出國報告（出國類別：國際會議）

參加第34屆國際鹵化持久性有機污染物研討會（2014戴奧辛年會）報告

服務機關：行政院環境保護署環境檢驗所

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派赴國家：西班牙

出國期間：103年8月31日至103年9月05日

報告日期：103年12月01日

摘要

第 34 屆國際鹵化持久性有機污染物研討會（通稱 2014 戴奧辛年會）會議，是全球最大的鹵化持久性有機污染物會議，在這個會議裡可與來自全球 800 多個科學家、學術界專家、企業和政府代表取得聯繫及進行進一步討論，在展場中亦可獲得所有最先進的技術與相關的化合物發展趨勢、充分擴展視野及其專業領域。

為持續了解國際持久性有機污染物研究趨勢、分析技術交流及收集最新研究成果，本所乃派員參加本（103）年於西班牙馬德里舉行第 34 屆國際鹵化持久性有機污染物研討會（通稱 2014 戴奧辛年會），除發表論文分享本所工作成果外，亦期望藉此大會吸取先進國家之經驗，提升本所分析技術並與國際潮流充分接軌。

參加本次大會之重要心得及建議如下：

一、 因應檢驗樣品特性分析濃度需求，本次儀器參展廠商發表新一代 GC-MS/MS，其儀器感度及解析度都已大幅提升到可以分析 ppt 及 ppq 濃度，而且與 GC/HRMS 有良好的比對性，甚至歐盟已在評估將其列為法規篩選法或確認方法，故建議本所優先評估建置本項技術。

二、 本所在戴奧辛及持久性有機污染物的分析技術上已有相當良好的基礎及充足的設備，故建議密切關注國際間對持久性有機污染物議題探討，並有效應用在國內相關議題之研究或相關檢測方法之開發。

三、 建議對國際間相關新興污染物應予持續性關注，目前已列入持久性有機污染物審議委員會（POPRC）審議中的化學品：短鏈氯化石蠟(Short-chained Chlorinated Paraffins, SCCPs)、多氯萘（氯化萘）(Chlorinated Naphthalenes, CNs)、六氯丁二烯(Hexachlorobutadiene, HCBD)及五氯苯酚及其鹽類和酯類(Pentachlorophenol, PCP)等應持續追蹤。

四、 第35屆國際鹵化持久性有機污染物研討會議預定於2014年8月23日~8月28日在巴西聖保羅(São Paulo, Brazl)舉行，期望本署及所內同仁有機會參與盛會，發表論文及吸收先進經驗。

目次

壹、目的

持久性有機污染物（Persistent Organic Pollutants, POPs）是指人類合成的化學物質，會持久存在於環境中、透過生物食物鏈而累積，進而對環境及人類健康造成危害影響。1997年聯合國環境規劃署（United Nations Environment Programme, UNEP）決定採取行動首批將12種POPs列爲管控重點，並推動國際條約「斯德哥爾摩公約」（Stockholm Convention），要求各國必須採取行動，減少環境中該等物質之殘留量，進而確保食品之安全。

首批列管之12種POPs包括阿特靈（Aldrin）、可氯丹（Chlordane）、滴滴涕（DDT）、地特靈（Dieldrin）、安特靈（Endrin）、飛佈達（Heptachlor）、六氯苯（Hexachlorobenzene）、滅蟻樂（Mirex）、毒殺芬（Toxaphene）等9種有機氯農藥，以及戴奧辛（Dioxin）、呋喃（Furans）及多氯聯苯（PCBs）等3種有機氯工業品和副產物。

此外，於98年5月4日第四次締約國大會（COP4）、100年4月第五次締約國大會（COP5）及102年5月第六次締約國大會（COP6）上， 決議納入了第2批9種、第3批1種及第4批1種新的POPs，包括α-六氯環已烷（Alpha hexachlorocyclohexane）、β-六氯環已烷（Beta hexachlorocyclohexane）、六溴二苯醚及七溴二苯醚（Hexabromodiphenyl ether and heptabromodiphenyl ether）、四溴二苯醚及五溴二苯醚（Tetrabromodiphenyl ether and pentabromodiphenyl ether）、十氯酮（克敵康，Chlordecone）、六溴聯苯（Hexabromobiphenyl）、靈丹（Lindane）、

五氯苯（Pentachlorobenzene）、全氟辛烷磺酸及其鹽類和全氟辛基磺醯氟（Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride, PFOS）、安殺番（Endosulfan）及六溴環十二烷(Hexabromocyclododecane, HBCD)等。

持久性有機污染物具有毒性、難以降解、生物累積性及具有蚱蜢效應（Grasshopper Effect）等特性，能經由不斷蒸發及沈降，在大氣至遠離污染源排放地區間傳遞，藉由空氣、水和遷徙物種作跨越國界的遷移，並沈積在遠離其排放源的地區。隨後在當地的陸域或水域生態系統中蓄積，就連在離污染源數千公里的北極、南極地區純淨的生物棲息地均難倖免。這些物質對野生動物會造成畸胎的發生、腫瘤、免疫力降低、生殖障礙等毒害，且已經有許多證據顯示長期暴露於高濃度的 POPs，對人體會增加畸形兒的比例、不孕、智能減退、致癌等機會，並會降低人體之免疫功能，使其較易受感染。POPs 亦能累積在人體組織內，再經由母體臍帶或受乳時之傳輸進入胎兒，而對發育中的胎兒產生影響。

