil 從 renewable energy 名單上除名，將影響整個 palm oil 產業，所以，除了要積極種樹、翻種之外，也要推出大馬永續棕油認證(MSPO)，證明 palm oil 生產是可永續經營的。此外，palm oil 產生其他廢棄 biomass，也要開發其它利用，例如發電、生質酒精、pellets、

biogas、biodiesel、biochemical 等。但過程中也遇到挑戰，如 palm biomass 體積、價格、品質、資金來源、市場支持、商業化、利用價值低等。另外，大量生產 palm oil 也引發爭糧問題的討論，Dr Kheang 表示只有 5%的 palm oil 被用作燃料，其餘 95%都是作為食品。





↑ Dr Loh Soh Kheang (馬來西亞棕櫚油委員會 MPOB 能源暨環境單元的負責人)的簡報節錄。上圖:馬來西亞目前運行的棕櫚樹生質電廠 7 座、生質酒精 1 示範場 1 座、生質燃料棒 11 座(小型)、生質氣體 100 多座。下圖：面臨的挑戰有體積、價格、品質等。另外，缺少資金、沒有市場支撐，商業化面臨地區的科技化、低價應用等。

3. 具體成效

從主題演講、口頭報告、海報論文等各個 sessions，摘要幾場重要、有趣的主題

3.1 主題演講 (Keynote speech)

(1)

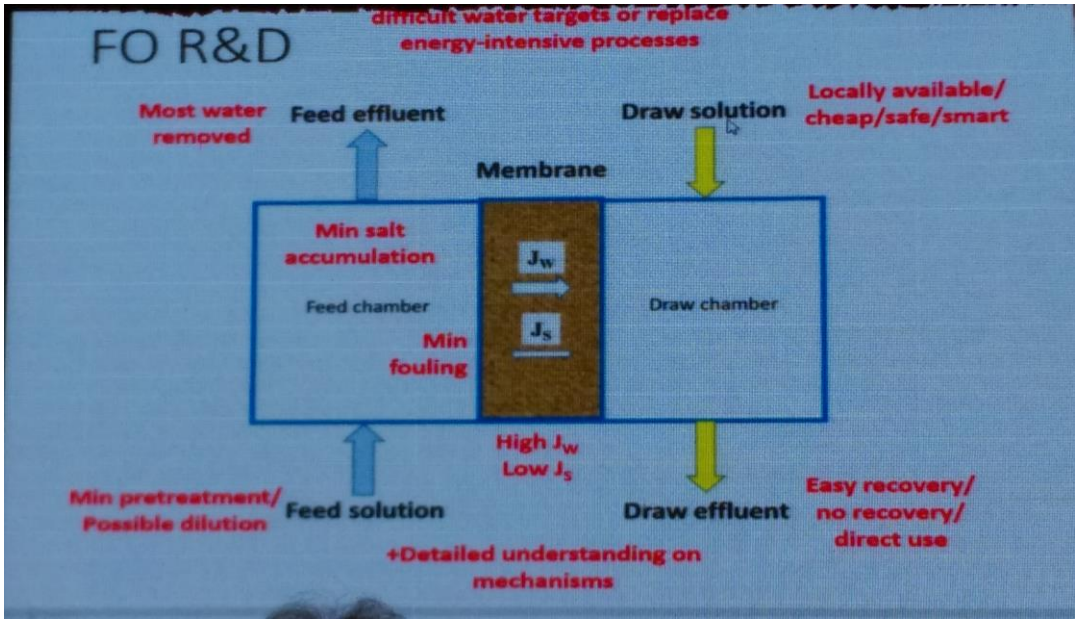
主題：Use of Forward Osmosis Membrane in Industrial Applications

(正滲透膜在工業上的應用)

講者：Prof. Duu-Jong Lee

(李篤中教授，台大化工系)

摘要：正滲透程序(Forward osmosis, FO)是利用draw solution與feed solution上的差異在半透膜之間產生滲透壓造成抽水現象。標的物可以是在draw邊、feed邊或在膜上。各種工業上的應用將以文獻資料基礎加以討論。



(2)

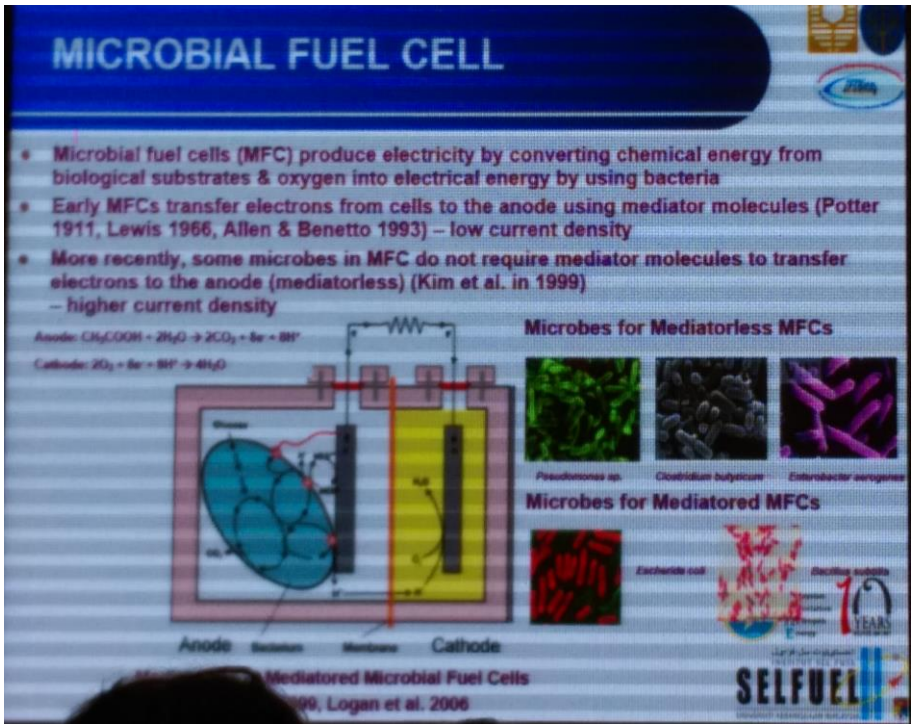
主題：Green Bioelectricity Generation, Wastewater Remediation, Hydrogen Production, Desalination and CO_2 Utilization

(綠電生產、汙水整治、產氫、去鹽化、CO_2 利用)

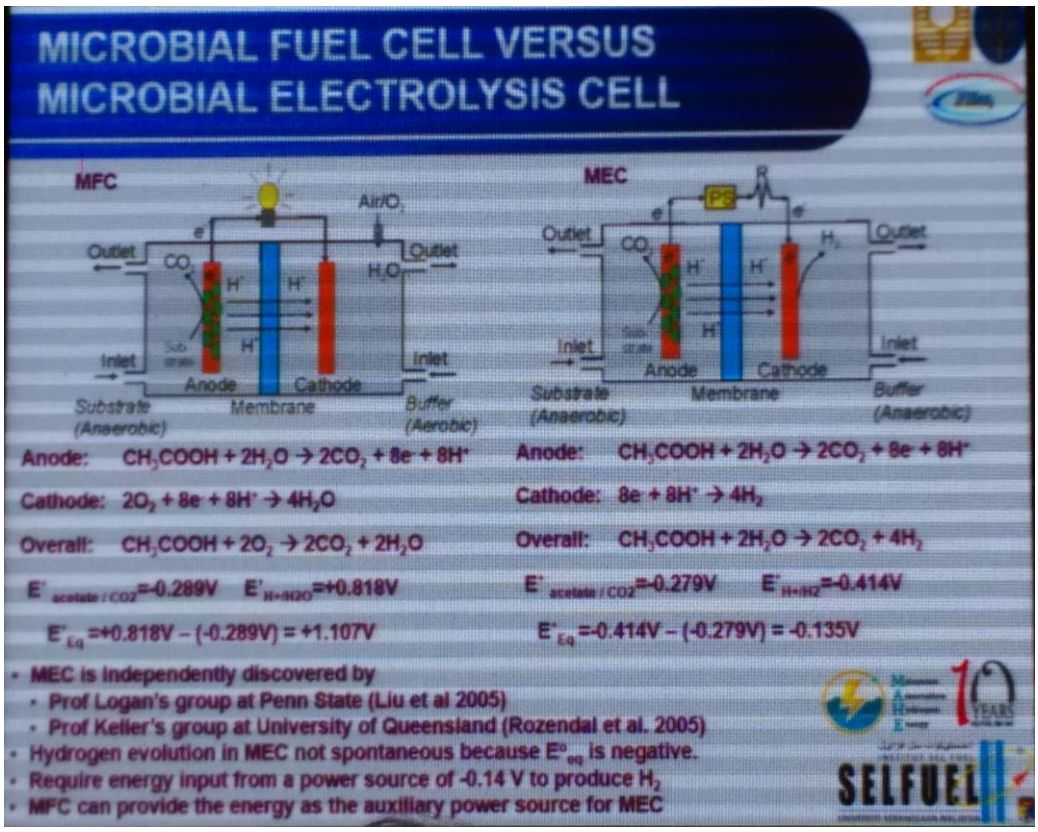
講者：Prof. Dato Ir. Dr. Wan Ramli Wan Daud Fasc

(Universiti Kebangsaan Malaysia)

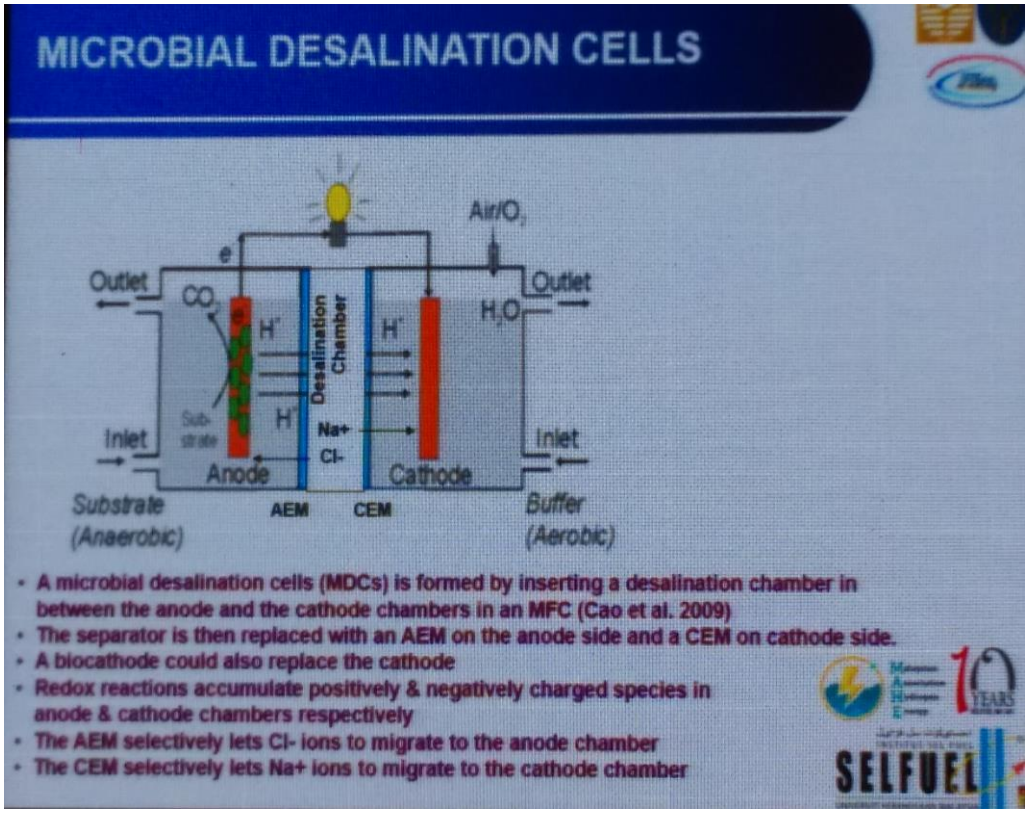
摘要：到 2040 年全球的能源需求將由 2015 年 393EJ 提高到 503EJ，其中高達 91%來自於非再生性的石化燃料。隱含的問題有油價的攀升、溫室氣體排放、石油耗竭等。科學家目前聚焦在發展更乾淨、可再生的能源，如太陽能、水力發電、生質能、風能等，但每種均有其挑戰，如太陽能板昂貴、水力發電造成棲地破壞、生質能引起作物競爭、風能及太陽能受天氣不穩定影響等。為了減少石化燃料依賴及減少碳足跡，綠色能源技術，如 microbial electrochemical technoloy (MET，微生物電化學技術)近年來引起注意，它可用來產生電力、汙水整治、產氫氣、鹹水去鹽化、CO_2 再利用等。MET 可概要分成幾類，如 microbial fuel cell (MFC)產生物電力及生物電化學的汙水整治；microbial electrolysis cell (MEC) 電解產氫氣；microbial desalination cell (MDC)將海水、鹹水湖去鹽；solar microbial fuel cell/biophotovoltaic cell (SMFC/BPVC) 進行 CO_2 再利用及產電、氫。關於各種 MET 的商業化挑戰及提高其產量、效率以及永續性等將一一討論探討。



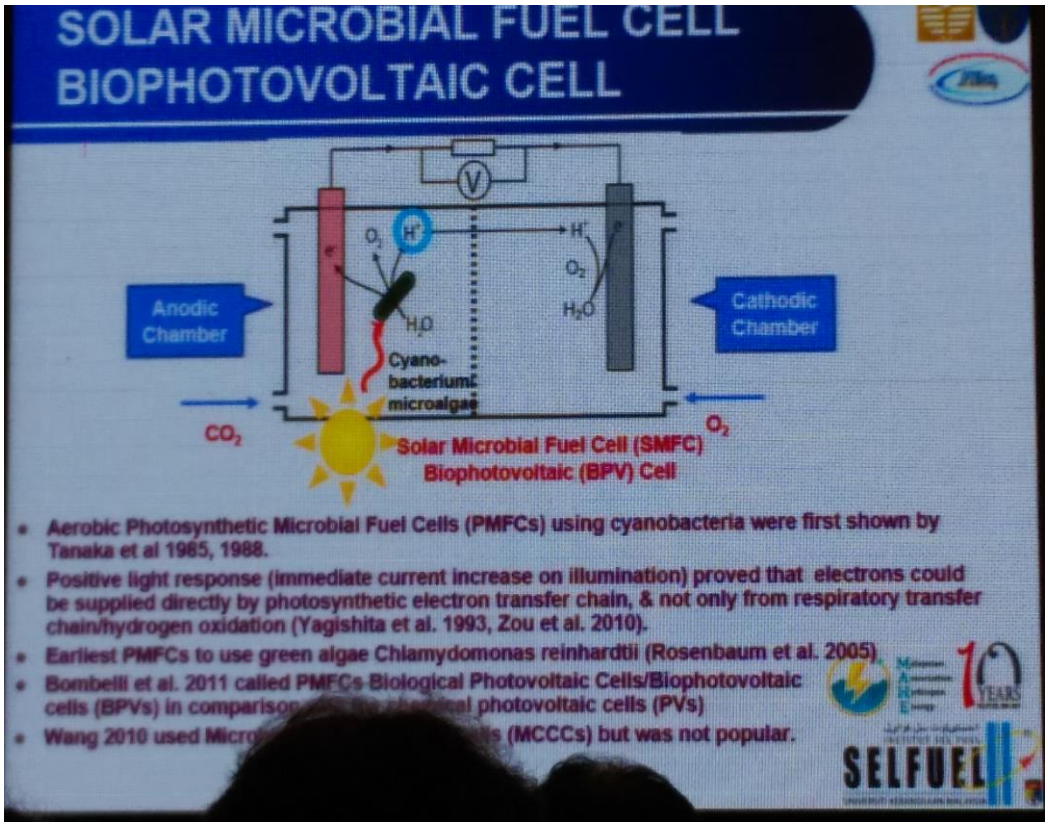
↑microbial fuel cell (MFC)，微生物燃料電池



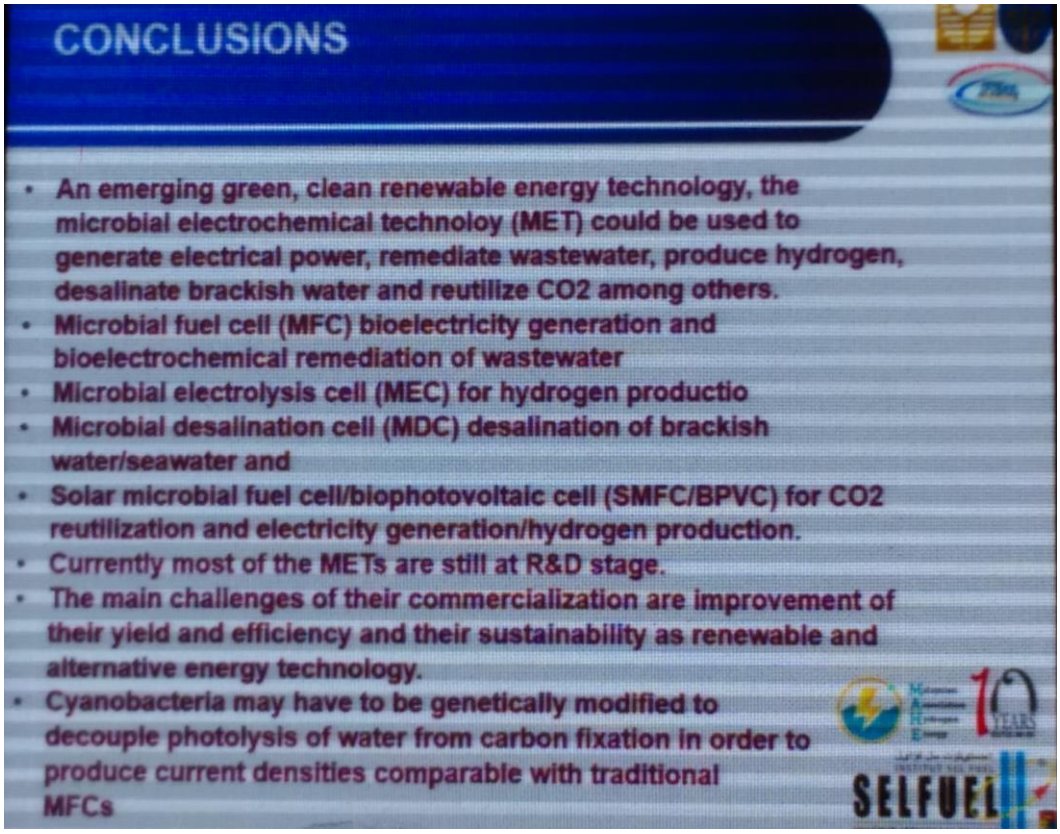
↑MFC 與 microbial electrolysis cell (MEC)微生物電解電池。



