出國報告（出國類別：開會）

參加2016年日本環境污染防治研討會

【2016 4th International Conference on Environment Pollution and Prevention】

服務機關：台灣中油公司探採研究所

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派赴國家：日本

出國期間：**105** 年 **12**月 **24** 日至 **105** 年 **12** 月 **28** 日

報告日期：**106** 年 **01**月 **1 8** 日

摘 要

職奉准出國案主要目的是參加「2016 4th International Conference on Environment Pollution and Prevention (ICEPP 2016)」會議，行程自105年12月24日至105年12月28日為期五日，會議在日本京都的Co-op Inn Kyoto飯店內舉辦，議程包含4大主題為Environmental Science and Engineering、Food Science and Engineering、Agricultural Science and Engineering 與 Chemical Engineering Technology and Bioengineering共90個題目，形式有包括壁報(Poster)論文發表及口頭(Oral)論文發表。藉由參與會議機會學習、研討相關新領域之新突破與研究結果；對於中油探採研究所在技術上具有助益。

本次「2016 4th International Conference on Environment Pollution and Prevention (ICEPP 2016)」會議，會議發表議題及研究成果包含許多專業領域，如：藉由植物修復系統可有效地整治重金屬土壤污染、微波熱脫附技術整治含油污泥、及可饒性的氧化石墨烯-碳超級電容應用於穿戴材料等，其中因應公司土壤環境整治方面可提供新穎的方法具有參考價值；本公司為台灣最大的石油能源公司，對於環境的議題矚目程度日益重要，提升環境的友善技術是社會的趨勢，不僅會是對企業形象的加分也對社會盡一份友善環境的心力。建議公司同仁可多參與該發展類型的研討會，藉以提升技術與拓展多元化思維。

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壹、 目的

ICEPP 2016研討會之目的在於研討與解決農業、食品、工業及環境方面所遭遇各類之困難與瓶頸。除了助於本公司規劃污染復育技術及再生能源應用做進一步之提升，並將新穎技術之概念進一步引進本公司，作為日後污染復育技術與再生能源技術之考量。

藉由 ICEPP 2016 研討會來自不同領域之觀點，包含有農業、食品科學、環工、化工與工業新技術之研究與應用，皆在研討會欲探討之課題，同時也希望藉此機會與其他專家互相交流，以吸取相關的污染防治新技術與觀念，避免在污染整治過程中人物力的損耗；並期望與會的交流能提昇本公司污染防治之技術能力。

貳、 行程

本次出國行程如表1所示。105年12月24日由桃園機場搭機至日本關西機場，12月25日為研討會報到註冊與會議行程，自12月25日起至12月27日為期3天，參加「2016 4th International Conference on Environment Pollution and Prevention (ICEPP 2016)」，會議全程於日本京都的Hotel Co-op Inn Kyoto舉行，過程除參與會議、聽取相關研究論文、實際經驗發表外，並觀看於會展所發表的壁報論文；行程於12月28日搭機返國。

表1.出國行程表

日期	地點	工作內容
12/24	台北-京都	啟程
12/25	京都	報到註冊/參加2016 4th International Conference on Environment Pollution and Prevention會議
12/26	京都	參加2016 4th International Conference on Environment Pollution and Prevention會議
12/27	京都	參加2016 4th International Conference on Environment Pollution and Prevention會議
12/28	京都-台北	返程

參、 心得

2016 4th International Conference on Environment Pollution and Prevention (ICEPP 2016)主要係由亞太化學、生物與環境工程協會Asia-Pacific Chemical, Biological & Environmental Engineering Society,簡稱APCBEES)所發起，協會成員來自美洲、歐洲、亞洲、非洲和大洋洲等全世界各大學學者。曾參與過上述研討會之成員，將在每一年度皆會通知研討會舉辦事宜與在各學界最新之研究成果。因應該研討會之領域與成員相當龐大，該組織之成立主要在蒐集各領域最新之發展研究，並提供不同領域知識以協助解決更深入之挑戰。圖1及圖2為本次行程12月25日會場之剪影，本研討會舉行地點為距離京都車站40分鐘車程之Hotel Co-op Inn Kyoto。本次研討會主席為Miwako Hosoda是日本的SEISA University教授。