環境檢驗所（以下簡稱本所）因應斯德哥爾摩公約進程，積極建立 POPs 檢測技術，於民國 84 年 8 月成立戴奧辛小組，先後建立戴奧辛/呋喃、戴奧辛類多氯聯苯、多溴二苯醚(polybrominated diphenyl ethers; PBDEs)及有機氯農藥（organochlorine pesticides, OCPs）等 POPs 之高解析氣相層析質譜儀（gas chromatography/high resolution mass spectrometry, GC/HRMS）分析技術。同時亦持續參與瑞典之國際實驗室比測及通過澳洲 NATA 認證，使本所之 POPs 超微量檢

測技術更具公信力。

為持續了解國際 POPs 研究趨勢、分析技術交流及收集最新研究成果，本所乃派員參加本（103）年於西安牙馬得里舉行第 34 屆國際鹵化持久性有機污染物研討會（俗稱 2014 戴奧辛年會），除發表論文分享本所工作成果外，亦期望藉此大會吸取先進國家之經驗，提升本所分析技術並與國際潮流充分接軌。

貳、過程

第 34 屆「國際鹵化持久性有機污染物研討會(The 34rd International Symposium on Halogenated Persistene Organic Pollutants)」於 103 年 8 月 31 日至 9 月 5 日假西班牙馬德里 Meliá Castilla hotel 飯店（如圖 1）舉行。本屆大會包含約 42 個國家專業人士與會，而發表之論文涵蓋 42 項議題，總數達約 900 多篇（其中口頭宣讀 325 篇；其餘爲壁報展示）。

圖 1 大會會場西班牙馬德里 Meliá Castilla hotel 飯店及演講聽

本次研討會分成口頭論文宣讀及壁報論文展示二種。口頭論文宣讀部分共分 5 個場地同時進行，每天每個場地可發表約 15 篇論文，進行方式是使用 Power Point 簡報軟體進行 15 分鐘簡報，然後接受 5 分鐘提問；壁報論文部分因數量較多，分別於 9 月 1、2 及 4 日 3 梯次展示（每梯次 1 天）。此次大會將儀器展示與壁報展示安排在不同樓層但極爲相近，讓參觀者可以在論文宣讀時段能方便移動參觀兩種展示。

大會於 8 月 31 日（星期日）中午就開始受理報到，並開始有儀器廠商辦的周邊會議（Side meeting）介紹最新技術訊息，這樣的周邊會議共有 5 場（集中在 8

月 31 日下午），8 月 31 日晚上大會安排第 1 場非正式的接待晚宴，讓與會者在輕鬆的氣氛下進行交誼；而 9 月 01 至 04 日是論文及大廳專題演講發表時間；而 9 月 5 日閉幕典禮前，更邀請位專家對 5 天來的主要議題做重點回顧；另外，大會安排所有今年參加口頭論文學生上台做 3~5 分鐘的心得分享，各國優秀學生大談理想及抱負，贏得全場熱烈迴響!!

2015 年會主辦單位巴西團隊，也精心播放簡報與影片，並誠摯邀請大家明年與會；整個大會於 9 月 5 日中午劃下完美的句點。

參、心得

一、本次研討會分 8 個場地（1 個大會演講廳、5 個口頭論文宣讀廳及 1 個壁報論文及 1 個儀器展示場地）舉行，大部分活動場地在 Meliá Castilla hotel 飯店的一樓，**大廳左側主要爲壁報論文及儀器展示場地，大廳右側主要報到櫃檯及**口頭論文宣讀廳**場地**，由於距離不遠，所以人員趕場時十分方便。2014 戴奧辛年會主辦單位對外聯絡主要途徑是主要是經由網際網路，網址爲 http://www.dioxin2014.org 。由網站中可獲得主辦單位的邀請函、主辦城市簡介、氣候、如何註冊參加研討會、論文投稿相關格式、截止日期、主辦人員……等絕大部分訊息。

二、本次戴奧辛年會論文內容涵蓋 11 大主題。各主題及所涵蓋之副主題如下：

Monday 1 September 2014

09:00 - 09:30	Opening ceremony	Auditorio
09:30 - 10:15	Plenary session —Prof Joan Grimalt	Auditorio
10:15 - 10:45	Coffee break & exhibition	
10:45 - 12:45	New screening methods and novel instrumental techniques	Auditorio
	Bioanalytical approaches for POPs detection	Comendador
	Sustainable production and use	Doblón
	Biomonitoring in humans I	Castilla
	POPs in terrestrial and freshwater ecosystems	Hidalgo
12:45 - 13:45	Lunch & exhibition	
	Lunch seminar presented by Agilent Technologies	Escudo
13:45 - 15:25	Multidimensional analytical techniques and other novel techniques	Auditorio
	Unintentional formation of POPs	Doblón
	POPs in developing countries	Comendador
	Advances in passive sampling for air and water	Hidalgo
	Biomonitoring in humans II	Castilla
15:25 - 16:00	Coffee break & exhibition	
16:00 - 17:20	Multidimensional analytical techniques and other novel techniques	Auditorio
	Halogenated natural products and chiral pollutants	Doblón
	Is TBBPA safe?	Hidalgo
	Food and feed. Evaluation of dietary intake I	Castilla
	Exposure to POPs in Vietnam	Comendador
17:20 - 18:30	Poster session 1	Poster Area
19:30 - 21:30	Welcome reception *Supported by CIL*	Cecilio Rodríguez Gardens, Retiro Park