↑microbial desalination cell (MDC)微生物去鹽電池。



↑solar microbial fuel cell/biophotovoltaic cell (SMFC/BPVC)太陽能微生物燃料電池/生物光伏電池



↑總結

(3)

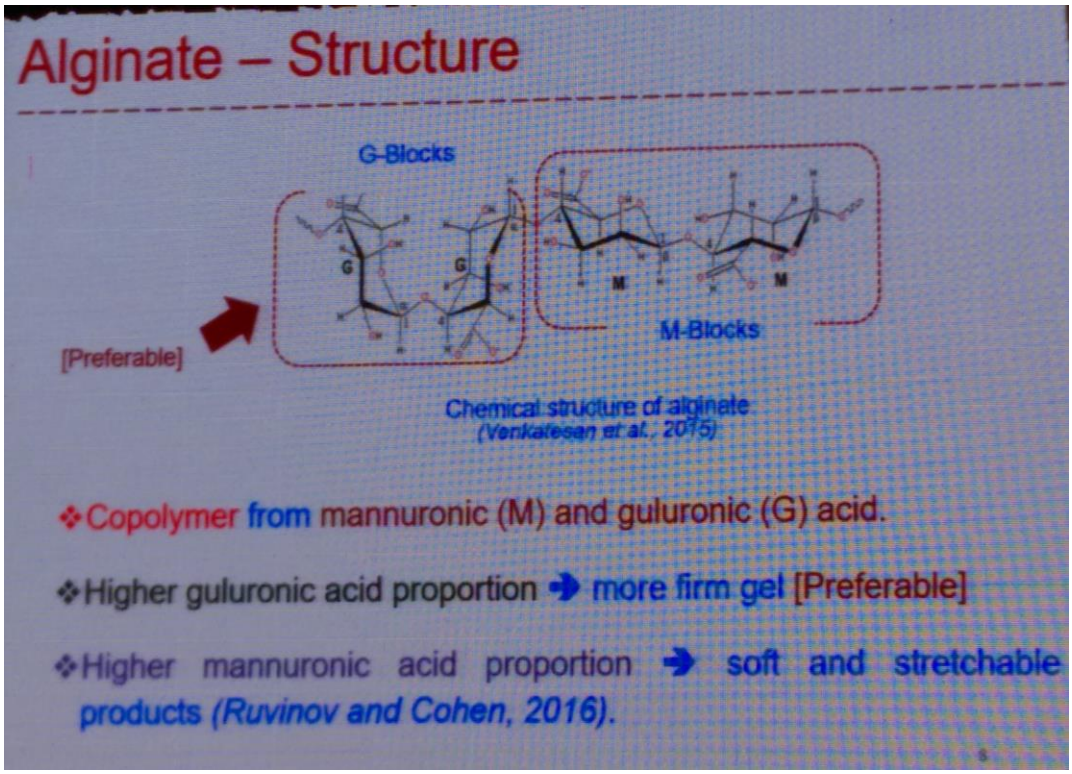
主題：Progresses and challenges of algae-based material for wastewater treatment

(藻類材料於汙水整治的進展及挑戰)

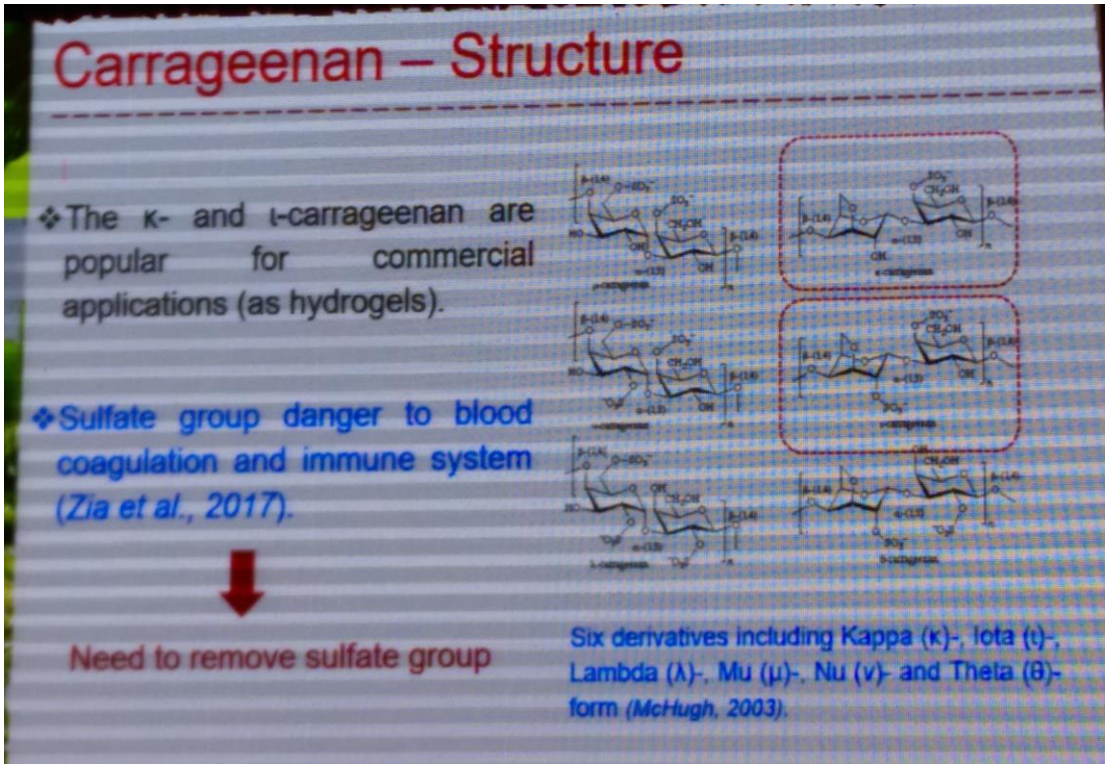
講者：Prof. Huu Hao NGO

(University of Technology Sydney, Australia)

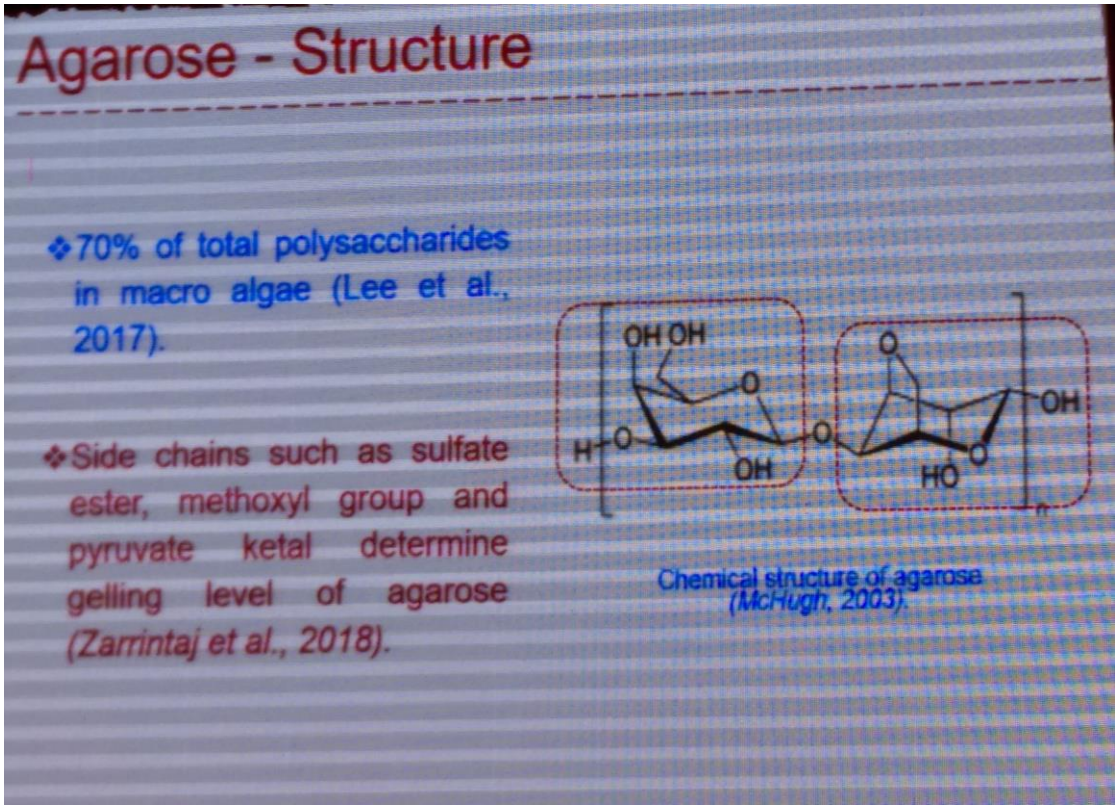
摘要：藻類材料(Algae-based material，ABM) 對於廢水處理相當有效。高級的藻類萃出物對於汙染物的移除比活的藻類有效果，ABM 具有高吸附能力、速度快、高度的機械及熱穩定性、能被生物分解具再利用性。常見的 ABM 有 chitosan (幾丁聚醣、甲殼素)、alginate (海藻酸)、carrageenan (卡拉膠、鹿角菜膠) 、agarose (瓊脂糖、洋菜糖) 及其改質物如 hydrogel(水凝膠)等。過去幾年被積極的研究，但其萃取、改質與應用面臨一些限制。其中，Chemical crosslinking (化學膠黏)是最常見的改質方法，影響 ABM 的交聯、強度及汙染物的吸附效能。當與無機物融和時(過去常用的如 sodium humate 腐植酸鈉、黏土等)，二氧化鈦 TiO_2 是另種偏好選擇，因為它的靜電作用(electrostatic interactions)是一個重要機制。再生性及重複使用性，將是評估 ABM 未來的應用是否具經濟效益、能否商業化最重要的準則。



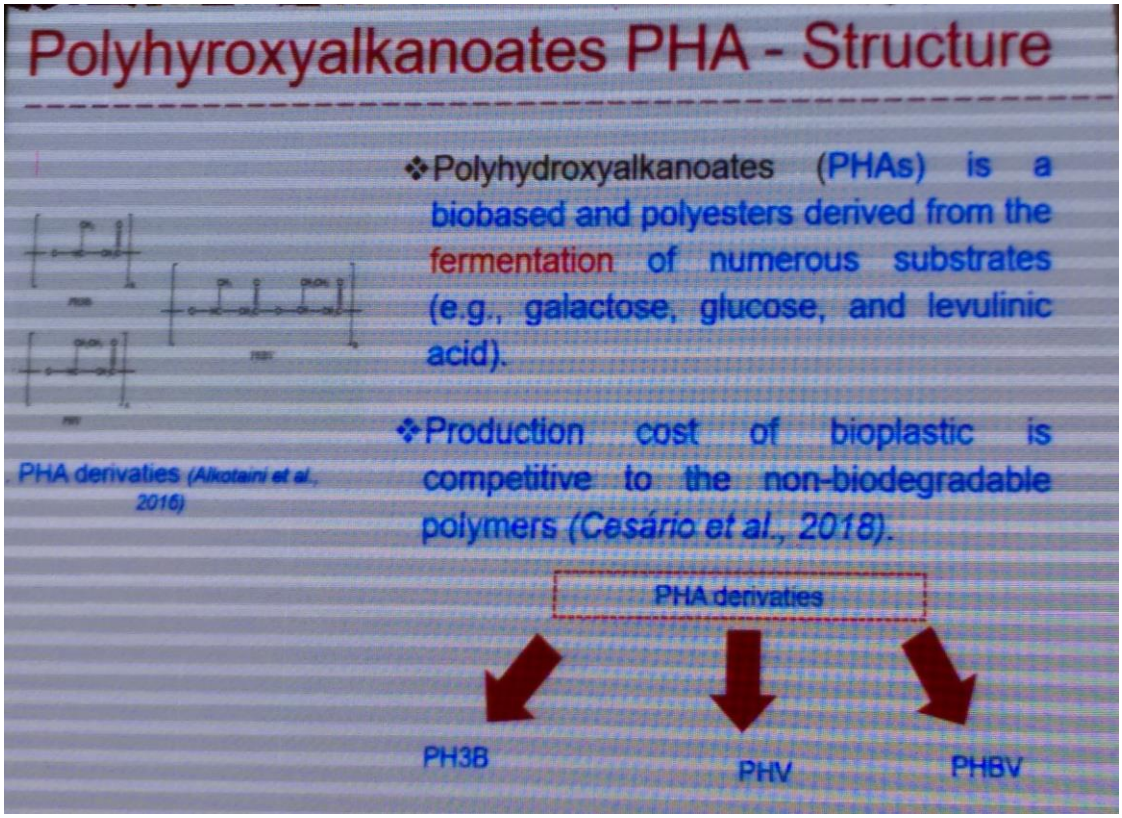
↑由 mannuronic acid (甘露糖醛酸)及 guluronic acid (古洛糖醛酸)具合而成。若 guluronic acid 多則成硬膠，反之 mannuronic acid 多則較軟、延展性較佳。



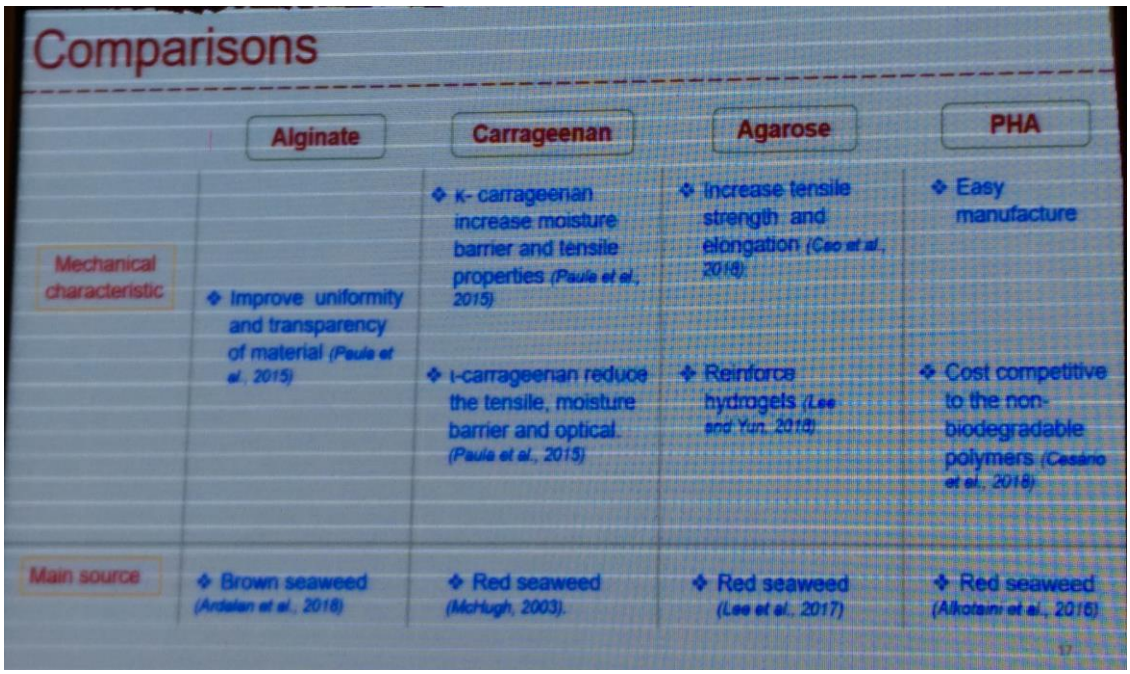
↑carrageenan (卡拉膠、鹿角菜膠)含有硫有造成血液凝結及免疫問題，須移除。



↑硫酯鍵、甲基、丙酮酸基等，影響 agarose(瓊脂糖、洋菜糖)的凝膠程度。



🡅生物來源的 PHA（從半乳糖、葡萄糖、戊酮酸發酵衍生物聚合而成）作為塑膠原料，生產成本具競爭性。



🡅每種藻類材料具其特色及優缺點。

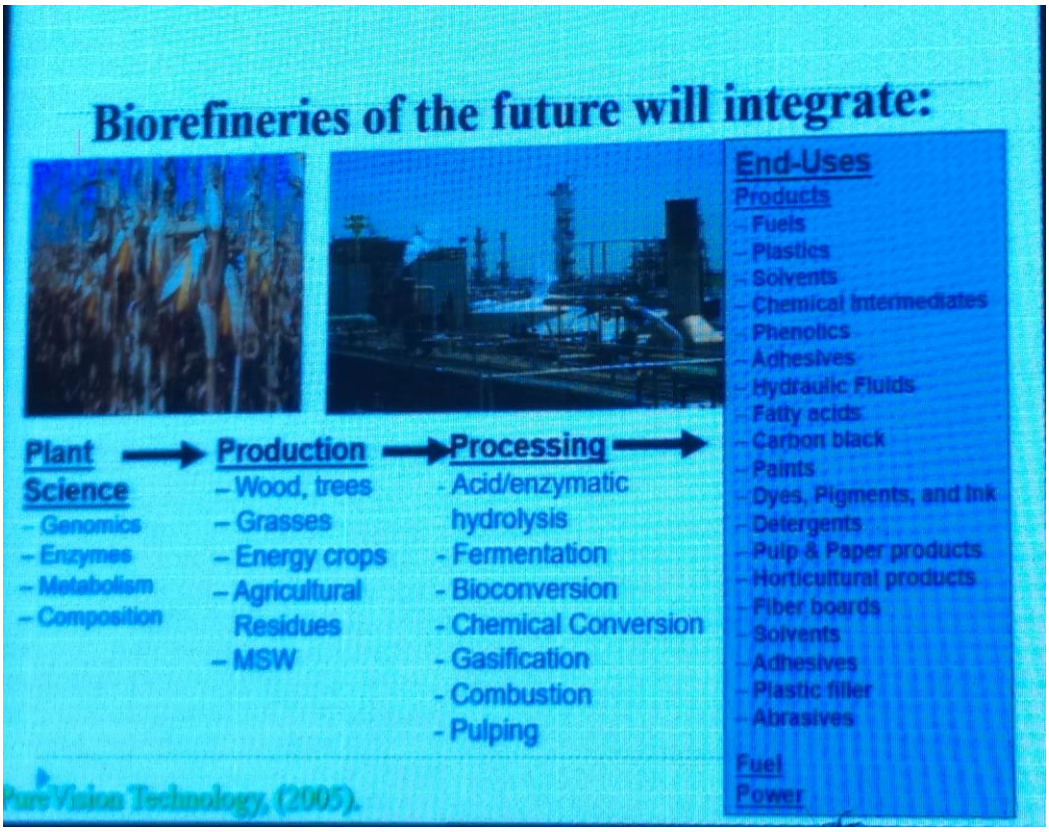
(4)