會議開幕式由日本環境科學中心Kokyo Oh教授、Hosei University的Chiharu Ishii教授、The University of Tokyo的Teppei Nunoura副教授與The Hong Kong Polytechnic University的Chi-wai KAN副教授進行四場專題演講，講題分別包括「Development of Profitable System for Phytoremediation of Contaminated Soils with Resourceful Plants」、「Applications of Robot Technology to Devices for Assistive Technology」、「Management of Chemically Hazardous Laboratory Wastes in the University of Tokyo」及「Dyeing Cotton with Reactive Dyes Using Solvent-assisted Dyeing System」，三天會議期間共有90篇論文成果發表，圖3為Kokyo Oh教授與圖4為Chiharu Ishii教授開幕致詞紀錄照片與圖5為會議現場即時討論照片，本報告列舉其中部分與本研究所或公司未來發展相關之論文摘要敘述如下：

藉由植物修復系統可有效地整治重金屬土壤污染

最近十年全世界農業土壤被重金屬所污染日趨嚴重，尤其是在都市化與工業化迅速發展的亞洲區國家，近年來發展出一套優於傳統的技術，應用在整治農業土壤污染上，好處是種植可吸收重金屬的植物，它對於土壤是友善而無害；目前統計出亞洲區國家被污染的土壤大部分都超標土壤所能忍受的負荷度，現況處理重金屬土壤污染的方式為種植低階植物，等待植物成長到採收期時則一次採收，採收完即被焚化處理；整治期間農業經濟毫無收入且年復一年地等待，對發展中國家經濟影響甚鉅。

Kokyo Oh教授提出改善策略就是改種植具有可提供生質燃料的植物或是觀賞用植物，這項策略應用在環境綠化可大大改善工業化單調感，生質燃料可應用在各項石化能源產業鏈上，達成一個生生不息的自循環鏈進而解決土壤在重金屬上污染的問題，土壤活化、土地擁有者也因此而擁有一筆豐厚的經濟收入構成一個彼此雙贏的局面。圖六為Kokyo Oh教授互動討論之影像。