Tuesday 2 September 2014

08:30 - 09:15	Plenary session —Dr. Antonia Calafat	Auditorio
09:15 - 09:55	Coffee break & exhibition	
09:55 - 12:15	Ten years of global monitoring under the Stockholm Convention on POPs: Trends, sources and transport modelling I	Auditorio
	Industrial, occupational and accidental exposure	Doblón
	Formation, inhibition and destruction of non dioxin-like compounds	Comendador
	Occurrence in sediments, soils and water I	Castilla
	Food and feed. Evaluation of dietary intake II	Hidalgo
12:15 - 13:30	Lunch & exhibition	
	Lunch seminars presented by Bruker & Thermo	Comendador & Escudo
13:30 - 15:10	Ten years of global monitoring under the Stockholm Convention POPs: Trends, sources and transport modelling II	Auditorio
	Innovative sampling strategies and sample preparation I	Castilla
	Sources and emission inventories	Hidalgo
	Risk assessment, management and communication	Doblón
	Non-target and emerging contaminant analysis	Comendador
15:10 - 15:40	Coffee break & exhibition	
15:40 - 17:20	Epidemiology and burden of disease	Comendador
	Sources, transport, bioaccumulation and fate of legacy and emerging organic pollutants in the marine environment. From coastal regions to the global oceans	Doblón
	Food and feed. Evaluation of dietary intake III	Hidalgo
	Contamination of persistent toxic substances (PTS) in Asian countries	Auditorio
	Innovative sampling strategies and sample preparation II	Castilla
17:20 - 18:30	Poster session 2 Sponsored by Pacific Rim	Poster Area

Wednesday 3 September 2014

08:30 - 09:15	Plenary session — Professors Barra/Giang/Heindrik	Auditorio
09:15 - 09:45	Coffee break & exhibition	
09:45 - 12:05	POPs in marine ecosystems	Doblón
	Toxicology and mechanisms I. Dioxins and dioxin-like chemicals	Castilla
	Occurrence in sediments, soils and water II	Auditorio
	Pseudo-POPs: Non persistent but persistently in the environment	Comendador
	Indoor exposure	Hidalgo
12:30 - 18:30	Symposium tours	

Thursday 4 September 2014

08:30 - 09:15	Plenary session —Prof Jacob de Boer	Auditorio
09:15 - 09:45	Coffee break & exhibition	
09:45 - 12:05	Formation, inhibition and destruction of PCDD/Fs I	Auditorio
	Atmospheric levels, transport and deposition	Castilla
	Regulatory aspects of POPs	Hidalgo
	Integrating toxicology and epidemiology for risk assessment	Comendador
	Modelling of environmental fate, transport and sources	Doblón
12:05 - 13:15	Lunch & exhibition	
	Lunch seminar presented by Agilent Technologies	Escudo
13:15 - 15:15	Formation, inhibition and destruction of PCDD/Fs II	Auditorio
	Biomarkers of exposure and effect. From individual to population level	Comendador
	QA/QC, interlaboratory studies, reference materials	Doblón
	Halogenated flame retardants in the environment from PBDEs to OPFRs and other emerging alternatives I	Castilla
	POPs in remote areas I	Hidalgo
15:15 - 15:45	Coffee break & exhibition	
15:45 - 17:25	Formation, inhibition and destruction of PCDD/Fs III	Auditorio
	Toxicology and mechanisms II. Other POPs	Comendador
	Food web studies. Bioaccumulation and biomagnification	Doblón
	POPs in remote areas II	Hidalgo
	Halogenated flame retardants in the environment from PBDEs to OPFRs and other emerging alternatives II	Castilla
17:30 - 18:30	Poster session 3	Poster Area
20:00	Gala dinner	Casino de Madrid

Friday 5 September 201

10:00 - 12:00	Summary and future outcomes. Students and mentors	Audito
12:00	Otto Hutzinger student awards	
12:15	Welcome to Dioxin 2015	
12:30	Closing remarks and farewell cocktail	

大會演講議題及口頭宣讀場地

各主題及所涵蓋之副主題如下：

1. Analytical chemistry	2. Environmental Transport & fate
A. Advances in instrument techniques B. Non-target and emerging contaminant analysis C. New screening and rapid methods D. Sampling and sample preparation methods E. QA/QC and interlaboratory studies F. Development and validation of bioanalytical methods G. Chiral compounds H. Others	A. Passive sampling approaches and applications B. Modeling of environmental fate, transport and sources C. Atmospheric deposition, fate and sources D. Indoor environments E. Long range transport F. Transfers between environmental compartments G. Mathematical modeling H. Others
3. Sources, formation and transformation	**4. Environmental levels**
A. Source and emission inventories B. Fingerprinting, sources and processes C. Formation and degradation processes and products D. Biological, chemical & photolytic transformation E. Thermal sources and formation processes F. Industrial formation G. Emission reduction methods and control	A. Temporal and spatial trends B. Mass balance C. Ambient air concentration D. Levels in soil and water E. Levels in industrial matrices F. Levels in vegetation, animals and food/feed G. Levels in marine biota H. Bioaccumulation and food web studies