主題：Biorefineries for Sustainable Economic and Environmental Development in Malaysia

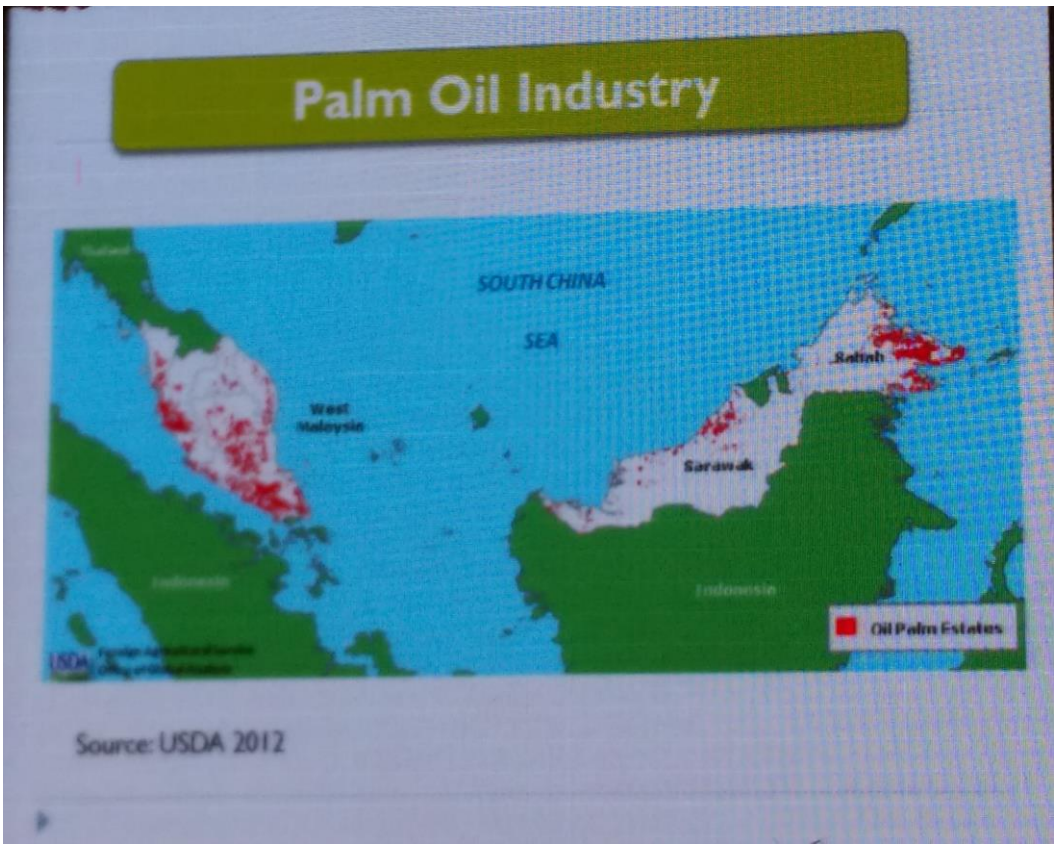
(馬來西亞生物精煉之永續經濟及環境發展)

講者：Prof. Dato Ir. Dr. Abdul Wahab Mohammad (Universiti Kebangsaan Malaysia)

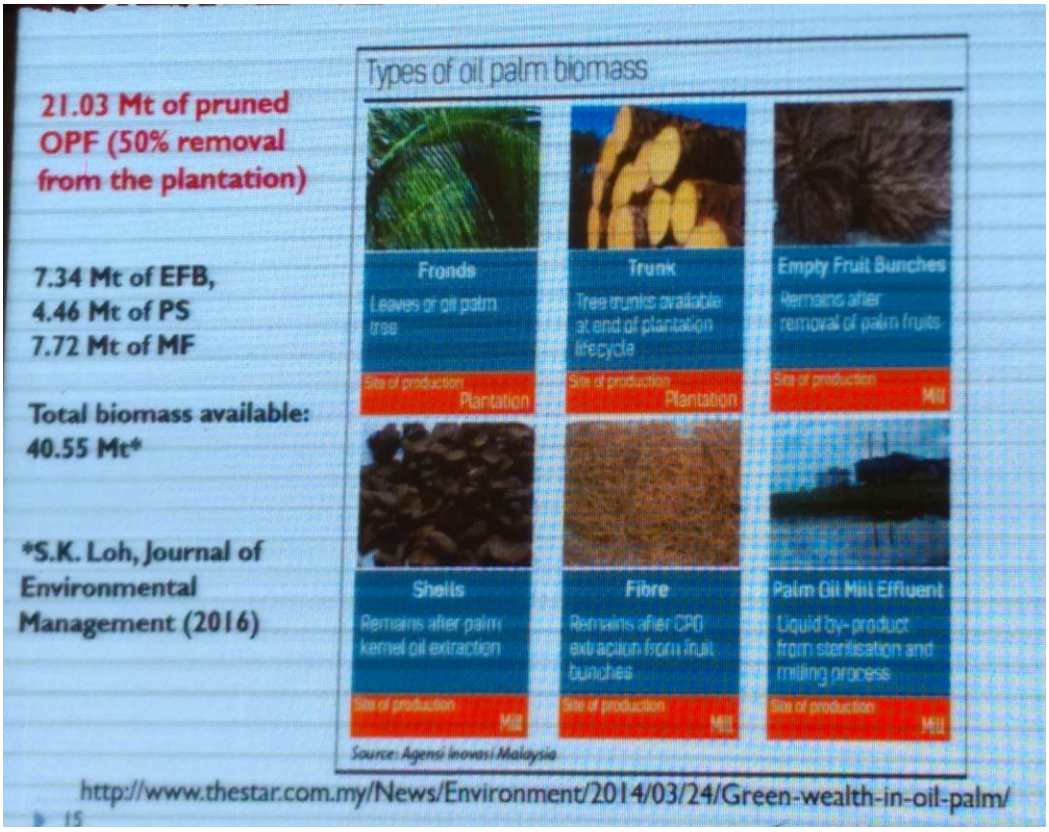
摘要：生物精煉(Biorefinery)是一個多功能整合型工廠，利用多元生質素材為原料永續地生產各種中間產物、終產物，如化學品、材料、生質燃料等。馬來西亞擁有豐富的生質材料來自棕櫚樹、稻米、sago(西殼椰子)等，具有巨大的潛力發展生物精煉並促進經濟成長，達到永續經營的目標。大部分的生質素材是屬於木質纖維(lignocellulosic biomass，LCB)，由纖維素、半纖維素及木質素所組成。LCB 是有前景的料源，因為它低價、量大、低環境衝擊。從 LCB 提煉出化學品能增加地方工作機會、刺激地方經濟發展。馬來西亞國家生質料源策略(Malaysian National Biomass Strategy，NBS)已經知道將 LCB 轉換成糖及其他高價物的生化、熱化學方法，有助於馬來西亞進入精緻化學品之高值產業。以兩種素材(1)棕櫚葉(oil palm fronds)或乾果束(empty fruit bunch)，(2) 棕櫚煉油廢水(palm oil mill effluent (POME)為例，探討生物精煉的執行概念。



↑生物精煉(Biorefinery)是一個多功能、整合型工廠的概念。



↑馬來西亞 (西邊的島為西馬，東邊的島為東馬)的棕櫚油產業分佈。



↑棕櫚料源如葉子(fronds)、樹幹(trunk)、乾果串(empty fruit bunches)、殼、纖維等。

↑五年 630 萬馬幣的研究計畫，希望產出多位生質精練專家及高影響力的著作。以棕櫚樹為主要生質料源的精煉藍圖。

↑以 Universiti Kebangsaan Malaysia 為例，有教授專研利用棕櫚葉生產 succinic acid(琥珀酸)，而另一位教授專研開發純化回收琥珀酸的製程。

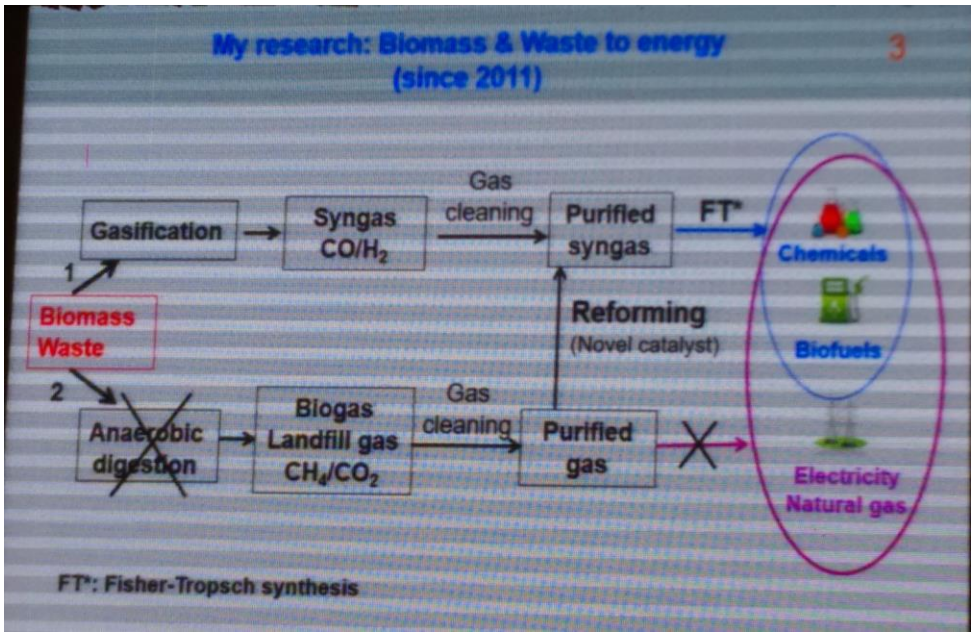
(5)

主題：From Municipal Solid Wastes to Green Hydrogen Production Case Study of VABHYOGAZ3 Project

(從城市固態廢料到氫氣生產，VABHYOGAZ3 計畫案例探討)

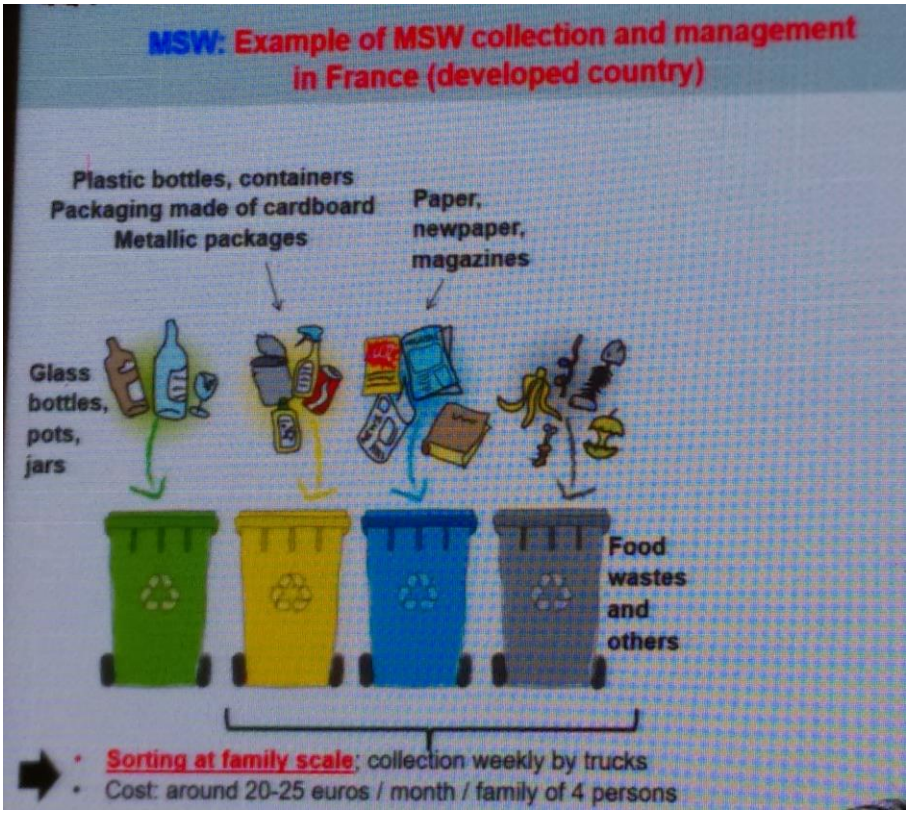
講者：Prof. Doan Pham Minh (Université de Toulouse, France)

摘要：城市固態廢棄物(Municipal Solid Wastes，MSW)通常是焚化或是掩埋處理。焚化有快速、明顯降低廢棄物體積及較少土地使用量，但需要較大的投資、煙氣及設備維護的費用也較高，相對的掩埋法較不昂貴。然而，廢棄物的分解動態較慢且通常需要大面積的土地。一般而言，發展中國家多採用掩埋，但已發展國家是兩者兼具。例如，法國 70%的 MSW 是燃燒，30%是掩埋。掩埋會將 MSW 慢慢產生 biogas(又稱掩埋氣體)，主要是甲烷、CO_2 跟一些氮氣、氧氣及多種汙染物如 H_2S、SO_2、輕的碳氫化合物、矽氧烷等。目前，在歐洲掩埋場需要回收甲烷、二氧化碳(兩個最主要的溫室氣體)。掩埋氣體在去除 CO_2 後純化達到天然氣標準後，會進入天然氣供應系統。現在學術界、工業界聚焦在將掩埋氣體進行高價利用，如產氫氣作為運輸用途，這就是目前在法國推動的 VABHYOGAZ3 計畫，將發展一套完整的轉化掩埋氣體為氫氣的程序，包括很多不同步驟:掩埋氣重組、水氣轉換、PSA(Pressure swing adsorption)分離、氫氣液化、運輸傳遞。目前這技術已能被財團商轉。

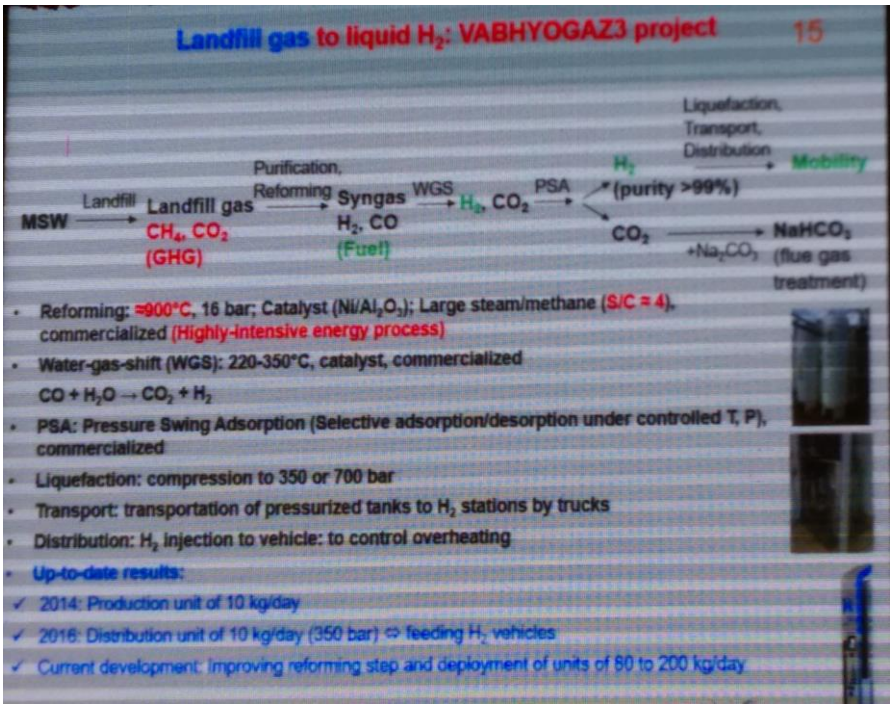


↑Dr. Doan Pham Minh 的研究聚焦在將生質廢料加以氣化產稱合成氣，在利用費托合成（Fischer–Tropsch process）技術轉化成化學品、燃料。

↑開發中國家(以越南為例)，家庭沒有分類習慣，主要是掩埋，少數焚化。在鄉村不掩埋，甚至直接就地燃燒。



↑已開發國家(以法國為例)，有垃圾分類，垃圾車也定期載運。



↑VABHYOGAZ3 計畫，由 2014 只產 10kg 氫氣/day，2016 年應用到汽車，目前改良重組步驟並發展能量產 80-200kg/day。

(6)

主題：Carbon Ecology of Termite Gut Microbes and Biodegradation of High Concentration of Phenol

(白蟻腸道微生物之碳生態及高濃度酚的生物分解)

講者：Prof. Raj Boopathy (Nicholls State University, Louisiana, USA)

摘要：白蟻後腸原生動物(protozoa)靠白蟻吃進的樹木木質纖維維生，此外，白蟻也有許多細菌維持生態，例如固氮(nitrogen fixation)、產乙酸(acetogenesis)、除氧(oxygen scavenging)等，替原生動物維持缺氧狀態(anoxic conditions)。利用宏基因體學(Metagenomics)及轉錄體學(transcriptomics)已經能成功分析白蟻腸道的生態群，但對於碳利用生態及攝取效益仍不清楚。本研究利用路易斯安那地區的三種硬木:oak (*Quercus* spp.)、red maple (*Acer rubrum*)、tupelo (*Nyssa aquatica*)對於白蟻(*Reticulitermes flavipes)* 攝取效益進行了解。將白蟻腹部漿液塗在分別含有醋酸、纖維二糖(cellobiose)、酚進行有氧、無氧培養。結果發現 cellobiose 有最高的微生物生長。特別是從吃 oak 樹的白蟻腹部漿液，觀察到最高的微生物生長。無氧、有氧沒有多大差異。從酚為碳源生長的微生物中分離出一株菌*(Acinetobacter tandoii)*，能分解高達 600mg/L 的酚。

3.2 口頭報告 (Oral session)

(1)