圖1 研討會會場

圖2 研討會會場

圖3 Kokyo Oh教授致開幕詞

圖4 Chiharu Ishii教授致開幕詞

圖5 研討會開會現場討論

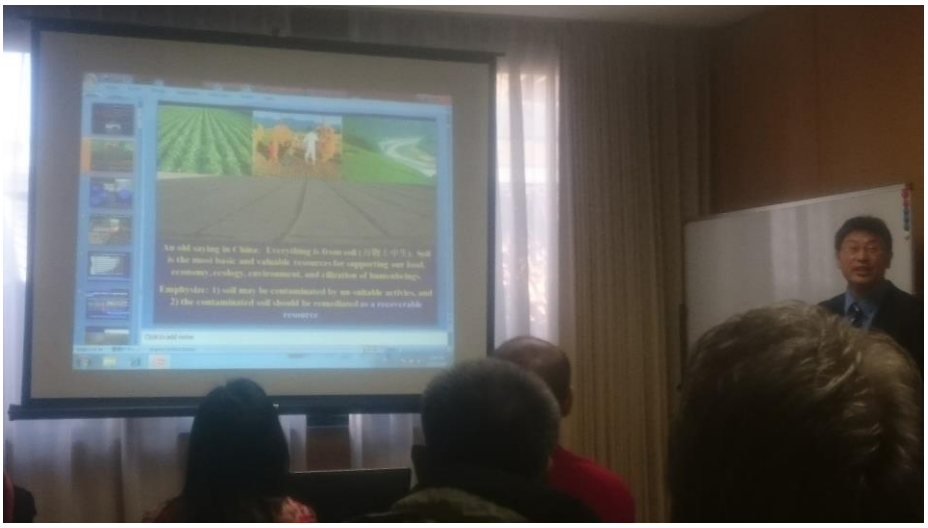

圖6 Kokyo Oh教授互動討論

微波熱脫附技術整治含油污泥

熱處理是快速處理油污染土壤的有效方法之一，但這個方法成本遠高於與其他傳統利用物理、化學及生物處理方式，最讓人所詬病的為屬於高能耗處理方式； 近年來微波的加熱模組公認是一種可提高熱效率之處理含油污染的土壤方法，傳統的熱脫附處理是採用fossil fuel thermal desorption rotary-kiln方式可處理污染較嚴重的油泥，缺點：它是利用fossil fuel直接對燃燒器進行加熱，所需加熱費用較多與排放大量的CO_2。圖7污泥熱處理過程之投影片 、圖8熱處理設備示意圖與圖9微波處理之前後比較。

微波熱處理模組可大幅提升能源使用效率，目的是在克服不利於傳統熱處理條件所發展出微波吸收腔體，其內部經由微波處理後可使整個腔體溫度達到均一，其處理溫度上由原先的熱處理670℃降低為230℃就可達到熱處理效果。費用上由74USD/ton減少至22USD/ton(約70%)，CO_2的排放量由0.162ton降低至0.0162ton(約90%)。藉由微波熱處理加熱模組可望做為公司未來在土壤環境整治的一個方法。

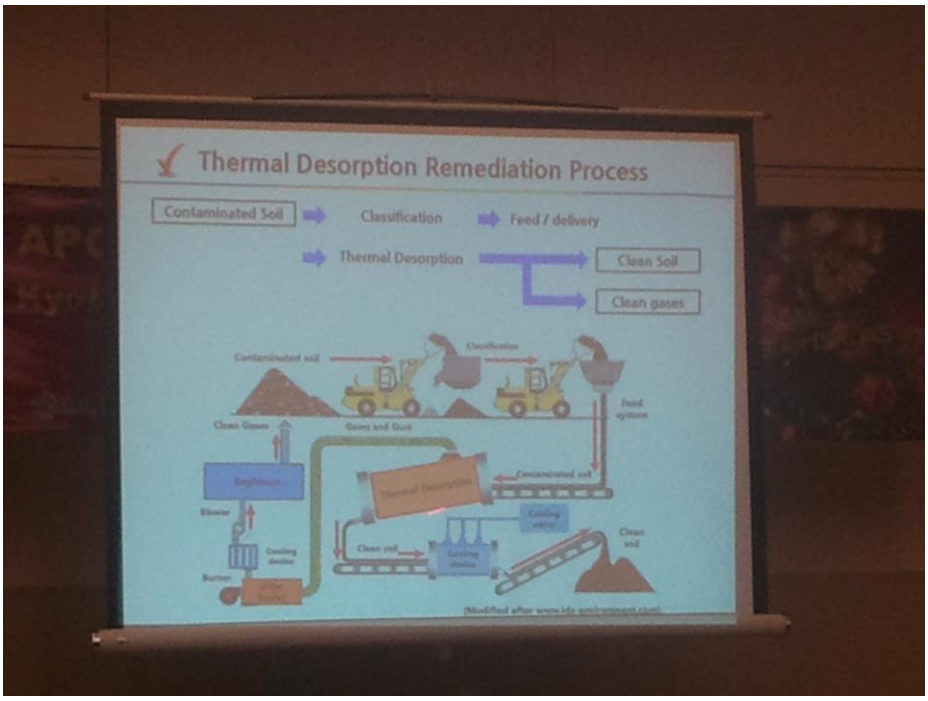

圖7 汙泥熱處理過程

圖8 熱處理設備示意圖

圖9 左側為未處理其濃度為50,000ppm，右側為微波處理後其結果為未檢出。

可饒性的氧化石墨烯-碳超級電容應用於穿戴材料

超級電容模組，具有高柔曲性（可折疊180度）、高穩定度、長壽命、大容量等特性，另可結合太陽能電池、二次電池、自行車發電機等成為完整能源系統。更可藉其撓曲性整合於隨身物品如衣服、背包、自行車袋包與定位紡織品上，成為輕薄、高容量、能隨時儲電之可攜式複合電源裝置，大幅提升相關能源產品應用性。其材料厚度為0.356mm時，性能與彎曲測試可達到最佳的穩定度。圖10為超級電容作用原理、圖11為合成方法。