technologies

H. Site clean-up

I. Natural halogenated compounds

J. Others

I. Others

5. Toxicology

A. Endocrine disruption (target and mechanism)

B. Toxicokinetics (ADME of POPs)

C. Biochemistry and molecular biology (mechanism)

D. Carcinogenicity

E. Developmental/Reproductive toxicology

F. Immunotoxicology

G. Neurotoxicology

H. mixture toxicity

I. Toxicity of Metabolite

J. Structure and function of the Ah-receptor

K. Others

6. Ecotoxicology

A. Bioaccumulation

B. Biomagnification and secondary poisoning

C. Biomarkers of exposure in the field

D. Reproductive effects

E. Marine ecosystem

F. Population effects

G. Others

7. Human Biomonitoring

A. Indoor environment

B. Work environment

C. Dietary intake

D. Levels and trends

E. Body burden

F. Others

8. Epidemiology

A. Cancer

B. Reproduction

C. Functional development

D. Neurological disorder in children

E. POPs and other diseases

F. Others

9. Risk assessment	**10. Regulation, Policy and life cycle management**
A. Toxic equivalent factor B. Comparative toxicity C. Dose-response relationships D. Species differences E. Mathematical modeling F. Environmental risk factor G. Toxicological interaction H. Others	A. Regulation and policy of POPs B. Risk management and communication C. Sustainable production and use D. Remediation and assessment of contaminated areas E. Others
11. Special Sessions	
S-1. Indoor Contamination with Flame Retardant Chemicals: Causes and Impacts. S-2. Integrating Toxicology and Epidemiology for Risk Assessment S-3. Contamination of persistent toxic substances (PTS) in East-Asian Countries S-4. Organosilicon compounds in the environment: analysis, source, and environmental fate S-5. Key findings from EU-funded project (SYSTEQ) S-6. Environmental Contaminants Exposure and Molecular Changes in Wildlife and Humans S-7. PFASs updates - global distribution and fate of perfluoroalkyl substances S-9. BAT/BEP session	

三、大會在 9 月 1~4 日期間，每天上午第一項議程均是在主會議廳安排針對所有與會者的專題演講（Plenary Lecture），講員分別由西班牙、美國、智力、南非、荷蘭及中國 6 位國際重量級的持久性有機污染物專家擔綱，場場精彩，座無虛席。4 場專題演講時間、講員、主題及內容簡要介紹如下：（講員英文

簡歷與專題演講摘要皆可由大會官方網站免費下載取得）

Time : 9:45 – 10:30 (45min.)SEP. 01 (Mon)

Prof. Joan O. Grimalt

Lecture Title : Impacts and potential effects of DDT reintroduction against malaria in African populations .

在 2005 年之後 DDT 被引入許多非洲國家藉以打擊瘧疾媒介的病媒蚊。

Prof. Joan 此次的報告主要是著重在對新生兒的影響研究，臍帶血中農藥濃度的高低反映新生兒從他們母親累積的風險，而且是持續的接觸。研究團隊在 2010 年從 Manhiça（莫桑比克）招募參與研究的母親及其新生兒，他們已持續四年在室內噴灑 DDT 用以消滅滯留的蚊蟲。其他的研究團隊在 2003-2006 年期間也做了類似的研究。調查結果顯示該殺蟲劑和其代謝物的濃度有顯著增加，這四年中暴露於高濃度滴滴涕的孩子與同樣來自 Manhiça 其他地區的相比，其認知技能受到明顯影響，而 DDT 暴露對健康的影響也做了評估。據資料顯示，這些 DDT 污染物可能是顯著的神經毒物。

Time : 9:00 – 9:45 (45min.) SEP. 02 (Tue)

Dr. Antonia M. Calafat

Lecture Title : Human exposure to POPs: Past, Present and Future.

本報告中提及過去，現在和未來針對持久性有機污染物，使用生物監測數據

建立參考範圍，以提供暴露數據用於風險評估和監控風險的挑戰。生物監測，運用生物標本對環境中的化學物質進行測量，用於調查持久性有機污染物和他們的替代化學品的暴露風險，是一種強大的工具，雖然生物監測數據本身無法提供對健康影響的信息，但生物監測的研究對環境暴 露和健康關聯性的探討至爲重要。本場次發表演講，座無虛席，走道全部都是聽眾，非常精采。

Time : 9:00 – 9:45 (45min.) SEP. 3 (Wed)

Prof. Hindrik Bouwman ,

Prof. Ricardo Barra ,

Prof. Jiang Guibin ,

Lecture Title : POPs in developing regions:Are the priorities changing?