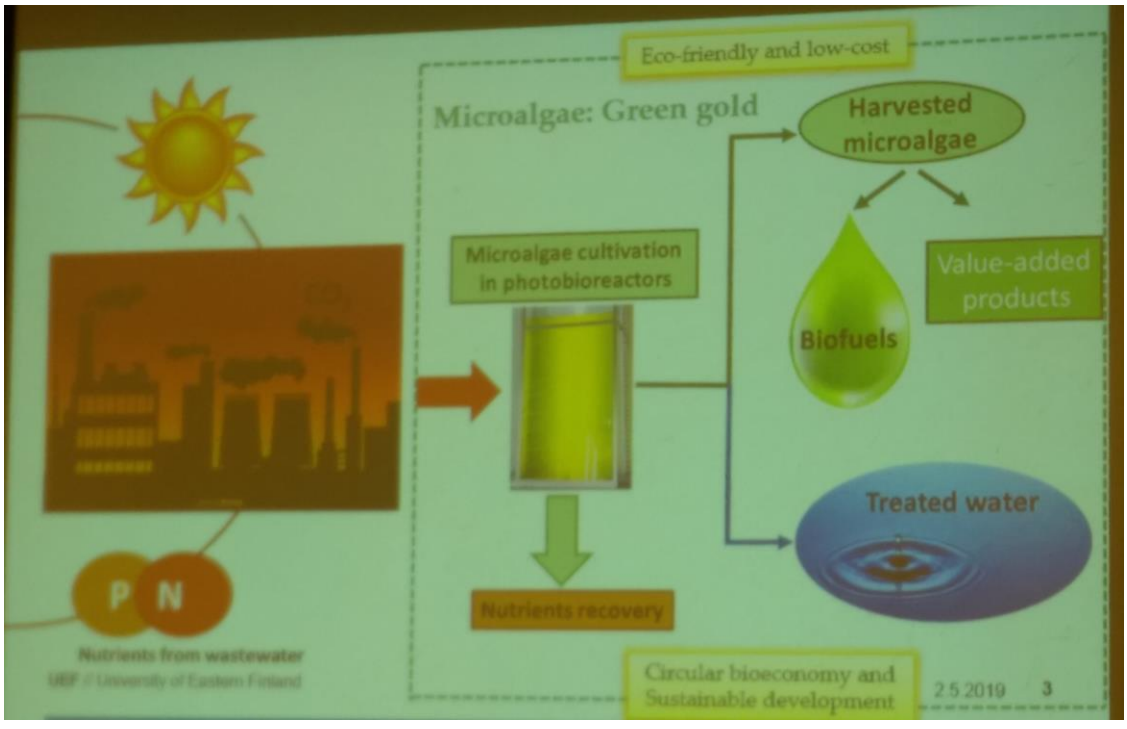
主題：Microalgae for wastewater treatment and value-added products generation: A synergistic approach

(一個利用微藻進行廢水處理及高價物生產的協同方法)

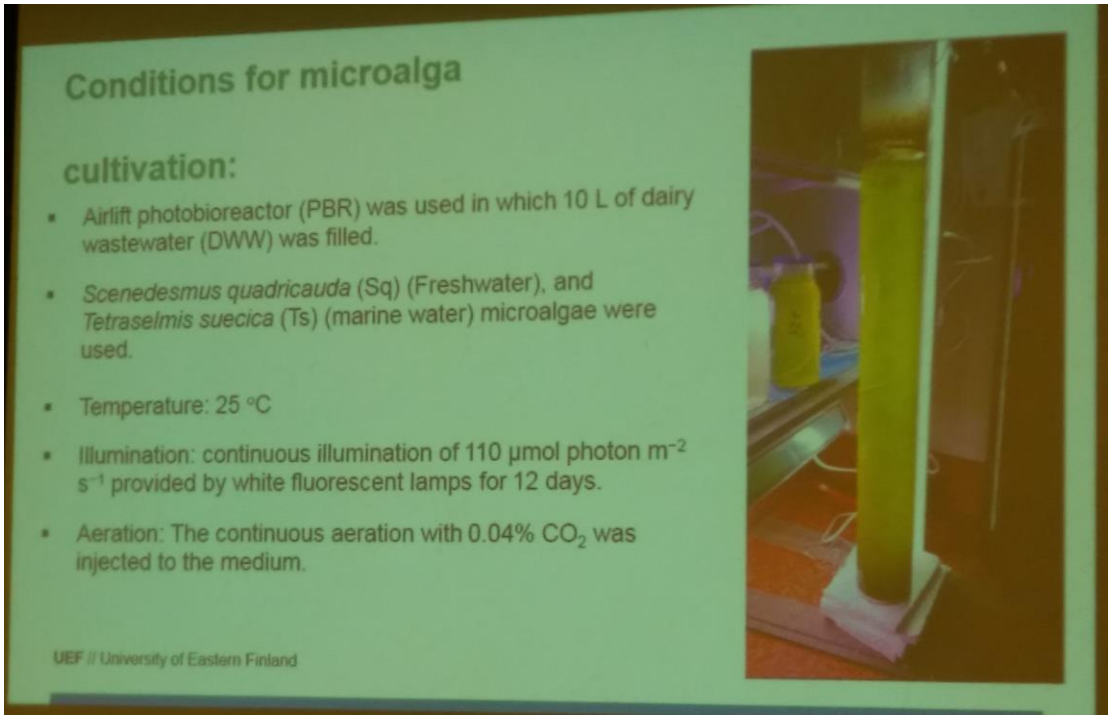
講者：Prof. Amit Bhatnagar

(Department of Environmental and Biological Sciences , Finland)

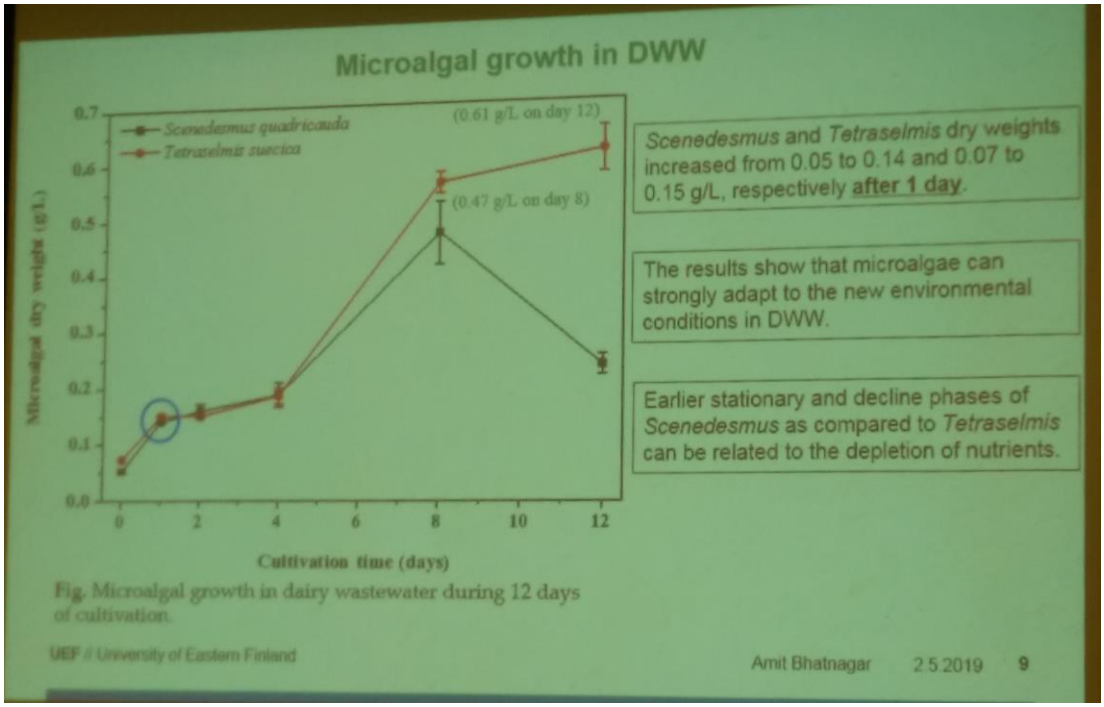
摘要：微藻能針對全球的兩大挑戰：有效廢水處理及供應新能源，提供一種巧妙且協同的解決之道。利用淡水(*Scenedesmus quadricauda, Sq*) ，海水(*Tetraselmis suecica, Ts*) 微藻處理日常廢水(dairy wastewater，DWW) 。發現 Sq 與 Ts 分別在 DWW 中培養在第8及12天有最大的生長率，且能移除 DWW 中64-86%及40-45%之多種汙染物（如氮，磷，有機碳等）。分析微藻中的脂肪酸甲酯(FAME)發現 C16 及 C18是最主要的脂肪酸，是常見的生質柴油原料。萃取油脂後的藻類餘物還可以用來處理水中的新興物染物。關於處理後的廢水再利用，對藻類進行第二次培養。第二次培養的效率更佳，移除 DWW 中目標汙染物的效率更好。第一次培養與第二次培養的最明顯不同的是飽和脂肪酸與多元不飽和脂肪酸的組成。



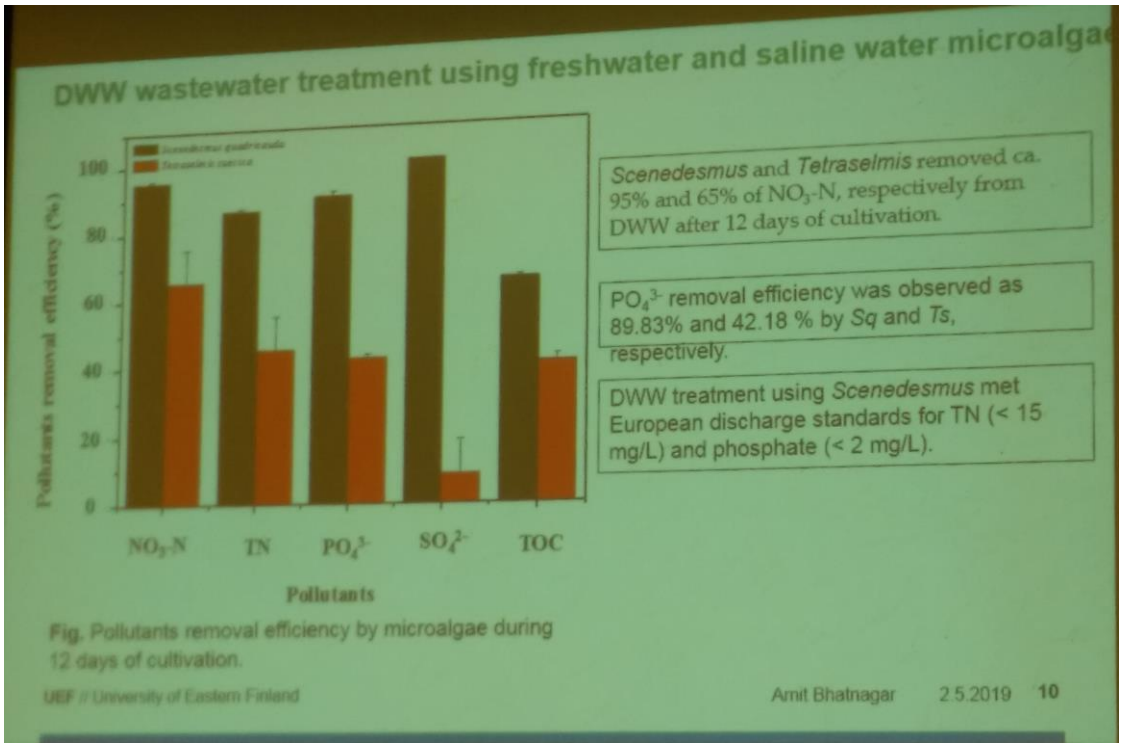
↑微藻綠金:利用微藻同時處理汙水又能取得生質燃料。



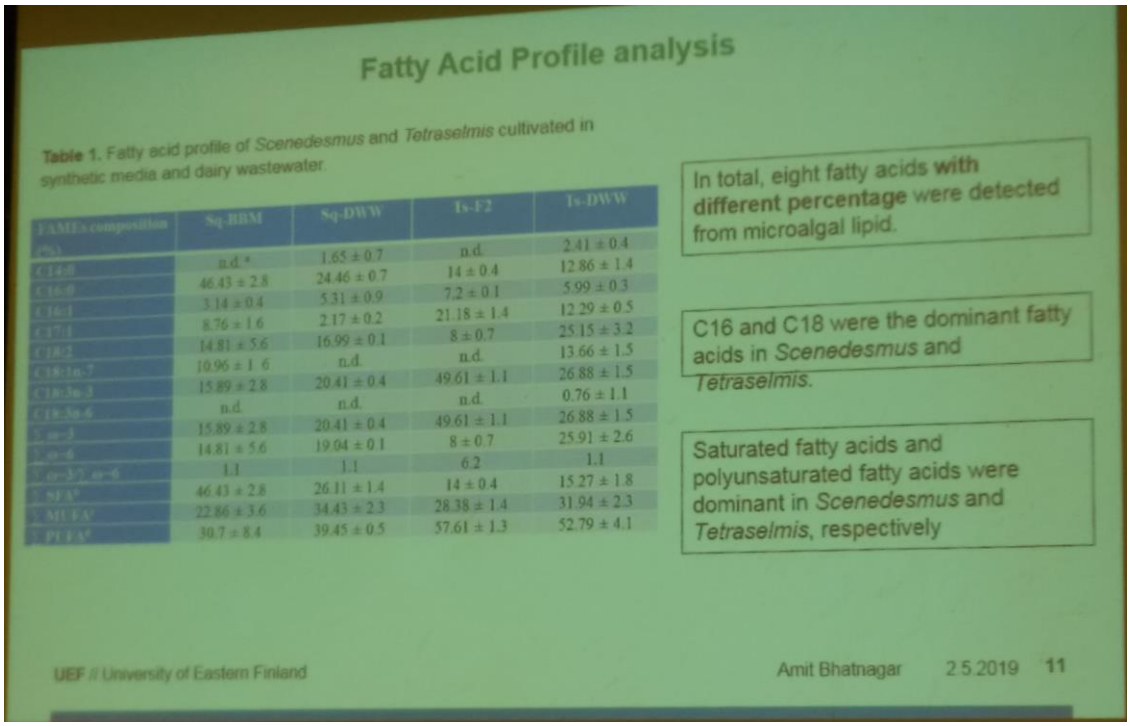
↑培養微藻的條件:用直立式光反應器(~10L 的 DWW)，溫度 25℃，照明 110umol/m^2/s，天數 12 天，並通 0.04%二氧化碳。



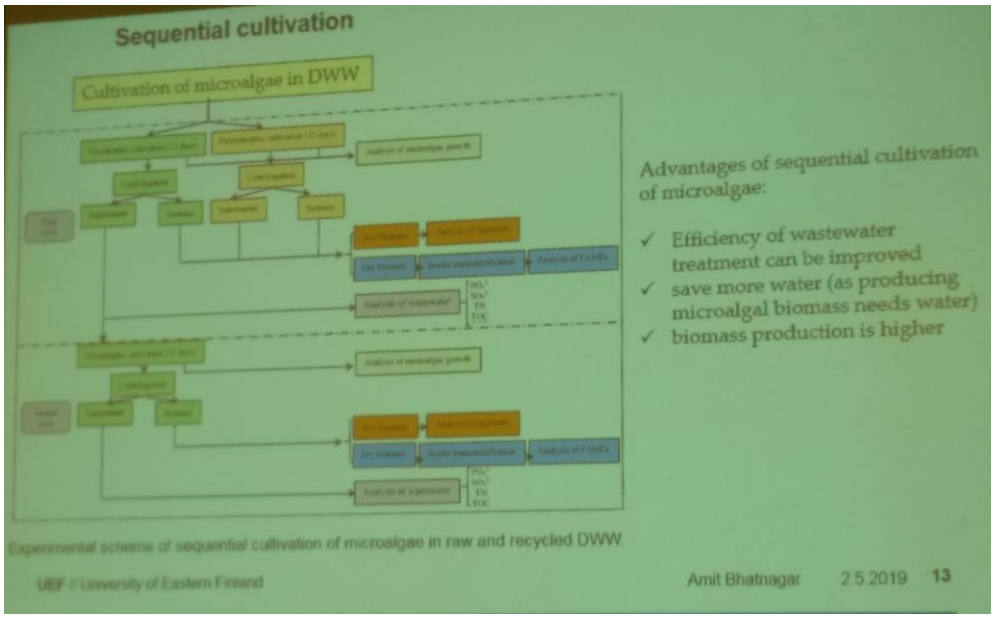
↑發現 Sq 在 DWW 中培養在第 8 有最大的生長率(黑線)，而 Ts 則是在第 12 天(紅線)。



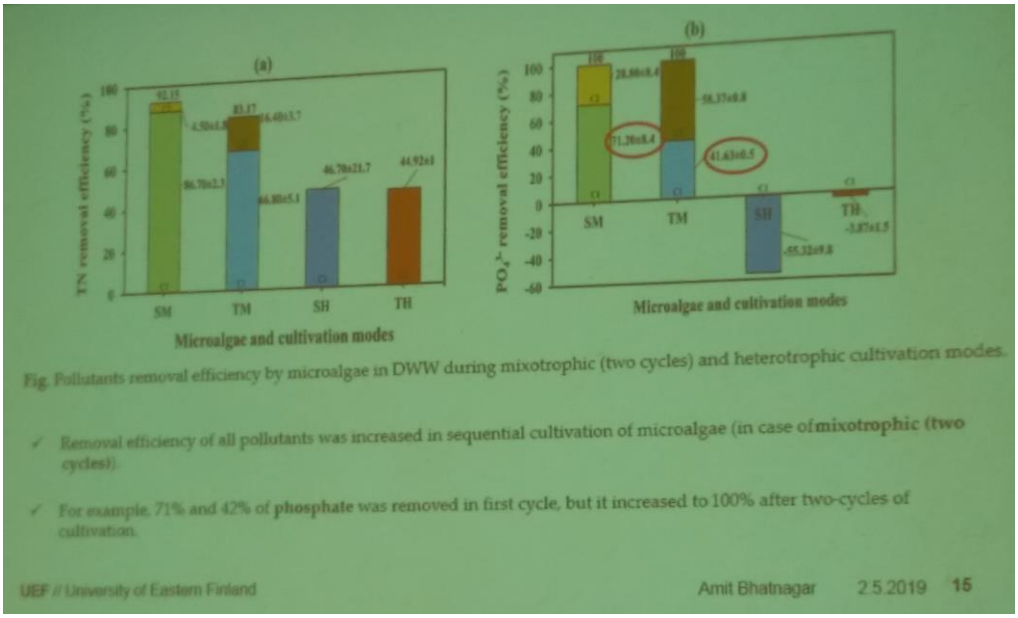
↑發現 Sq(黑 bar，淡水藻)、Ts(紅 bar、海水藻)能分別移除 DWW 中的氮氧化物(NO_3-N)達 95%及 65%，磷化物達 89%及 42%。Sq 處理過的 DWW 達到歐盟的排放標準。



↑發現 Sq 飽和脂肪酸較多、Ts 多元不飽和脂肪酸較。其中主要是 C16、C18 的脂肪酸。



↑續次培養(二次培養)的優點有:提升汙水處理效率、省水(因為培養藻需要水)以及提高藻類的生物質量。



↑以磷化物而言，第一次培養約移除71%(Sq)及42%(Ts)，第二次培養之後 Sq 及 Ts 均能將磷化物100%移除。

(2)