超級電容優點所敘述如下：

1. Rapid charge-discharge time
2. High power density
3. Longer life
4. A simple electrical circuit

圖10 超級電容作用原理

圖11 超級電容合成方法

肆、建議

1.本次研討會焦點在討論環境工程與工業綠色材料上創新技術之發表，參與該類型研討會並學習如何應用於實際情況，可助於擴展研究體系的視野。建議公司同仁可多參與該發展類型的研討會。

2.土壤與重金屬整治包含物理、化學及生物方法的研究相當廣泛。本研討會中關於如利用植物修復系統可有效地整治重金屬污染土壤整治，微波熱處理方式節能方法，皆為現地復育需要考量的技術層面。

3.中油為台灣最大的石油能源公司，對於環境的議題矚目程度日益重要，提升環境的友善技術是社會的趨勢，不僅會是對企業形象的加分也對社會盡一份友善環境的心力。

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B0018	Factors Influencing Energy Intensity of Indian Cement Industry Hena Oak
B3002	Sustainable Watersheds: Assessing the Source and Load of Cisadane River Pollution Adipati Rahmat Gumelar, Abimanyu Takdir Alamsyah, Ida Bagus Hendra Gupta, Darul Syahdanul, and Daniel Mambo Tampi
B3007	Managing Good Safety Culture and Practices at the Polytechnic Joon Lin Chew, Mirko Stoll, Eric Tan, Boon Hwee Eng, and Hedy Goh
B0008	Techno-Economic Analysis of Hybrid Drainage Systems in South Australia Faisal Ahammed, Christian Somerville, Fergus Hamilton, and Robert Beardwell
F1002	Effects of Rainfall on Microbial Water Quality on Haeundae and Gwangan Swimming Beach Seoung-Hwa Choi, Seung-Min Lee, Gyeong-Seon Kim, Mi-Hee Kim,

	and Hwa-Seong Ji, Yu-Na Jeong, Eun-Chul Yoo and Jeong-Gu Cho
F1006	A Comparison of Different Models for Collection of WEEE in Europe Marcos Dieste, Arcione Ferreira Viagi, Roberto Panizzolo, and Stefano Biazzo
F1013	Environmentally Relevant Levels of Chromium induces Histopathological Changes in Duttaphrynus melanostictus Tadpoles Fernando, Vindhya Ashvinie Kulasena Fernando, Perera, I. C., Dangalle, C. D., Premawansa, S., Wijesinghe, M. R.
F2004	Issues in Recycling of Post Industrial Plastics Yushan Zhao
F2007	The Development Model of the Policy Alternatives in Controlling Air Pollution in the Jakarta Province – Indonesia Sri Listyarini and Lina Warlina

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F0026	MiSeq Sequencing Analysis of Prokaryotic Community Structures in Wastewater Treatment Plants in Eskisehir, Turkey Mehmet Burcin Mutlu and Nilgün Poyraz
F2005	Dynamic Model to Reduce the Impact of Climate Change on the environment and the Economy Lina Warlina and Sri Listyarini
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F0025	Eco-friendly treatment of Oil-contaminated Soil by Microwave Thermal Desorption Technology Taehoon Koh and Donggeun Lee
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B0007	Novel Proposed Biodegradation Pathways of the Organophosphate Trichlorfon by Aspergillus Sydowii PA F-2 Jiang Tian and Lanzhou Chen
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