這個場次分別由南非 Prof. Hindrik Bouwman、智利 Prof. Ricardo Barra 及中國 Prof. Jiang Guibin 三位學者分別發表 POPs 在其國家發展趨勢，Bouwman 教授是應用於各種生物系統生態毒理學教授。Bouwman 教授一直密切參與關於斯德哥爾摩公約和持久性有機污染物審查委員會（POPRC）的談判。在 Orange River 流域持久性有機污染物的代表項目，DDT 對人類健康，POPs 分析技術與儀器的演進史等。**Prof. Jiang Guibin** 是在中國新興的有機污染物研究的先驅者之一，他主要發表在中國的環境已發現了幾個新的持久性有機污染物的情形及相關趨勢等。

Time : 9:00 – 9:45 (45min.)09. 04 (Thu)

Prof. Joan O. Grimalt

Lecture Title : **No Risk for Public Health**

Prof. Joan O. Grimalt 教授是環境化學和毒理學研究重量級學者，他的專題演講著重在健康風險計算、評估以及管理等策略探討。在這份報告中，**Grimaltr 教授**簡要概括最近的研究調查成果，他也相信未來這塊領域的研究發展與計畫產出會更加蓬勃。

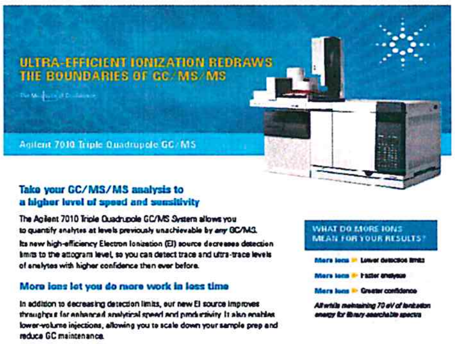
四、現場儀器展示參觀心得

本次大會亦安排現場儀器展示，許多戴奥辛類化合物分析相關廠商都有參與設攤，介紹最新的技術發展及其產品。我也利用一些論文發表的空檔時間去參觀這些攤位。參觀心得摘述如后：

(一)、目前分析戴奥辛類化合物高解析氣相層析質譜儀（GC/HRMS）只有Thermo、Waters 及 JEOL 三個廠牌的產品。這三個廠商在本屆大會均有設攤，我也都一一前往參訪。惟參訪後發現 2014 年的這 3 廠牌最新 GC/HRMS 機種，功能提昇有限，價格扔要一千多萬；但 Thermo 及 Agilent 最新的 GC-MS/MS 機種則是今年的新亮點，於是我分別參加這兩家產品說明會。

1、09/02 Thermo 公司產品說明會，先前在介紹今年年會的周邊會議及新儀器分析技術時，已提到新一代 GC-MS/MS 的感度及解析度都已提升到可以分析 ppt (parts-per-trillion,10^{-12}) 及 ppq (parts-per-quadrillion,10^{-15})濃度，而且 GC-MS/MS 測值與 GC/HRMS 有良好的比對性。Thermo 公司的機種 TSQ8000 GC-MS/MS，主要分析食品樣品的機種，體積小、操作簡單、維護容易及價格更具競爭力，會後也跟廠商洽詢相關發表文獻及資料希望能帶回單位參考。

2、09/04 Agilent 公司產品說明會， Agilent 7890 一樣都比 GC/HRMS 體積小、操作簡單、維護容易及價格相對便宜，而且感度也達到 ppq level，在本次年會裡也看到比利時 Dr. Jeff 團隊發表的食品與飼料戴奧辛類化合物分析成果，因此 2014 年它也絕對是 GC/HRMS 地位的強力挑戰者之一。



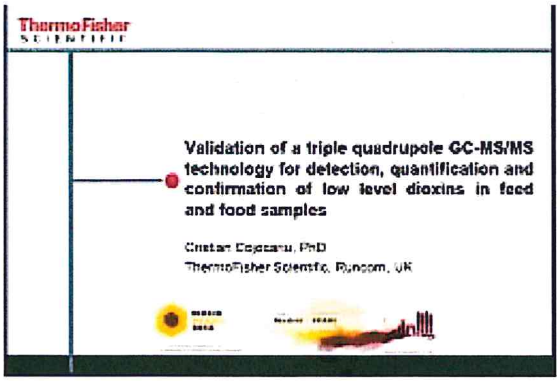


圖 3 Thermo 公司產品說明會　　圖 Agilent 公司產品說明會

(二)、參觀全自動淨化系統 FMS（Fluid Management System, inc.）

負責解說的是 Phil 博士，他曾在 2005 年本所戴奧辛小組採購 Power-Prep™ 及去年有機小組購入 PLE 時，均曾來所裝機及執行技術轉移，故熟識親切。我發現今年發表論文有不少實驗室採用 FMS 相關自動化設備之硬體與耗材，在 Phil 博士深入的介紹下，我更加了解新一代 PLE 與 Power-Prep™ 的功能，該公司新開發相關自動化設備，體積變小空間更加節省，操作也更簡單。不過 FMS 相關自動化設備之硬體與耗材價格仍是偏高，讓一般的商業實驗室較難成爲其客戶，這與本所目前使用 CAPE 公司酸性矽膠-活性碳複合管柱價格上相去甚遠。