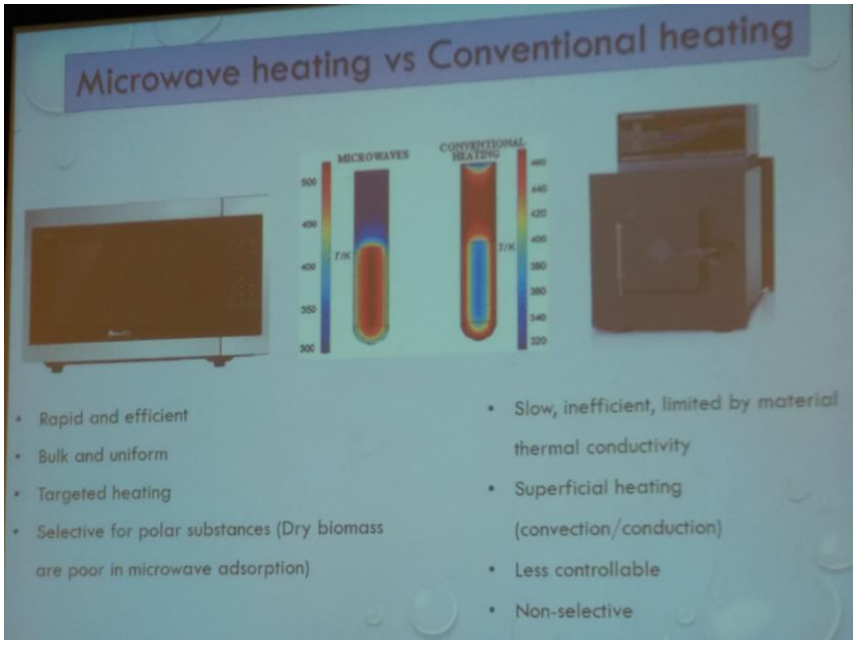
主題：Microwave pyrolysis processing of household and agricultural waste into bioenergy and valued-added char products

(微波熱裂解處理家庭&農業廢棄物作為生物能及高價焦炭產物)

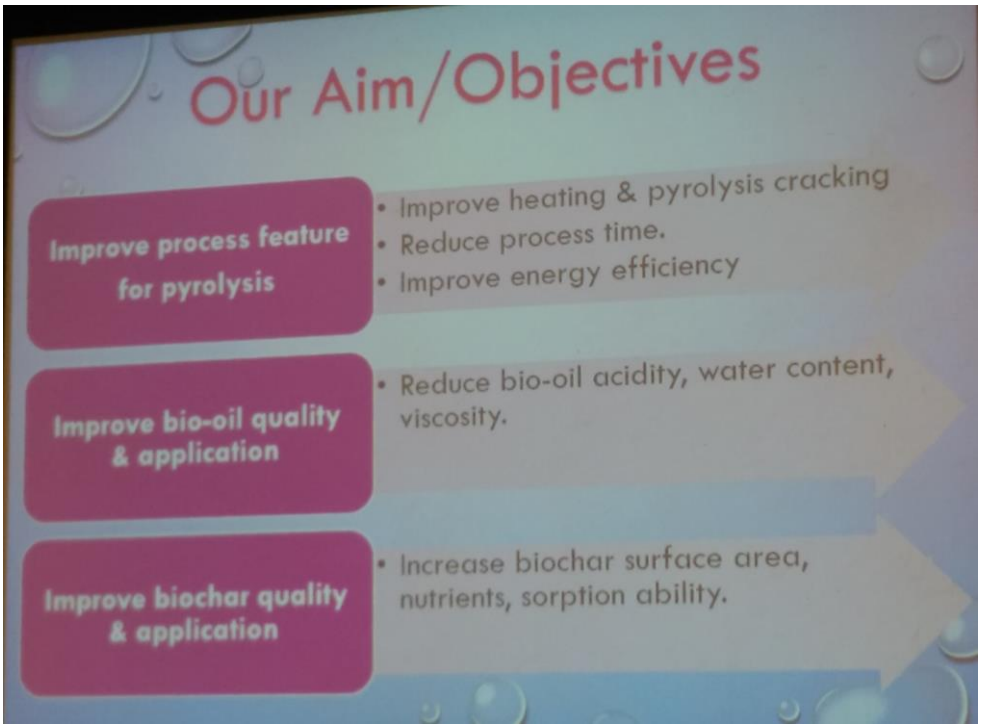
講者：Prof. Su Shiung Lam

(Universiti Malaysia Terengganu)

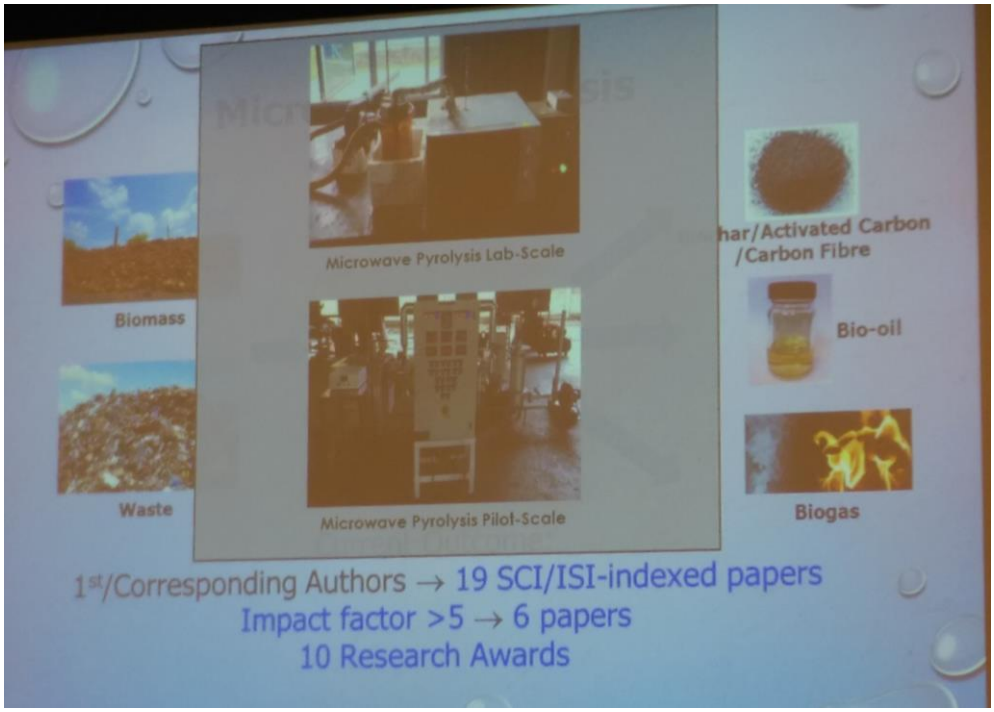
摘要：家庭&農業廢棄物是可再生的資源，能被轉化成各種有用產品。微波熱裂解是在常溫狀態下利用微波產熱將生質料源分解轉化成有用的液態油、氣體、焦炭等。微波熱裂解有很多種形式，有批次式、連續式、共裂解、催化裂解、真空裂解、活化裂解等。這種裂解技術比傳統加熱方式具有快速加熱、短時間、低能量消耗等優點。產生的液態油可作為生質燃料、燃料用油，氣體產物可作為生物氣，固態產物如焦炭、活性碳，經過精煉後可作為過濾材料、觸媒、生物肥料或儲能材料。研究顯示，微波熱烈解是一種俱有未來性、改良加熱表現的熱烈解方法，非常適合於將家庭&農業廢棄物處理成想要的產物。因此，專利申請、工廠執照申請、文獻發表、獲獎、工業上原形設備開發（prototype development)、推廣及應用等，持續呈現出來。



↑微波熱加熱與傳統加熱比較。微波加熱具有快速有效、大規模、一致性。能目標性加熱，乾的物質較不易吸收微波。



↑微波熱裂解研究目標: 裂解方面:提升的效率、減少處理時間。裂解油脂方面:降低的酸性、含水量、黏度。生物焦炭方面:增加的表面積、養分、吸附能力。



↑微波熱裂解由小型試驗級演進到前導級(pilot-scale)，在技術、裂解油脂、生物焦炭等開發上，有許多研發進展，發表數篇文章及獲獎。

(3)

主題：Development of Enabling High Throughput Platform Technologies for Smart Integrative Biobreeding of Microbial Cell Factories

(發展智慧型整合性微生物品種高通量篩選平台)

講者：Prof. Xin-hui Xing (Tsinghua University, China)

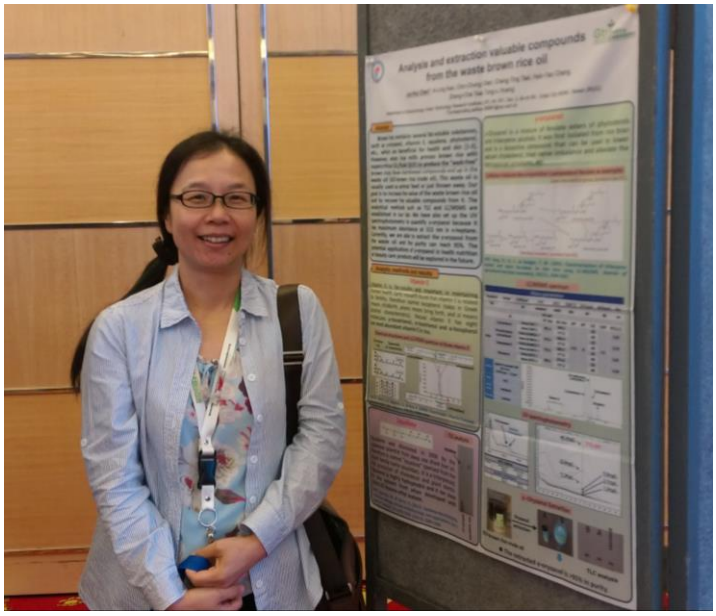
摘要：發展快速且強力的高通量篩選平台對於生產超級細胞工廠是極為重要的，藉由與其他方法的整合，有助於發現新穎功能或尚未被鑑定出種類、作用的基因。本研究開發的 ARTP (atmospheric and room temperature plasma) mutagenesis (常壓室溫等離子體誘變)技術能夠經由獨特的機制直接引起複雜的基因突變，包含斷鏈、鹼基突變等。為了發展整合性平台將 ARTP 與高通量天擇結合在一起，本研究還納入微滴微生物生長系統(microdroplet-based microbial culture, MMC) ，在微晶片上自動高通量培養微生物，有很好的重複性，線上偵測生長狀態，能重新程序化的軟體，自動添加不同濃度的化學成分等。再加上基因編輯技術(genome editing technology)便成為一個智慧型整合性微生物品種高通量篩選平台。

3.3海報論文 (Poster session)

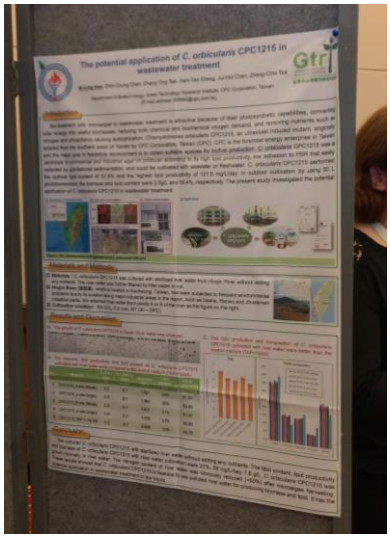
■ 本組這次發表的三篇海報(大會的邀請函**如附件 3)**如下:

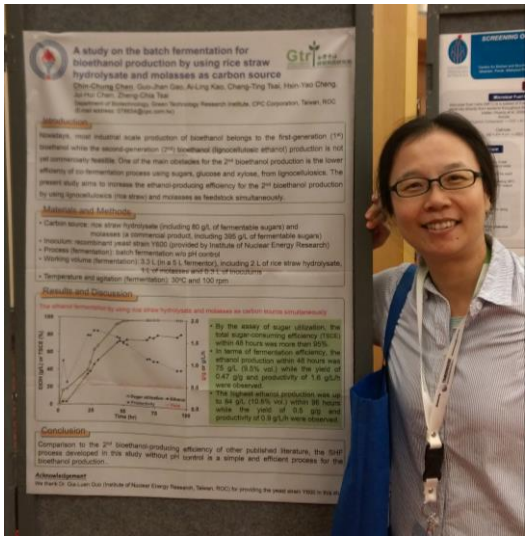
(1) **Poster ID: E-01** (environmental biotechnology 類)

Analysis and Extraction Valuable Compounds from the Waste Brown Rice oil (Chen Jui-Hui)



↑Poster ID: E-01 榮獲 **environmental biotechnology 類最佳海報獎** (附件 4)





↑Poster ID: I-04 **↑Poster ID: B-07**

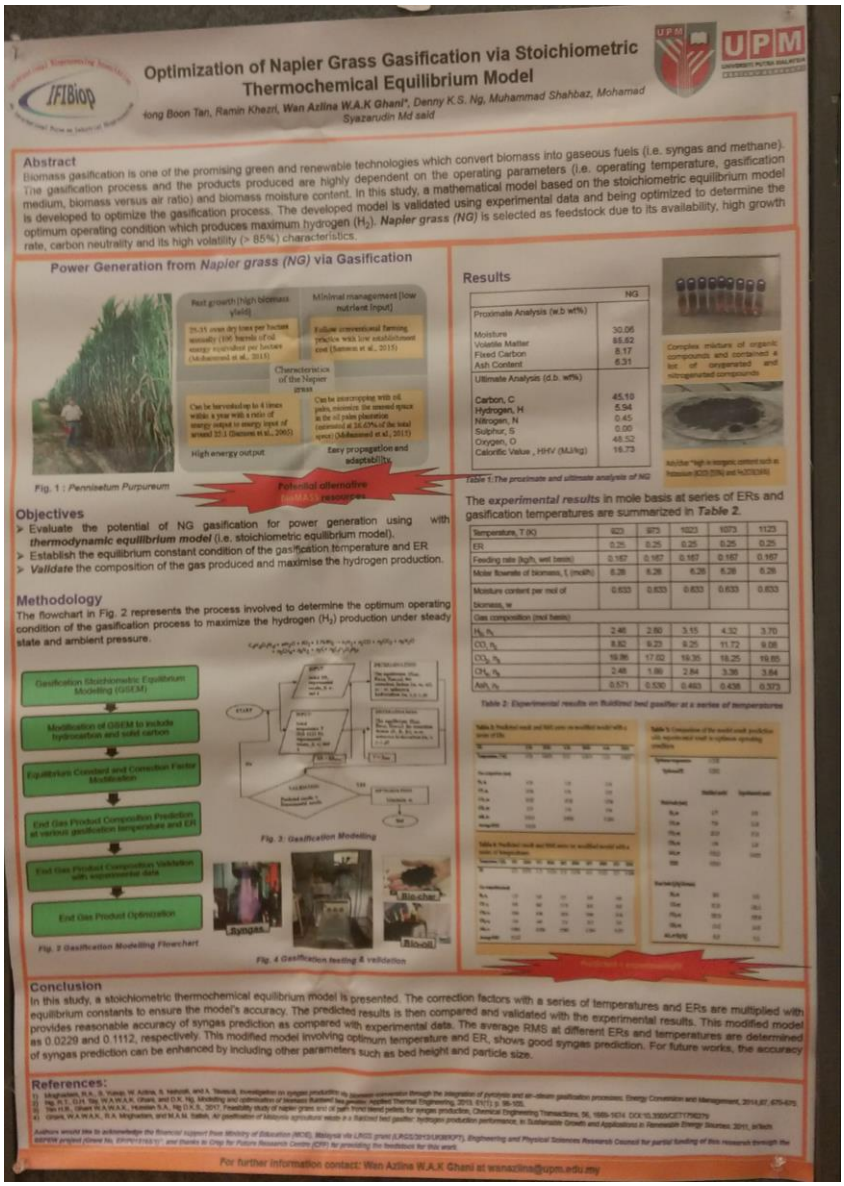
(2) **Poster ID: I-04** (industrial biotechnology 類)

The Potential Application of C. Orbicularis CPC1215 in Wastewater Treatment (Kao Ai-Ling)

(3) **Poster ID: B-07** (bioenerygy/ biofuel 類)

A Study on the Batch Fermentation for Bioethanol Production by Using Rice Straw Hydrolysate and Molasses as Carbon Source (Chen Chin-Chung)

■ 其他海報：

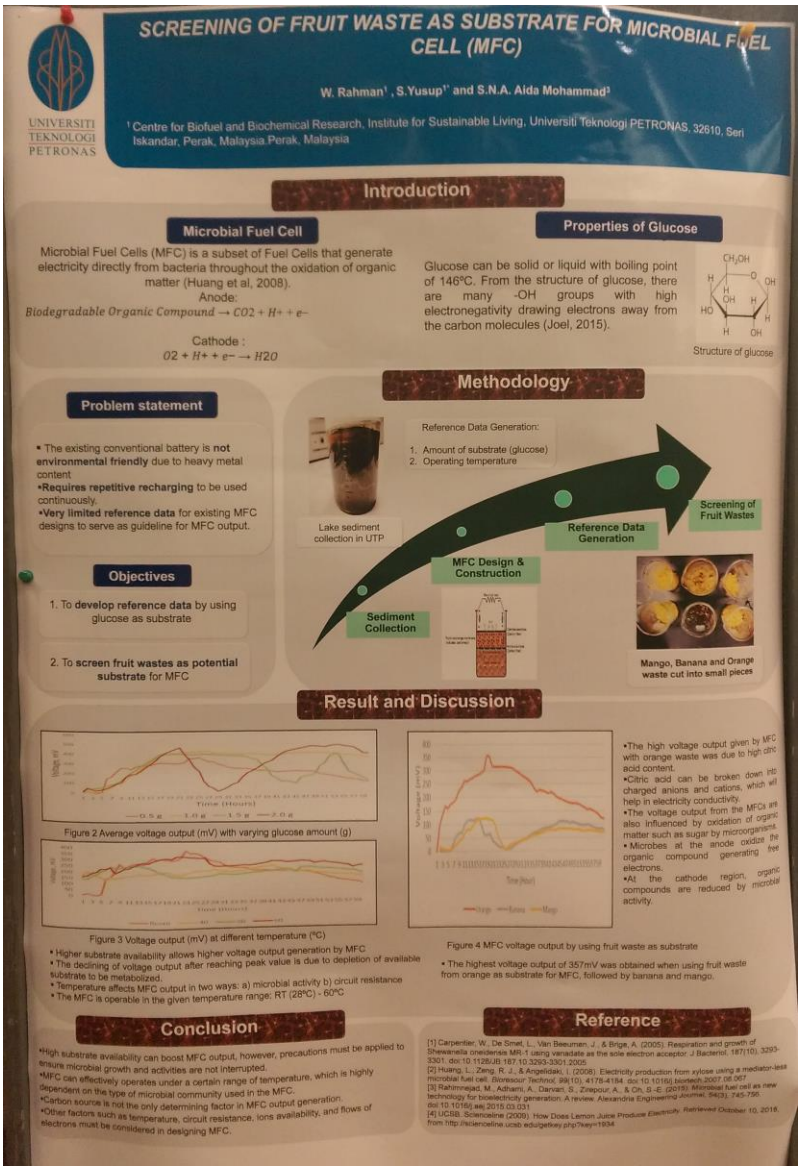


↑Poster ID:B-06

題目：Optimization of Napier Grass Gasification via Stoichiometric Thermochemical Equilibrium Model