圖 FMS 公司攤位與 Phil 博士合影

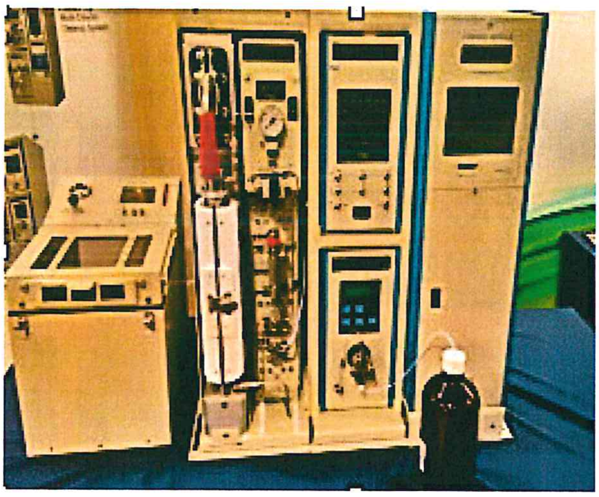


圖 6 自動淨化系統

五、閉幕典禮

爲期六天的 2014 西班牙馬德里奧辛年會，在 9 月日中午畫下完美的句點。

但在閉幕典禮前仍有高潮活動，大會特地安排本屆口頭宣讀學生上台進行5~10 分鐘演講，來自世界各地優秀學生，每人就論文發表重點再一次聚焦回顧，並點出該主題之未來挑戰，各個學生精彩絕無冷場，其中有一位中國學生在大會的投影版秀出「Our students，Our future!!」，強烈企圖心令人震撼!!這也使會議廳即使到了最後一天仍是人氣旺盛，這樣的安排既專業又熱鬧，很值得國內研討會效法。第 35 屆國際鹵化持久性有機污染物研討會議預定於2015 年 8 月 23 日~8 月 28 日在巴西聖保羅舉行，相關網址資料爲www.dioxin2015.org（網站影像如下圖）。期望本署及所內同仁有機會參與盛會，發表論文及吸收先進經驗。2015 年會主辦單位網站主網頁上的邀請函如下：

2015 年會主辦單位網站

肆、建議

一、 因應檢驗樣品特性分析濃度需求，本次儀器參展廠商發表新一代 GC-MS/MS，其儀器感度及解析度都已大幅提升到可以分析 ppt 及 ppq 濃度，而且與 GC/HRMS 有良好的比對性，甚至歐盟已在評估將其列爲法規篩選法或確認方法，故建議本所優先評估建置本項技術。

二、 本所在戴奧辛及持久性有機污染物的分析技術上已有相當良好的基礎及充足的設備，故建議密切關注國際間對持久性有機污染物議題探討，並有效應用在國內相關議題之研究或相關檢測方法之開發。

三、 建議對國際間相關新興污染物應予持續性關注，目前已列入持久性有機污染物審議委員會（POPRC）審議中的化學品：短鏈氯化石蠟 (Short-chained Chlorinated Paraffins, SCCPs)、多氯萘（氯化萘）(Chlorinated Naphthalenes, CNs)、六氯丁二烯 (Hexachlorobutadiene, HCBD)及五氯苯酚及其鹽類和酯類(Pentachlorophenol, PCP)等應持續追蹤。

四、 第 35 屆國際鹵化持久性有機污染物研討會議預定於 2014 年 8 月 23 日~8 月 28 日在巴西聖保羅(São Paulo, Brazl)舉行，期望本署及所內同仁有機會參與盛會，發表論文及吸收先進經驗。

伍、參考資料

一、 環境保護署持久性有機污染物（POPs）資訊網站，http://ivy1.epa.gov.tw/Dioxin_Toxic/NewDefault.aspx

二、 第 34 屆「國際鹵化持久性有機污染物研討會」論文集。

三、 第 34 屆「國際鹵化持久性有機污染物研討會」網站，http://www.dioxin2014.org。

四、 翁英明，參加第 32 屆國際有機鹵化環境污染物及持久性有機污染物研討會（2011 戴奧辛年會）報告，行政院環境保護署環境檢驗所，中華民國 101 年 12 月。

附件 1 本次大會本所發表論文 1 篇

The Evaluation of Organochlorine Pesticides in Tissue and Sediment in Estuary of Taiwan

Hsu YC[1], WU CP[1], Sung YY[1], Tsai CL[1], Chen YW[1], Weng YM[1], Chi KH[2]

[1]Environmental Analysis Laboratory, Taiwan EPA, Chungli, Taiwan 320; [2] Institute of Environmental and Occupational Health Sciences, National Yang Ming University

Introduction

Persistent Organic Pollutants (POPs) are those compounds that persist in the environment. They can transport across a long distance and tend to bioaccumulate in human or animal tissue through the food chains. Consequently, residual POPs have great chance to cause significant impacts on human health and the environment. The health hazard effect of POPs has been thoroughly debated in recent years resulting in a consensus agreement of the Stockholm Convention on Persistent Organic Pollutants in 2001, which prohibit the production and use of these chemicals. Some POPs have been widely used as pesticides for long. Organochlorine pesticides such as DDT, BHC, Lindane have been banned in Taiwan since 1977. In the same time, EPA Taiwan has been carrying out a systematic tracking on the residual concentration of organochlorine pesticides in environment with analytical tools such as GC/ECD for the past thirty years. Recently, we start to use the isotope dilution method by HRGC/HRMS to analyze organochlorine in environmental samples so as to determine the residual POPs in a more accurate way. We have collected 54 sediment samples and 54 tissue samples from some representative estuaries of Taiwan. The average POPs concentration in sediment and tissue samples are 709 ng/kg d.w and 4255 pg/g w.w. separately. The concentrations ranged 57.5~3970 ng/kg d.w. and 149~75300 pg/g w.w. in sediment and tissue. The highest POPs level is found in the sample of western estuary though still well below the official risk threshold limit. Hexachlorobenzene, DDE and DDT are detected in more than 90% of the sediment samples, while Hexachlorobenzene, DDE, DDT, Cis-Chlordane, Trans-Nonachlor, Dieldrin and Mirex are detected in more than 90% of the tissue samples. The ratio of DDT and its metabolites can be served as indicators for possible liable sources as well as the degree of degradation. The ratio of p,p'-DDT/(p,p'-DDT+p,p'-DDE) of all samples are found to be lower than 0.60 which imply that these DDT contamination in estuary of Taiwan might originate from aged pollutants in the long past.