講者：W. A. Wan Ab Karim Ghani (Universiti Putra Malaysia)

摘要：生質氣化是將生物質轉化成氣態燃料如合成氣，甲烷的一種技術。氣化的過程及產物取決於操作條件例如溫度，生物質/氣體比，生物質溼度等。一種以計量化學 (stoichiometric) 為基礎的數學模式用來模擬氣化程序及用實際的試驗數據加以驗證，達到最佳產氫氣之參數。

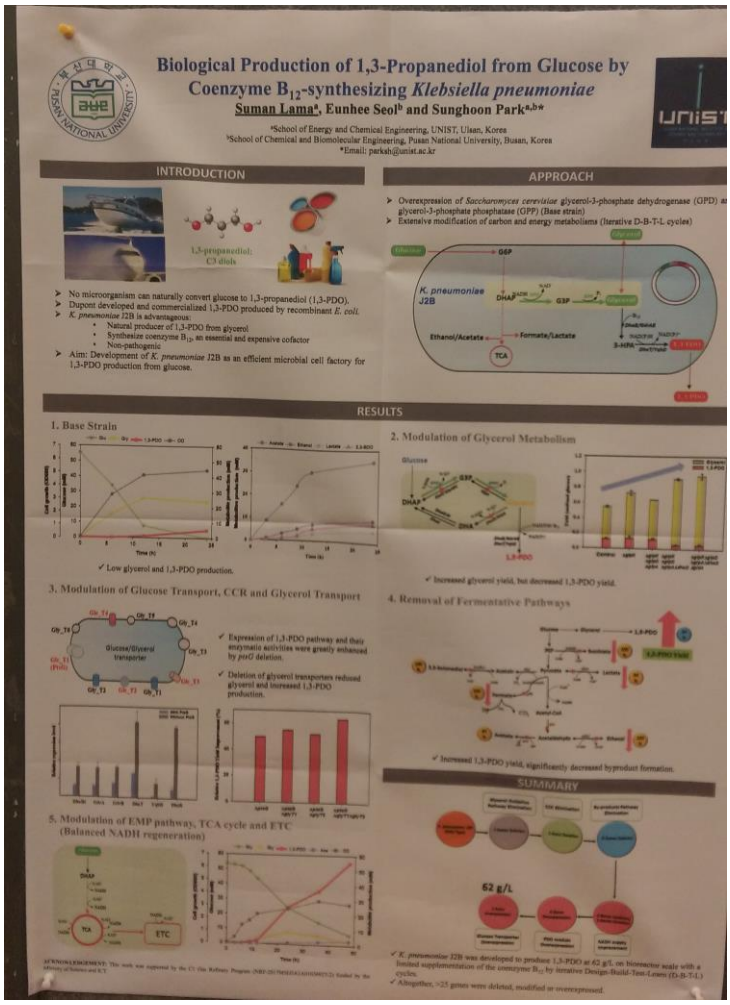


↑Poster ID:B-08

題目：Screening of Fruit Waste as Substrate in Microbial Fuel Cell (MFC)

講者：Waqiuddin Rahman Abd Wahab (Universiti Teknologi PETRONAS)

摘要：本研究在發展燃料電池對電器進行供電，主要鎖定在用葡萄糖為基質發展 Microbial Fuel Cell (Mfc，微生物燃料電池)，篩選各種水果廢棄物如橘子、香蕉、芒果等。根據不同糖濃度、溫度，成功發展不同參考數據。高濃度的糖有較高的電壓輸出鋒，但低濃度糖有較穩定的電壓輸出。常溫下 MFC 最高的電壓輸出鋒為 360mV，而在溫度 40°C, 50°C and 60°C 最高的電壓輸出鋒為分別為 259mV、255mV、320mⅤ。篩選水果廢棄物發現橘子有較最高的電壓輸出 357mV，接著為香蕉、芒果。



↑Poster ID:B-08

題目：Biological Production of 1,3-propanediol from Glucose by Coenzyme B12-synthesizing *Klebsiella pneumoniae*

講者：Suman Lama (Pusan National University, Korea)

摘要：1,3-丙二醇 (1,3-PDO)是重要的平台化學品，在食品、美妝、醫藥、織品工業上有廣泛的應用。利用基因改造的大腸桿菌，用葡萄糖當碳源發酵而取得 1,3-PDO 的技術已被杜邦公司(DuPont)進行量產了，但是大腸桿菌無法生產輔酶 B12 (coenzyme B12)，(1,3-PDO 代謝途徑上一個必要且昂貴的輔因子)。本研究開發出一個微生物工廠(Klebsiella pneumoniae J2B，克雷伯氏菌)能自然的合成輔酶 B12。此外，該 J2B 菌的甘油代謝途徑也被破壞，以及 1.移除「碳代謝物抑制」、2.阻止「甘油的輸出」、3.阻斷「其它副產物的生成」、4.增加 NADH 的取得、5.改變 dihydroxyacetone-3-phosphate (DHAP，糖解過程的中間產物) 碳分佈等，共約 25 個以上的基因被修改，最好的菌株在無添加輔酶 B12 條件下就能生產 1.25 mol 1,3-PDO/mol glucose。

4 心得及建議

4.1 研討會規模及內容

本次研討會有超國 20 家、200 人參與，由於已經舉辦許多屆，與會人員似乎都互相熟識對方。本次在美里城舉辦，國際學者需要轉機才能到達，相較之下交通較不便利，不然應該有更多人參加。然而，我覺得本次規模適中，涵蓋的五大主題，每個主題裡約有 20~30 篇的報告(及海報)，已讓我應接不暇。

因為是馬來西亞主辦，參加的人員以馬國人最多，而研討會內容也多跟棕櫚油產業有關，聚焦馬國的產業困境及急待解決的問題。可能由於地利之便及機會難得，馬國教授會帶學生來參加，並讓學生有機會在國際場合發表演講，也因此發現數篇性質相近的文章。

以往生質醇類研究是主流，即將生物質(主要是木質纖維素)經過粉碎、糖液化、發酵等技術生產酒精或其他醇類，但今年較少有發酵的應用，反而多了生物質的熱裂解(pyrolysis)。另外，氫能及微生物燃料電池，也是本次研討會常出現的主題。藻類的應用也不少，概念與我們中油 CPC1215 微藻類似，用來處理廢水及產油脂。

4.2 與其他學者交流

參加前有跟主辦教授(Prof. Ir. Dr Suzana Yusup)有電子信件的交流，表明一人參加卻要發表三篇海報，經 Dr Yusup 協助、取得大會理解後終於成行。因此，開幕後便向 Dr Yusup 表達感謝之意。

會場遇到成大張嘉修老師，經由張老師的介紹認識台大李篤中教授(IBA-IFIBiop 主席)、台科大蔡伸隆教授(今年最佳口頭報告獎得主)、元智大學藍祺偉教授、宜蘭大學的陳博彥教授，以及高雄科大董正釱教授等。可見，本研討會也是

台灣學者會參與的重要會議。

此外，也認識中國大陸清華大學邢新會教授(Prof. Xin-hui Xing)，他的口頭報告主題: Development of Enabling High Throughput Platform Technologies for Smart Integrative Biobreeding of Microbial Cell Factories (發展智慧型整合性微生物品種高通量篩選平台)，相當精彩，若有平台想篩選菌種，可以藉由他們的 ARTP (atmospheric and room temperature plasma) mutagenesis (常壓室溫等離子體誘變)技術，增加突變多元性，提高篩選適當菌種的機會。

另外，還有澳洲雪梨的 Prof. Huu Hao NGO(受邀的主題演講講者之一)。及其他馬來西亞大學如 UTM (University Teknologi Malaysia)、UTP (University Teknologi PETRONAS)、UPM (University Putra Malaysia)、UTAR (University Tunku Abdul Rahman)等的教授。此外，也認識一位背景跟我非常類似的學者(Dr Law Poh Gaik (Jenny)，她不是學校教授，而是馬來西亞國內的唯二油公司 PETRONAS(另一家是英國 Shell)的研究員，也前來了解目前學界的研究內容。

4.3 心得

本次最大的心得是了解東南亞發展的現況，在台灣最大宗生質料源就是稻稈，而在馬來西亞就是棕櫚樹。然而，稻米在台灣的角色除了供應本國自有糧食外，並不是外銷主打，有時甚至只是為了維持農地耕耘狀態而種植，不是台灣經濟的命脈。相反的，棕櫚油是馬來西亞的重要出口產品，從搭飛機的高空上鳥瞰，便可知其耕種之廣泛，而可想而知取油後的乾果束、棕櫚葉、莖幹等，將是龐大的農業廢棄物(生質料源)，因此，馬國各研究單位無不致力於這些剩餘生質料源的再利用開發。

然而，研發成果總是慢慢累積，但也常遇到學術理論與實際商轉間的障礙。

因此，馬國政府特地成立一個類似創投公司的經費補助單位，專門補助研發成果已經有商品化的雛形，但缺乏行銷經費的單位，以加強創新產品的推廣。

此外，與研究較不相關的是對於馬來西亞文化氛圍的認識。看似東方人面孔者，大概超過六成會說華語，讓我訝異馬國有如此多的華僑，用中文溝通都沒問題。但是，也有例外。另外，就是裝扮上的差異，信奉伊斯蘭教的女生都會包頭巾，因此，非常好區分。有些伊斯蘭教女生看似華人，卻不是華僑只能用英語溝通，但無礙於彼此對研究內容的討論。在開幕會、Gala dinner 上，大會還有安排當地的原住民舞蹈表演，他們不戴頭巾、裝扮有如台灣原住民，很顯然是另一群種族信仰的人。馬來西亞族群多元，彼此互相尊重，相安和諧，令我好奇又敬佩。

4.4 建議

今年的研討會地點在馬來西亞，是地理位置較鄰近台灣的國家(相對於歐美)，且地點在東馬，物價不高，因此，費用能維持在編列的預算之內。儘管這次沒有去歐美，但研討會規模也不小，很多 sessions 同時進行是不得已的做法，卻也無法同時聆聽到好的發表，常需要取捨。演講題目次序雖有提前公布，但因演講者缺席或臨時對調，若沒有在同一演講廳聽完整場的話，也常因次序調整而無法「趕場」(換會議廳)而及時參與，因此，建議還是挑選一個最有興趣的主題類別，在同一個會議廳，聆聽完全場會是比較有效率的做法。此外，這次的 poster sessions 時間較短，大概都只有 1 小時，但 poster 數目卻不少，有些海報很有內容，但因為自己本身也帶有海報，需要站在海報前介紹，無法離開位置，錯過好好瀏覽其它海報與作者面對面討論的機會，甚為可惜。如果大會能延長 poster sessions 的時間會更好。

另外，本次研討會地點是在熱帶地區，沒有預料需要攜帶厚衣服，然而，研

討會的現場冷氣十足，加上進出室內外冷熱變化大，易引起身體不適。因此，建議日後參加會議時仍要帶長袖外套以備不時之需。

5 附件

附件 1. Poster Presentation Slots

附件 2. Parallel/oral session lists

附件 3. 海報論文接受邀請函

附件 4. 最佳海報獎狀

May 2nd 2019 (1.00 pm - 2.00 pm)

Tracks	No.	Poster ID	Abstract ID	Abstract Title	Presenter
Bioenergy / Biofuel	1	B-01	1570524759	Parameters Influence on the Physico-Chemical Properties of Napier Grass Biopellets	Ahmad Ismail
	2	B-02	1570512038	Statistical and Media Engineering Approaches to Improve the Production of Isobutanol	Binod Parameswaran
	3	B-03	1570522643	Radiation Grafted Kenaf Catalyst for Palm Oil-Based Biodiesel Production in a Continuous Flow System	Nur Haryani Zabaruddin
Environmental Biotechnology	4	E-01	1570529052	Analysis and Extraction Valuable Compounds from the Waste Brown Rice Oil	Chen Jui-Hui
	5	E-02	1570518068	Structuring an Evaluation Approach for Sustainability of Urban Anaerobic Digester Project in Indonesia. Case Study: Bandung City	Elisabeth Rianawati
	6	E-03	1570526811	Rapid Aerobic Granulation by Using Diatomite in Sequencing Batch Reactor System for Treating Domestic Wastewater	Hazlami Fikri Basri
	7	E-04	1570524743	Removal of Methylene Blue from Aqueous Solution by Using Fish Scales: Adsorption Kinetic and Thermodynamic Study	Lam Man Kee
	8	E-05	1570521113	Eutrophic Water Improvement Using Ecological Floating Bed the Response and Role of Microbial Eukaryotic Community	Lemian Liu
Industrial Biotechnology	9	I-01	1570525245	Synthesis of Vanillin from Pineapple Leaves Derived Lignin	Anita Ramli
	10	I-02	1570510949	Cost-effective of Heat Exchanger Network Design for FELCRA Palm Oil Mill	Azlin Azmi
	11	I-03	1570525358	A Colorimetric Semi-Quantitative Detection of Total Polar Compounds and Acrylamide in Seeds Oil (Sunflower Corn Peanut Etc.) Based in a Novel Enzymatic Method	Chrysa Voidarou
	12	I-04	1570529056	The Potential Application of C. Orbicularis CPC1215 in Wastewater Treatment	Kao Ai-Ling

	13	I-05	1570525349	Whey Valorization Through the Development of Novel Bilayer Bacterial Cellulose Biocatalysts	Dr. Loulouda Bosnea
	14	I-06	1570520901	Immobilization of B-Galactosidase on Polymethacrylate Monolith for Galacto-oligosaccharide Production	Mailin Misson
	15	I-07	1570525493	Mass Balance of Integrated Alkaline and Acidic Peroxide Oxidation on Oil Palm Empty Fruit Bunch Biomass in Reducing Lignocellulose Recalcitrance and Cellulose Extraction	Mastura Abd Manaf
	16	I-08	1570525206	Isolation and Characterization of Hemicellulose from Alkaline Black Liquor of Sago Palm Bark	Nor Shahirah Ishak
Food Technology & Engineering	17	F-01	1570510068	Microfluidization Improves the Stability of Sugarcane Juice	Ayon Tarafdar
	18	F-02	1570518434	Effect of Roasting on Oxidative Stability and Antioxidant Properties of Dabai Kernel Fat	Azrina Azlan
	19	F-03	1570524616	Isolation of a Novel Potentially Probiotic Lactic Acid Bacteria from Kefir Grains	Eugenia Bezirtzoglou
Upstream & Downstream Bioprocesses	20	UD-01	1570528954	Application of an Innovative Biomaterial Based Packed Bed Biofilm Bioreactor for the Treatment of Pharmaceutical Industry Wastewater	Shabnam Murshid

May 3rd 2019 (12.00 pm - 2.00 pm)

Tracks	No.	Poster ID	Abstract ID	Abstract Title	Presenter
Bioenergy / Biofuel	1	B-04	1570511526	Co-pyrolysis of EFB/PKS, EFB/OPTL and EFB/Sawdust to Produce Fine Chemicals	Nurul Asyikin Badir Noon Zaman
	2	B-05	1570522621	Anaerobic Digestion of Fruit-Based Agroindustrial Waste Estimation of Biogas Production and Electrical Potential	Sri Suhartini
	3	B-06	1570503780	Optimization of Napier Grass Gasification via Stoichiometric Thermochemical Equilibrium Model	W. A. Wan Ab Karim Ghani
	4	B-07	1570529054	A Study on the Batch Fermentation for Bioethanol Production by Using Rice Straw Hydrolysate and Molasses as Carbon Source	Chen Chin-Chung
	5	B-08	1570532440	Screening of Fruit Waste as Substrate in Microbial Fuel Cell (MFC)	Waqiuddin Rahman Abd Wahab
	6	B-09	1570522854	Simulation Studies on Microwave-Assisted Pyrolysis of Biomass for Bioenergy Production	Bello Salman
	7	B-10	1570545973	Experimental Study of the Dissolution of Commodity Waste Plastics as Additives to Palm Biodiesel	Rafael Damar Arjanggi
Environmental Biotechnology	8	E-06	1570525225	Development of A Novel Poly (Ethylene Glycol)/Polyethersulfone Blended Membrane for Acidic Gas Separation	Shu Yi Lim
	9	E-07	1570533440	Dye Removal Using Hibiscus Cannabinus: Batch and Column Studies	Suriati Sufian
	10	E-08	1570532398	Removing Organic Components in Crude Palm Oil (CPO) Using Local Bleaching Earths via Adsorption	Mohd Hakimi Rosli
	11	E-09	1570532403	Fabrication of NH 2 -MIL-101/Cellulose Triacetate Mixed Matrix Membrane for CO 2 /CH 4 Separation	Lim Huei Yeong
	12	E-10	1570528972	Synthes of Lactic Acid from Industrial Waste Paper Sludge Using Rhizopus Oryzae MTCC5384 by Simultaneous Saccharification and Fermentation	Neha R

	13	E-11	1570524569	Process Modeling and Optimization for Composting of Empty Fruit Bunch (EFB) from Oil-palm	Chua Han Bing
	14	E-12	1570525318	Enhanced Astaxanthin Extraction Efficiency and Astaxanthin Stability from Haematococcus Pluvialis Using Biological and Chemical Treatment	Jae Min Joun
	15	E-13	1570544413	Removal of Heavy Metals Using Low-Cost Bentonite A Review	B. Au Pek Ing
	16	E-14	1570544421	Effect of Xpike Fertilizer Application on Palm Oil	A.R.H. Settinayake
	17	E-15	1570544424	Adsorption of Heavy Metals from Industrial Wastewater onto Low-Cost Kaolin Clay Based Adsorbent: A Review	Jia-Boon Chai
Industrial Biotechnology	18	I-09	1570525266	Production of High Value-Added Xylooligosaccharides from the Black Liquor of Alkaline Solubilized Xylan Extracted from Oil Palm Frond by Acid and Enzymatic Hydrolysis	Nur Ahmad Sobri
	19	I-10	1570512203	Thermo-chemical Hydrolysis of Spoiled Wheat Grains a Preliminary Study for Potential Future Industrial Applications	Ranjna Sirohi
	20	I-11	1570524313	Effect of Peper Betel Leaves Extract on Cotton Fabrics for Underclothes	Srie Gustiani
	21	I-12	1570522289	Multi-operation Integrated Strategy for Enhanced Lutein Production of a Lutein-Enriched Microalga Chlorella Sorokiniana FZU60 Under Mixotrophy/Photoinduction Culture	Youping Xie
	22	I-13	1570525483	Large-scale Cultivation of Sporosarcina Pasteurii Strain in a Low-Tech Customized Bioreactor for In-Situ Biocement Application	Armstrong Omoregie
	23	I-14	1570525288	Studies on the Characterization and Cell Proliferation of Keratinocyte by the Collagen from Makaira Nigricans Skin	Mei-Ling Tasi
	24	I-15	1570529050	Biological Production of 1,3-propanediol from Glucose by Coenzyme B12-synthesizing *Klebsiella pneumoniae*	Suman Lama
	25	I-16	1570518464	Biocatalytic Access to Optically Active 3-Cyclohexene-1-carboxylic Acid at High Substrate Loading	Zhe Dou
	26	I-17	1570525229	Study on the Characterization and Wound Healing Activity by the Collagen and Chondroitin Sulfate from Sturgeon Cartilage (Acipernser Baerii)	Mei-Ling Tasi

	27	I-18	1570525305	Studies on the Characterization and Cell Proliferation of Keratinocyte by the Collagen from Makaira Nigricans Skin	Pei- Pei Sun
	28	I-19	1570519333	Additional Bioprocess by a Cell in the Same Batch Without Genetic Modification	Konstantina Boura
	29	I-20	1570544426	Feasibility Study of Fibre Cement Board Production Using Empty Fruit Bunch Fibre	C.Y. Wong
Food Technology & Engineering	30	F-04	1570534349	Optimization of Oil Extraction from Mesocarp Using Response Surface Method	Hasmira Hashim
	31	F-05	1570525323	Red Algae (Agardhiella Subulata) Down-Regulated Inflammatory Mediators in Lipopolysaccharide-Stimulated Macrophages and 12-O-tetradecanoylphorbol-13-acetate-treated Mouse Skin	Ching-Shu Lai
	32	F-06	1570522748	Effect of Monascus Spp. Fermentation from Aquatic Waste on Anti-Inflammatory	Ya-Ting Chen
Upstream & Downstream Bioprocesses	33	UD-02	1570541944	Optimization of Esterification Reaction for Biodiesel Production Using Dicationic Acidic Ionic Liquid Catalyst	Wan Zaireen Yahya

TECHNICAL PAPER

Bioenergy / Biofuels

Environmental Biotechnology

PARALLEL SESSION I | Thursday, 2 May 2019

Venue: Danum 2
Session Chairs: Professor Dr Syed Farman Ali Shah & Dr Kim Sang-Hyoun

IL - Invited Lecture SO - Speaker Oral

Title	Slot	Time
Microalgae for Wastewater Treatment and Value-Added Products Generation – A Synergistic Approach *Amit Bhatnagar*	IL-B1	3.30 – 3.50 pm
Energy and Chemicals Production Based on Carboxylic Acids from Anaerobic Digestion *Sang Byoung-In*	IL-B2	3.50 – 4.10 pm
A Comparative Study on the Heat Release During the Combustion of Coal and Charcoal Briquette via Thermogravimetric Analysis (TGA) *Aminu Safana Aliyu*	SO-B1	4.10 – 4.20 pm
Non-Catalytic Synthesis of Ethyl Glucoside from Glucose in Supercritical Carbon Dioxide *Daiki Fukushima*	SO-B2	4.20 – 4.30 pm
Kinetic Analysis of Catalytic Pyrolysis of Microalgae Chlorella Vulgaris Biomass Using Thermogravimetric Analysis *Melissa Fong Jia Bao*	SO-B3	4.30 – 4.40 pm
Source and Formation Mechanism of Representative Liquid and Gas Products from Torrefaction of Oil Palm Residues *Yoshimitsu Uemura*	SO-B4	4.40 – 4.50 pm
Metal-Biochar Composites as Novel Solid Catalysts for Isomerisation of Glucose to Fructose *Daniel CW Tsang*	SO-B5	4.50 – 5.00 pm

Venue: Danum 1
Session Chairs: Professor Dr Jonathan Wong & Dr Eldon Rene

Title	Slot	Time
Characteristics of Tetracycline Degradation in Seawater over a Magnetically Modified Spent Coffee Ground Biochar *Dong Cheng-Di*	IL-E1	3.30 – 3.50 pm
Black Soldier Fly Composting Using Organic Waste for High-Value Production *Zhang Zengqiang*	IL-E2	3.50 – 4.10 pm
Chemically Modified Chitosan by Imidazolium Based Ionic Liquid as Potential Biosorbent for the Removal of Permanganate- Manganese (II) Ions *Wan Zaireen Yahya*	SO-E1	4.10 – 4.20 pm
Kinetic Modeling for Mineralisation of Oil-Palm Empty Fruit Bunch (EFB) Composting *Chua Han Bing*	SO-E2	4.20 – 4.30 pm
Municipal Solid Waste Management and Green Energy Production via Anaerobic Digestion *Mohd Zulkhairi Mohd Yusoff*	SO-E3	4.30 – 4.40 pm
Anaerobic Digester Implementation in Urban Setting as a Waste to Energy Approach in Indonesia: Comparative Study of Landfill Household and Communal Scale *Elisabeth Rianawati*	SO-E4	4.40 – 4.50 pm

TECHNICAL PAPER

Industrial Biotechnology

Food Technology & Engineering

IL - Invited Lecture SO - Speaker Oral

Venue: Danum 3
Session Chairs: Professor Mohammad J. Taherzadeh & Dr Binod Parameswaran

Title	Slot	Time
Technological Advances in CO_2 Electrobiorefinery: Linking Bioelectrochemical CO_2 Reduction with Renewable Energy *Deepak Pant*	IL-I1	3.30 – 3.50 pm
Engineering a Glucosamine-6-Phosphate Responsive glmS Ribozyme Switch Enables Dynamic Control of Metabolic Flux in Bacillus Subtilis for Overproduction of N-acetylglucosamine *Du Guocheng*	IL-I2	3.50 – 4.10 pm
Exploitation of Industrial Side Streams for the Production of Bio-Based Chemicals & Polymers - Techno-economic Sustainability Potential *Apostolis Koutinas*	IL-I3	4.10 – 4.30 pm
Bovine Mastitis Quantitative Detection of Subclinical Mastitis *Chrysa Voidarou*	IL-I4	4.30 – 4.50 pm
Lactose Fermentation Performed by Saccharomyces Cerevisiae Cell Factory *Agapi Dima*	SO-I1	4.50 – 5.00 pm
Production of Superior Alternative Fuels Biohydrogen & Biobutanol from Native & Pretreated Fruit Waste by Clostridial Fermentation *Rabindra Mahato*	SO-I2	5.00 – 5.10 pm
Two Layer Bioprocess for One Step Treatment of Starch Succinic Acid & Alcohol Production *Konstantina Boura*	SO-I3	5.10 – 5.20 pm
Bioconversion of 5-Hydroxymethylfurfural to Furan-2 Acid by Heterogeneous Expression of 5-Hydroxymethylfurfural Oxidase in Pseudomonas Putida S12 *Tsai Shen-Long*	SO-I4	5.20 – 5.30 pm

Venue: Linau 1
Session Chairs: Dr Sindhu Ramakrishnan & Dr Gopalakrishnan Kumar

Title	Slot	Time
Rational and Integral Reuse of Wastes from Food and Bioproducts Processing as Effective Alternative to Reduce Human Malnutrition and Hunger *Cristobal N Aguilar*	IL-F1	3.30 – 3.50 pm
Plant-Microbe Interaction at the Rhizosphere: Quorum Sensing and Root Colonisation by Plant Growth Promoting Rhizobacteria *Paramasamy Gunasekaran*	IL-F2	3.50 – 4.10 pm
Screening of Probiotic Properties of Isolated Lactic Acid Bacteria from Kefir Grains *Eugenia Bezirtzoglou*	IL-F3	4.10 – 4.30 pm
Effects of Fruit Position in the Bunch on Cutting Force and Stickiness of Banana (Musa Acuminata Balbisiana) Variety Nipah *Rosnah Shamsudin*	SO-F1	4.30 – 4.40 pm
Saccharification of Sorghum Durra by Chimeric Enzyme (β-Glucosidase & Endo β-1 Glucanase CtGH1-L1-CtGH5-F194A) & Cellobiohydrolase (CtCBH5A) from Clostridium Thermocellum for Bioethanol Production *Mohanapriya Nedumaran*	SO-F2	4.40 – 4.50 pm
Optimisation of Anthocyanins Extracts from Roselle Using Ultrasonic-Assisted Extraction Method *Muhammad Syafiq Hazwan Ruslan*	SO-F3	4.50 – 5.00 pm

TECHNICAL PAPER

Bioenergy / Biofuels

Environmental Biotechnology

PARALLEL SESSION II | Friday, 3 May 2019

Venue: Danum 2
Session Chairs: Professor Amit Bhanagar & Professor Sang Byoung-In

IL - Invited Lecture SO - Speaker Oral

Title	Slot	Time
Policy Implications for Sustainable Ethanol Production *Syed Farman Ali Shah*	IL-B3	10.30 – 10.50 am
Biogas Production from Food Waste using Dynamic Membrane: Effect of Shear Velocity *Kim Sang-Hyoun*	IL-B4	10.50 – 11.10 am
Development of a Photoelectrochemical Glucose Fuel Cell Using ZnO Nanorods & CuO Nanocrystals *Azzah Pramata*	SO-B6	11.10 – 11.20 am
High-Efficiency Catalytic Degradation of Various Organic Pollutant Using Ball-milled Metal-Biochar Composites *Sun Yuqing*	SO-B7	11.20 – 11.30 am
Bioelectricity Generation Using Microalgal Biomass as Electron Donor in a Bio-Anode Microbial Fuel Cell *Fabrice Ndayisenga*	SO-B8	11.30 – 11.40 am
Reactive Separation for Conversion of Glucose to 5-Hydroxymethylfurfural by Synergistic Effect of H_2O & CO_2 *Ryuto Inoue*	SO-B9	11.40 – 11.50 am
Deciphering Redox-Mediating Characteristics of Catecholamines for Bioenergy Extraction Using Microbial Fuel Cells *Chen Bor-Yann*	SO-B10	11.50 – 12.00 pm

Venue: Danum 1
Session Chairs: Professor Ganti Murthy & Associate Professor Dr Zainon Mat Sharif

Title	Slot	Time
Biorefinery Using Biochar-Supported Catalysts *Daniel Tsang*	IL-E3	10.30 – 10.50 am
Effect of Leach Bed Reactor off Gas Diversion & Headspace Pressures on Methane Gas Generation of Two-Phase Anaerobic Digestion *Jonathan Wong*	IL-E2	10.50 – 11.10 am
Surface Modification on Rubber Seed Shell Activated Carbon Using Chitosan for Heavy Metals Removal from Industrial Waste *Azry Borhan*	SO-E5	11.10 – 11.20 am
Part 2 Effects of Temperature and Dark Fermentation Effluent on Biomethane Production in Two-Stage UASFF Bioreactor *Bidattul Zainal*	SO-E6	11.20 – 11.30 am
Hydrogen Gas Sensor Using Graphene Oxide Composite *Aynul Sakinah Ahmad Fauzi*	SO-E7	11.30 – 11.40 am
Fabrication of Pn Junction Films Using ZnO Nanorods & Semiconductor Nanocrystals for Gas Sensing *Takeshi Shinkai*	SO-E4	11.40 – 11.50 am

TECHNICAL PAPER

Industrial Biotechnology

Food Technology & Engineering

IL - Invited Lecture SO - Speaker Oral

Venue: Danum 3
Session Chairs: Professor Dr Du Guocheng & Dr Deepak Pant

Title	Slot	Time
Fungal-Based Biorefinery *Mohammad J. Taherzadeh*	IL-I5	10.30 – 10.50 am
Development of Green Processes for the Production of 2,5-Furandicarboxylic Acid *Binod Parameswaran*	IL-I6	10.50 – 11.10 am
Bioconversion of Lupanine-Containing Industrial Wastewater into Added-Value Products Bioprocess Development & Metabolic Properties of P Putida LPK411 *Michalis Koutinas*	IL-I7	11.10 – 11.30 am
Enzyme-Based Processes Towards Neuroprotective Bioactive Compounds *Maria Ribeiro*	SO-I5	11.30 – 11.40 am
Lean and Green Approach in Bio-Refinery Processing *Leong Wei Dong*	SO-I6	11.40 – 11.50 am
Valorisation of Bakery Wastes for the Production of Butanediol and Acetoin by Bacillus Amyloliquefaciens *Sofia Maina*	SO-I7	11.50 – 12.00 pm

Venue: Linau 1
Session Chairs: Professor Dr Cristobal N. Aguilar & Dr Ahmad Safuan Bujang

Title	Slot	Time
Valorisation of Spent Coffee Grounds (SCG) to Biofuels and Bioproducts: Recent Progress *Gopalakrishnan Kumar*	IL-F4	10.30 – 10.50 am
Application of Phytate-Degrading Enzymes (Phytases) in Food Processing *Ralf Greiner*	IL-F5	10.50 – 11.10 am
The Study on the Mechanism for Foaming Properties Changes Caused by the Glycation to Beer Foam Proteins *Wang Jinjing*	SO-F4	11.10 – 11.20 am
Integration of Maceration and Freeze Concentration for Recovery of Antioxidant Contents from Pomegranate Peel *Shafirah Samsuri*	SO-F5	11.20 – 11.30 am
Retention of Phytochemicals in the Concentration of Broccoli Extract by Progressive Freeze Concentration *Nurul Aini Amran*	SO-F6	11.30 – 11.40 am
An Improvement in Fermentability of Acid-Hydrolysed Hemicellulose from Kenaf Stem for Xylitol Production *Siti Syazwani Mohd Shah*	SO-F7	11.40 – 11.50 am

TECHNICAL PAPER

Bioenergy / Biofuels

Environmental Biotechnology

PARALLEL SESSION III | Friday, 3 May 2019

Venue: Danum 2
Session Chairs: Dr Anil Kumar Patel & Dr Arif Hidayat

IL - Invited Lecture SO - Speaker Oral

Title	Slot	Time
Lignophenol from Oil Palm Biomass as Carbon Fibre Precursor *Kelly Yong*	IL-B5	2.00 – 2.20 pm
Bio-Transformation of Wastes into Biodiesel *Rajeshwar Dayal Tyagi*	IL-B6	2.20 – 2.40 pm
Stable Isotope Fractionation of Methane Allows Direct Methanosarcina Population Monitoring in Anaerobic Digestion *Lyu Zuopeng*	SO-B11	2.40 – 2.50 pm
Protective Effect of Reverse MBR Towards Syngas Impurities on Methane Production *Ria Millati*	SO-B12	2.50 – 3.00 pm
Whole-Cell Immobilisation on Biochar-Based Carriers for Enhancement of Ethanol Production from Citrus Peel Waste *Maria Kyriakou*	SO-B13	3.00 – 3.10 pm
Screening of 2-Keto Acid Decarboxylase the Key Enzyme of Biosynthesis of D-1,2,4-Butanetriol by the Method of Bioinformatics *Wu Bin*	SO-B14	3.10 – 3.20 pm
Physico-Chemical Analysis and Production of Biogas from Different Composition of Fresh Broiler Chicken Manure *Siti Aminah Mohd Johari*	SO-B15	3.20 – 3.30 pm

Venue: Danum 1
Session Chairs: Professor Dr Madhavan Nampoothiri & Professor Dr Indu Sekhar Takhur

Title	Slot	Time
Exploring Nutrient Recovery and Reuse of Algal Biomass from Wastewater Treatment *Ganti S Murthy*	IL-E5	2.00 – 2.20 pm
Removal of Lead from Water Using Biogenic Hydroxyapatite Prepared from Biowaste *Tsang Yiu Fai*	IL-E6	2.20 – 2.40 pm
Method for Assessment of Sludge Compost Maturity Using Seed Germination *Zheng Guodi*	SO-E9	2.40 – 2.50 pm
Bioflocculant Produced by Citrobacter Youngae as Conditioning Aid to Enhance Sludge Dewatering *Lau Shiew Wei*	SO-E10	2.50 – 3.00 pm
Blended Cellulose Acetate / Multi-Walled Carbon Nanotube Mixed Matrix Membrane for CO_2/N2 Separation *Nigel Chin*	SO-E11	3.00 – 3.10 pm
Electrochemical Hydrogen Separation Using Graphene Oxide *Masataka Shintaniai*	SO-E12	3.10 – 3.20 pm

TECHNICAL PAPER

Industrial Biotechnology

Food Technology & Engineering

IL - Invited Lecture SO - Speaker Oral

Venue: Danum 3
Session Chairs: Professor Dr Xing Xin-Hui & Dr Venkata S. Mohan

Title	Slot	Time
Multilateral Approaches to Improving CO_2 Mitigation of Microalgal Energy Systems *Sang Jun Sim*	IL-I8	2.00 – 2.20 pm
Bacterial Cellulose with 14C- Glucose to Test Cell Factory and Bi-Layer Biocatalysts for Starch One Step Bio-Processing *Magdalini Soupioni*	IL-I9	2.20 – 2.40 pm
Chimera Construction from Cellulose Hydrolysing Enzymes by Protein Engineering for Enhancing Biomass Saccharification *Arun Goyal*	SO-I8	2.40 – 2.50 pm
New Routes to Fermentative Production of Cyclic and N-methylated Amino Acids from Renewable Carbon Sources *Volker Wendisch*	SO-I9	2.40 – 2.50 pm
Exploitation of Open Market Wastes Through Biorefinery Development & Production of Natural Pigments by Penicillium Purpurogenum *Chrysanthi Pateraki*	SO-I10	2.50 – 3.00 pm
Artificial Photosynthetic Capsules for Enzymatic Hydrogenation *Jiafu Shi*	SO-I11	3.00 – 3.10 pm
Bioprocess Development for Biolubricant Production Using Microbial Lipids Derived via Solid State Fermentation of Protein Rich Side Streams *Erminda Tsouko*	SO-I12	3.10 – 3.20 pm

Venue: Linau 1
Session Chairs: Professor Dr Paramasamy Gunasekaran & Professor Dr Ralf Greiner