Material and methods

(1) Sample collection, extraction and clean-up

Samples were collected from 9 selected representative estuaries of Taiwan. 6 sampling sites were chosen for each estuary as shown in Fig.1. Sampling were carried out in spring and autumn season. The 9 rivers cover almost all essential agricultural area of Taiwan. Therefore the level of organochlorine of estuary will reflect the use of pesticides. All samples were dried, ground and homogenized before being spiked with 13C-isotopes of the analyzed compounds and extracted by Soxtherm with (1+1)Acetone/n-Hexane solvent mixture. Target compound standards and isotope labeled spiking solution were purchased from Chembridge Corporation. The extracts were concentrated to about 1 mL by turbo evaporation and then replaced their solvent with 1 mL hexane for the need of subsequent pretreatment process. Proceed the clean up step with Florisil SPE column. Gel permeation chromatography can be used to remove high molecular weight interference (such as polymeric materials, humic acids, lipids and so on).

(2) HRGC/HRMS analysis

Results and discussion

The concentrations of 23 organochlorine pesticides in estuary samples ranged between 57.5~3970 ng/kg d.w. in sediment and 149~75300 pg/g w.w. in tissue. The average concentration are 709 ng/kg d.w and 4255 pg/g w.w. in sediment and tissue separately.

Organochlorine pesticides concentrations in most sediment samples are below 500 ng/kg d.w.. However in the case of tissue samples, the concentrations scattered in a wide range for samples from different organism species and ages. The lowest average concentration in sediment is the one from Hualien(82.0 ng/kg d.w.). Sediment samples from Sihcao and Wuwei both have much higher OCP concentrations than those from other locations. Sample from one site of Sihcao estury reached up to nearly 4000 ng/kg d.w.. It is quite different than other sites of that estuary. On the other hand, sediment samples from four sites of the Wuwei estuary are over 2000 ng/kg d.w.. Analyzed results of tissue samples collected from Sihcao and Wuwei are about the same.

Wuwei estuary has been disconnected from the sea since the two typhoon calamities in 1942 and 1968. There is no tidal dilution since then and it explains the relatively higher concentrations over the whole estuary area(6 sample sites).

Organic pollutants tend to adsorb on sediment particles and be carried down along the water bodies. Particles of different characteristics will migrate to different locations depending on their sizes and densities. Tidal and currently flushing will also move the sediment according to the geographical features in the tidal flat. Therefore, concentrations are widely varied for different sampling sites where tidal frictions present. Take the case of Sihcao estuary for example, among the 8 sampling sites as shown in Fig. 2, we found that the sediment sample of A4 site has a significant higher OCPs content than other 7 sites. A4 site is a typical river delta that accumulates the sediment from the upstream pollution sources. Tidal dilution is also less than those sites near the seawater such as A5 or A8.

As the highest concentration of Sihcao and Wuwei are about in the same level, we can estimate the concentration of organochlorine pesticides in the estuaries of Taiwan have been reduced to approximately 20% of their original levels during the past forty years. Average concentration distributions of each congener for the 23 organochlorine pesticides in sediment and tissue samples are illustrated as shown in Fig.3 and Fig.4.

Some of previous research works revealed that the half-lifes of DDTs are about two years or more in soil. However, they will last longer even more than eight years in tissue before being metabolized to DDDs and DDEs. The largest portion of OCPs is p,p'-DDE (30% in sediment and 35.7% in tissue). p,p'-DDT and p,p'-DDD also accounted for more than 10% each. Residual data of these congeners reflects the widely usage of DDTs in the past. Nevertheless, the concentrations of DDTs in sediment (125 ng/kg d.w.) and tissue (884 pg/g w.w.) found in the estuaries of this investigation are far below the regulated level for sediment (0.01 mg/kg d.w.).

FDDTe is a frequently used indicator for the degree of DDT degradation as show below:

FDDTe = p,p'-DDT/(p,p'-DDT + p,p'-DDE)

For the fresh DDT, the FDDTe will generally fall within the range of 0.95-0.99. On the other hand, aged DDT contamination usually exhibits lower values. As illustrated in Fig.5, all FDDTe indices are lower than 0.60 which implied that no fresh DDT input into the environment is found.

The concentration distribution of four BHCs in sediment and tissue are about of the same level. Lindane accounted for about 40% , possibly due to that the banning of Lindane was late than other BHCs for about ten years in Taiwan. The levels of chlordane are much lower and are in consistent with the levels of nonachlor in sediment. However, the levels of chlordane in tissue (348 pg/g w.w.) are much higher than those of nonachlor(38 pg/g w.w.). It might be reasonably attributed to the slower metabolism of chlordane in the tissue of organisms.