Title	Slot	Time
Techno-Economic Evaluation of Thermal Post-Harvest Bulk Processing of Stingless Bee (Kelulut) Honey *Ahmad Safuan Bujang*	IL-F6	2.00 – 2.20 pm
Bioconversion of Waste Cooking Oil to Poly-3-Hydroxybutyrate by a Microbial Consortium *Sindhu Ramakrishnan*	IL-F7	2.20 – 2.40 pm
Greek Functional Feta-type Cheese Enhanced Quality and Safety with Probiotic Cells Immobilised on Lathyrus Sativus Beans *Loulouda Bosnea*	IL-F8	2.40 – 3.00 pm
Preservation of Wine and Apple Juice Through Cold Pasteurisation *Maria Kanellaki*	IL-F9	3.00 – 3.20 pm
Effect of Supercritical Carbon Dioxide Extraction Process Parameters on Yield & Anthocyanins from Roselle Calyces *Zuhaili Idham*	SO-F8	3.20 – 3.30 pm
Selection of Multicoper Oxidases for Degradation of Biogenic Amines in Fermented Foods *Fang Fang*	SO-F9	3.30 – 3.40 pm

TECHNICAL PAPER

Bioenergy / Biofuels

Environmental Biotechnology

PARALLEL SESSION IV | Friday, 3 May 2019

Venue: Danum 2
Session Chairs: Professor Dr Armando Quitain & Dr Lam Su Shiung

IL - Invited Lecture SO - Speaker Oral

Title	Slot	Time
Biodiesel Synthesis from Kapok Seed Oil Using Red Mud as Heterogeneous Catalyst *Arif Hidayat*	IL-B7	4.00 – 4.20 pm
Cost Effective Production of Algal Biodiesel from Industrial Wastes *Anil Kumar Patel*	IL-B8	4.20 – 4.40 pm
Effect of Oxygen Control and Limitation on Sugar Metabolism in Kluyveromyces Maxianus for Biomass and Ethanol Production a Metabolic Flux Analysis Study *Mohamad Fahrurrazi Tompang*	SO-B16	4.40 – 4.50 pm
Parametric Study and Optimisation of Methane Production in Catalytic Co-Gasification of Coconut Shells-Oil Palm Fronds Blends in the Presence of Portland Cement Dolomite & Limestone *Muddasser Inayat*	SO-B17	4.50 – 5.00 pm
Hemicellulose Saccharification from Pretreated Finger Millet Straw by Recombinant Hemicellulases for Bioethanol Production *Sumitha Jamaldheen*	SO-B18	5.00 – 5.10 pm
Zeolite Beta-based Catalyst for Renewable Diesel Production from Palm Product via Hydrodeoxygenation *Nur Azreena Idris*	SO-B19	5.10 – 5.20 pm
Carbocatalysts in Synergy with Microwave Irradiation for Glucose Conversion to 5-HMF *Tomomi Hasunuma*	SO-B20	5.20 – 5.30 pm
Microwave Assisted Etherification of the Crude Glycerol into Polyglycerol by Lithium Hydroxide *Muhammad Ayoub*	SO-B21	5.30 – 5.40 pm

Venue: Danum 1
Session Chairs: Professor Dr Michael Sauer & Professor Dr Rekha Singhal

Title	Slot	Time
Lignin Valorisation Whole Genome Sequencing and Proteomic Analysis of Pandoraea Sp. ISTKB for Biofuel and Biomaterials *Indu Shekhar Thakur*	IL-E7	4.00 – 4.20 pm
An Expedition Through Extracellular Polysaccharides of Lactic Acid Bacteria *Madhavan Nampoothiri K*	IL-E8	4.20 – 4.40 pm
Life-Cycle Assessment of Essential Oil Extraction from Aquilaria Sinensis Using Supercritical Carbon Dioxide *Gwee Yong Ling*	SO-E13	4.40 – 4.50 pm
Formaldehyde Inhibition Kinetics of Methanogenesis from Acetate and Formate by Consortium of Anaerobes *Michelle Lau*	SO-E14	4.50 – 5.00 pm
Development of Economic Bioprocess for Microalgal Removal of Urban-Area-Focused Carbon Dioxide from Industrial Flue Gas *Min Eui Hong*	SO-E15	5.00 – 5.10 pm
Enhancing the Tetracycline Removal by UCPs-TiO_2 Combine Periphyton *Yu Wang*	SO-E16	5.10 – 5.20 pm
Green Revolution to Protect Environment - An Identification of Potential Microalgae for the Biodegradation of Plastic Waste in Malaysia *Prakash Bhuyar*	SO-E17	5.20 – 5.30 pm

TECHNICAL PAPER

Industrial Biotechnology

Upstream & Downstream Bioprocesses

IL - Invited Lecture SO - Speaker Oral

Venue: Danum 3
Session Chairs: Professor Ir Dr Suzana Yusup & Dr Lam Man Kee

Title	Slot	Time
Biorefining the Soybean *Soccol Carlos Ricardo*	IL-I10	4.00 – 4.20 pm
Growth Performance Biochemical Composition and Corresponding Gene Expression Profiles of Lutein-Producing Microalgae Chlamydomonas Sp. JSC4 in Response to Different Temperatures *Ma Ruijuan*	SO-I13	4.20 – 4.30 pm
Production and Characterisation of Rhamnolipid Based Biodiesel Side Stream Waste Glycerol by Pseudomonas Aeruginosa RS6 *Mohd Rafein Zakaria*	SO-I14	4.30 – 4.40 pm
Mechanism of the Production of Fucose from Fucoidan *Jonas Karl Christopher Agutaya*	SO-I15	4.40 – 4.50 pm
Techno-Economic Sustainability Analysis of Succinic Acid Production from Glucose Syrup & Spent Sulphite Liquor *Dimitrios Ladakis*	SO-I16	4.50 – 5.00 pm
Partition Efficiency of Cytochrome C in Alcohol Aqueous Biphasic Flotation *Grace Ng Hui Suan*	SO-I17	5.00 – 5.10 pm
Engineering Versatile Alcohol Dehydrogenase KpADH for the Synthesis of Chiral Secondary Alcohols with Pharmaceutical Relevance *Xu Guochao*	SO-I18	5.10 – 5.20 pm
Analysis of Mechanism for Enhanced Catalytic Efficiency of CMCase from Bacillus Amyloliquefaciens SS35 UV2 Mutant Strain *Shweta Singh*	SO-I19	5.20 – 5.30 pm

Venue: Linau 1
Session Chairs: Professor Dr Wu Yong Hong & Professor Dr Veluri Murthy

Title	Slot	Time
Cell Factories and Biocatalysts for Additional Bio-processing in the Same Batch Without Cloning *Athanasios Koutinas*	IL-U1	4.00 – 4.20 pm
Optimising Growth Conditions of Pavlova Sp for Fucoxanthin Production & Using Pavlova Sp as the Feed Supplement for Shrimp Cultivation *Chang Jo-Shu*	IL-U2	4.20 – 4.40 pm
Comparison of Different Bioreactor Configurations for Wastewater and Waste-Gas Treatment Potential for Resource Recovery and Modelling Aspects *Eldon R. Rene*	IL-U3	4.40 – 5.00 pm
Electrochemical Applications of Graphene Oxide Nanosheets for Hydrogen Production & Carbon Dioxide Reduction *Tetsuya Kida*	IL-U4	5.00 – 5.20 pm
Risk and Economic Feasibility Study for Palm-Based Biorefinery *Ngan Sue Lin*	SO-U1	5.20 – 5.30 pm
Development of Environmentally Friendly Synthetic Oil Based Mud Using Calophyllum Oil *Sonny Irawan*	SO-U2	5.30 – 5.40 pm
The Potential of Palm Kernel Shell to Enhance CO_2 Adsorption Capacity of Calcium Oxide *Mustakimah Mohamed*	SO-U3	5.40 – 5.50 pm
The Development of Semi-Automated Paste Filling Machine for Spicy Shrimp Paste *Nurul Jannah Jalil*	SO-U4	5.50 – 6.00 pm

TECHNICAL PAPER

Bioenergy / Biofuels

Environmental Biotechnology

PARALLEL SESSION V | Saturday, 4 May 2019

Venue: Danum 2
Session Chairs: Professor Dr Rajeshwar Dayal Tyagi & Dr Kelly Yong

IL - Invited Lecture SO - Speaker Oral

Title	Slot	Time
Microwave Pyrolysis Processing of Household and Agricultural Waste into Bioenergy & Value-Added Char Products *Lam Su Shiung*	IL-B9	10.00 – 10.20 am
Microwave Carbocatalysis for Bioenergy and Biochemical Conversion *Armando Quitain*	IL-B10	10.20 – 10.40 am
The Effect of Temperature on Synthesis of Bio-crude Oil from Indonesian Spirulina Sp Using Hydrothermal Liquefaction Process *Baskoro Ajie*	SO-B22	10.40 – 10.50 am
Efficient Biobutanol Production from by Using Solventogenic Clostridium Strains *Xin Fengxue*	SO-B23	10.50 – 11.00 am
Microwave-Carbocatalysis Method for Conversion of Cellobiose to Glucose *Kisara Tsuruta*	SO-B24	11.00 – 11.10 am
UKM2 Chlorella Strain Performance as Bio-Anode in a Biophotovoltaic Cell *Mimi Hani Abu Bakar*	SO-B25	11.10 – 11.20 am
Enhancing Performance of a Groove-Type Flat Panel Bioreactor Using Immobilised Photosynthetic Bacteria for Continuous Photofermentative Hydrogen Production *Yi Wang*	SO-B26	11.20 – 11.30 am
Synthesis & Characterisation of Monk Fruit Seed (Siraitia Grosvenorii) Based Heterogeneous Acid Catalyst for Biodiesel Production Through Esterification Process *Steven Lim*	SO-B27	11.30 – 11.40 am

Venue: Danum 1
Session Chairs: Professor Dr Michael Sauer & Professor Dr Rekha Singhal

Title	Slot	Time
Biorefinery of Plant Oil Production Derived Carbon Side Streams *Michael Sauer*	IL-E9	10.00 – 10.20 am
Immobilisation of Acrylamidase from Novel Isolate Cupriavidus Oxalaticus ICTDB921 for Mitigation of Acrylamide from Industrial Waste Water *Rekha Singhal*	IL-E10	10.20 – 10.40 am
Anaerobic Digestion Processes for Dairy Waste Treatment for Fuel & Bioproduct Diversification *Piet Lens*	SO-E18	10.40 – 10.50 am
Enhanced Astaxanthin Extraction Efficiency and Astaxanthin Stability from Haematococcus Pluvialis Using Biological & Chemical Treatment *Jae Min Joun*	SO-E19	10.50 – 11.00 am
Oil Palm Empty Fruit Bunch as Alternative Wood Fibers Recovery of Cellulose Using Low-Transition Temperature Mixtures *Yiin Chung Loong*	SO-E20	11.00 – 11.10 am
Insight into Catalytic Fast Pyrolysis of Rice Husk Thermochemical Behaviour & Kinetic Study *Adrian Loy Chun Minh*	SO-E21	11.10 – 11.20 am
Mass Balance of Integrated Alkaline & Acidic Peroxide Oxidation on Oil Palm Empty Fruit Bunch Biomass in Reducing Lignocellulose Recalcitrance & Cellulose Extraction *Mastura Abd Manaf*	SO-E22	11.20 – 11.30 am

TECHNICAL PAPER

Industrial Biotechnology

Upstream & Downstream Bioprocesses

IL - Invited Lecture SO - Speaker Oral

Venue: Danum 3
Session Chairs: Professor Dr Soccol Carlos Ricardo & Professor Dr Sang Jun Sim

Title	Slot	Time
Renewable Chemicals and Fuels from Waste Biorefinery in Circular Mode *S Venkata Mohan*	IL-I11	10.00 – 10.20 am
Development of Enabling High Throughput Platform Technologies for Smart Integrative Biobreeding of Microbial Cell Factories *Xing Xin-Hui*	IL-I12	10.20 – 10.40 am
Xanthan Gum by Xanthomonas Campestris as a Printing Thickener on Polyester Fabrics with Disperse Dyes *Srie Gustiani*	SO-I20	10.40 – 10.50 am
Enhanced Fuzzy P-graph for Optimal Synthesis of Microalgae Cultivation Systems *How Bing Shen*	SO-I21	10.50 – 11.00 am
Conversion of Glucose into 5-HMF Using Ultrasonic System in the Presence of Low Transition Temperature Mixture *Yeo Jhin Xern*	SO-I22	11.00 – 11.10 am
Kinetic Analysis of Kojic Acid Production by Aspergillus Oryzae with Yeast Powder & Soybean Cake Powder as Nitrogen Sources *Ying Liang*	SO-I23	11.10 – 11.20 am
Compatibility of Utilising Nitrogen-Rich Juice from Oil Palm Trunk for Economical Succinic Acid Fermentation Employing Wild-Type Bacterium *Nurul Adela Bukhari*	SO-I24	11.20 – 11.30 am
Enzymatic Delignification of Leucaena Leucocephala and its Effect on the Phytochemical Properties *Nor Hanimah Hamidi*	SO-I25	11.30 – 11.40 am

Venue: Linau 1
Session Chairs: Professor Dr Athanasios Koutinas & Professor Dr Chang Jo-Shu

Title	Slot	Time
Application of Palm Oil for the Enhancement of Process Performance in Biopolymer Production *Veluri VPS Murthy*	IL-U5	10.00 – 10.20 am
The Development of Goat/Sheep Holding Cage Slaughtering Mechanism *Zainon Mat Sharif*	IL-U6	10.20 – 10.40 am
A New Concept of Promoting Nitrate Reduction in Surface Waters: Simultaneous Supplement of Denitrifiers, Electron Donor Pool & Electron Mediators *Wu Yonghong*	IL-U7	10.40 – 11.00 am
A New Approach to Reveal the Mechanism of a Bacterium Against Microcystis Aeruginosa *Sun Pengfei*	SO-U5	11.00 – 11.10 am
Analysis of a Distributed Parameter Gas Balance During Solid State Fermentation on Newly Design Multi-Stacked Circular Tray Solid State Bioreactor with Influence of Variable Initial Moisture Content Arrangement *Musaalbakri Abdul Manan*	SO-U6	11.10 – 11.20 am
Improved sgRNA Design in Bacteria via Genome-Wide Activity Profiling *Guo Jiahui*	SO-U7	11.20 – 11.30 am
Evaluation and Modeling of Phenol Solubility from Supercritical Carbon Dioxide Extraction of Pyrolysis Oil Derived from Palm Kernel Shell *Chan Yi Herng*	SO-U8	11.30 – 11.40 am
Metabolic Construction of Efficient Biocatalytic Systems Characterised by Lignocelluloses Utilisation and Non-Photosynthetic CO_2 Fixation *Jiang Min*	SO-U9	11.40 – 11.50 am

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15th February 2019

Dear **Chen Jui-Hui,**

Thank you for submitting your manuscript to the 8th International Forum on Industrial Bioprocessing 2019 (IBA-IFIBIOP 2019) in Sarawak, Malaysia to be held on May, 1st – 5th, 2019.

You are listed as the submitter of the following abstracts:
Abstract ID : **1570529052**
Mode of Presentation : **Poster**
Title : **Analysis and Extraction Valuable Compounds from the Waste Brown Rice Oil**

We are pleased to inform you that your abstract has been accepted for this conference. The important dates are listed as below:

Deadline for early bird registration :**28th February 2019**
Deadline for normal registration :**30th April 2019**

Note: One of the authors must register for paper presentation and publication. Please refer to the payment details available in this link: **http://ifibiop2019.utp.edu.my/.** For further information, please visit our website http://ifibiop2019.utp.edu.my/ or send an email **ifibiop2019@utp.edu.my.** We look forward to see you in Sarawak!

Sincerely,

Prof. Ir. Dr. Suzana Yusup
Chairman of IFIBIOP 2019

8th International Forum on Industrial Bioprocessing
1 – 5 May 2019
Imperial Hotel, Miri, Sarawak, Malaysia

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15th February 2019

Dear **Chen Chin-Chung,**

Thank you for submitting your manuscript to the 8th International Forum on Industrial Bioprocessing 2019 (IBA-IFIBIOP 2019) in Sarawak, Malaysia to be held on May, 1st – 5th, 2019.

You are listed as the submitter of the following abstracts:
Abstract ID : **1570529054**
Mode of Presentation : **Poster**
Title : **A Study on the Batch Fermentation for Bioethanol Production by Using Rice Straw Hydrolysate and Molasses as Carbon Source**

We are pleased to inform you that your abstract has been accepted for this conference. The important dates are listed as below:

Deadline for early bird registration :**28th February 2019**
Deadline for normal registration :**30th April 2019**

Note: One of the authors must register for paper presentation and publication. Please refer to the payment details available in this link: **http://ifibiop2019.utp.edu.my/.** For further information, please visit our website http://ifibiop2019.utp.edu.my/ or send an email **ifibiop2019@utp.edu.my.** We look forward to see you in Sarawak!

Sincerely,

Prof. Ir. Dr. Suzana Yusup
Chairman of IFIBIOP 2019

8th International Forum on Industrial Bioprocessing
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19th February 2019

Dear **Kao Ai-Ling,**

Thank you for submitting your manuscript to the 8th International Forum on Industrial Bioprocessing 2019 (IBA-IFIBIOP 2019) in Sarawak, Malaysia to be held on May, 1st – 5th, 2019.

You are listed as the submitter of the following abstracts:
Abstract ID : **1570529056**
Mode of Presentation : **Poster**
Title : **The Potential Application of C. Orbicularis CPC1215 in Wastewater Treatment**

We are pleased to inform you that your abstract has been accepted for this conference. The important dates are listed as below:

Deadline for early bird registration :**28th February 2019**
Deadline for normal registration :**30th April 2019**

Note: One of the authors must register for paper presentation and publication. Please refer to the payment details available in this link: **http://ifibiop2019.utp.edu.my/.** For further information, please visit our website http://ifibiop2019.utp.edu.my/ or send an email **ifibiop2019@utp.edu.my.** We look forward to see you in Sarawak!

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Prof. Ir. Dr. Suzana Yusup
Chairman of IFIBIOP 2019

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THIS IS TO CERTIFY THAT

JUI-HUI CHEN

WAS AWARDED IN THE

8TH INTERNATIONAL CONFERENCE ON BIOPROCESSING

IBA-IFIBiop2019

WITH THE THEME

"BRIDGING SUSTAINABILITY AND INDUSTRIAL EVOLUTION THROUGH GREEN BIOPROCESSING"

AS A

BEST POSTER PRESENTER

ON

1 - 5 MAY 2019

AT

IMPERIAL HOTEL, MIRI, SARAWAK, MALAYSIA

Prof Suzana Yusup
Conference Chair

Prof Ashok Pandey
General Chair

Prof Duu-Jong Lee
Chairman, IBA-IFIBiop