Acknowledgments

We would like to express our deep gratitude to the support from the Soil and Groundwater Fund Management Board of Taiwan EPA.

Reference

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2.Kurt-Karakus, P. B., Bidleman, T. F., Staebler, R. M., Jones, K. C. Technol. 2006;40: 4578-4585.
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Table 1 Summary of Total OPPs concentration in estuary sediment ~~of estuary~~

Location	Sampling sites	Sample	Concentration range (ng /kg d.w.)	Average (ng /kg d.w.)
Sihcao	8	8	342~3970	1231
Beigang	6	6	195~545	396
Puzi	6	6	109~1199	427
Bajhang	6	6	98.2~756	366
Zengwun	4	4	139~457	258
Chiku	6	6	81.7~460	263
Lanyang	6	6	148~544	344
Wuwei	6	6	883~3959	2691
Hualien	6	6	57.5~162	82.0

Table 2 Summary of concentration in tissue of estuary.

Location	Sampling sites	Sample	Concentration range (pg /g w.w.)	Average (pg /g w.w.)
Sihcao	8	10	1080~75300	9243
Beigang	6	10	97.3~13340	396
Puzi	6	8	103~23855	3681
Bajhang	6	8	149~2538	875
Lanyang	6	6	877~5055	2217
Wuwei	6	6	2608~8941	5776
Hualien	6	6	1427~2927	2159

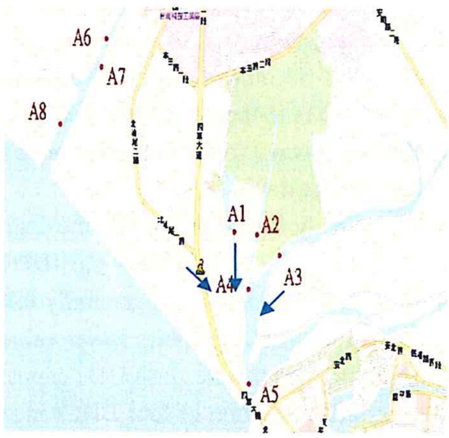


Figure 1 Location of the 9 sampling estuaries. **Figure 2 Location of the 8 sample sites of Sihcao.**

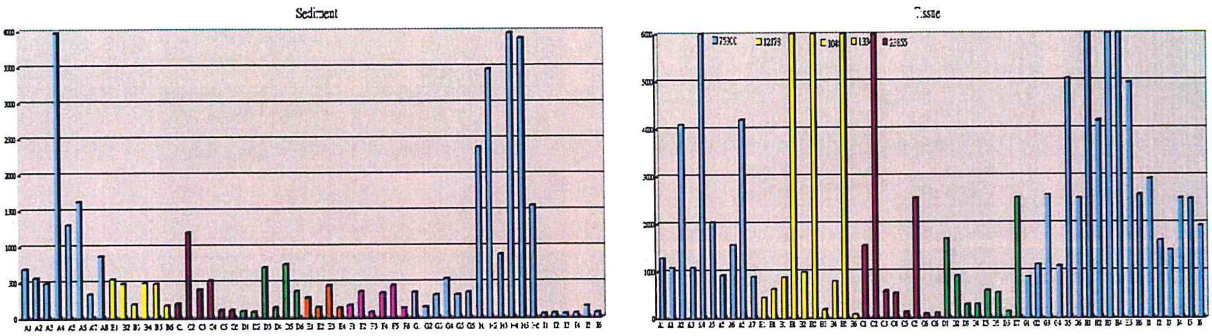


Figure 3 Total concentrations of 23 organochlorine pesticides in estuaries.

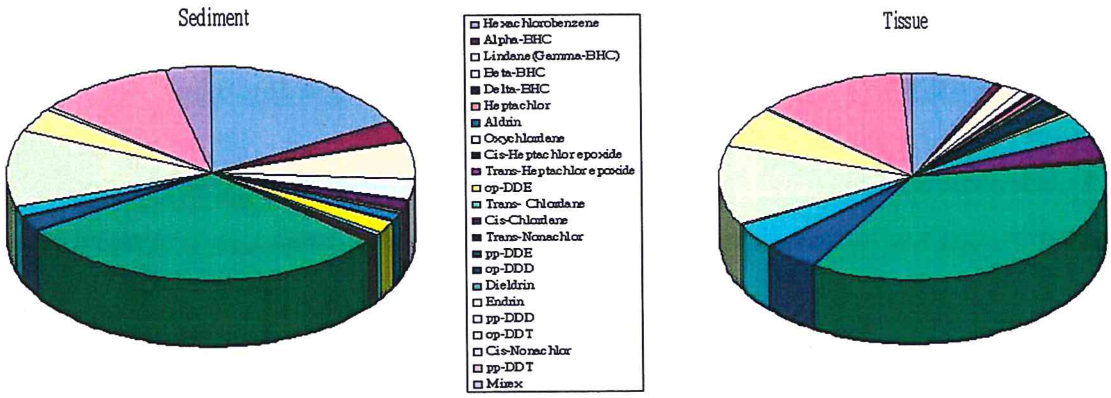


Figure 4 Average concentration distributions of 23 organochlorine pesticides in samples.

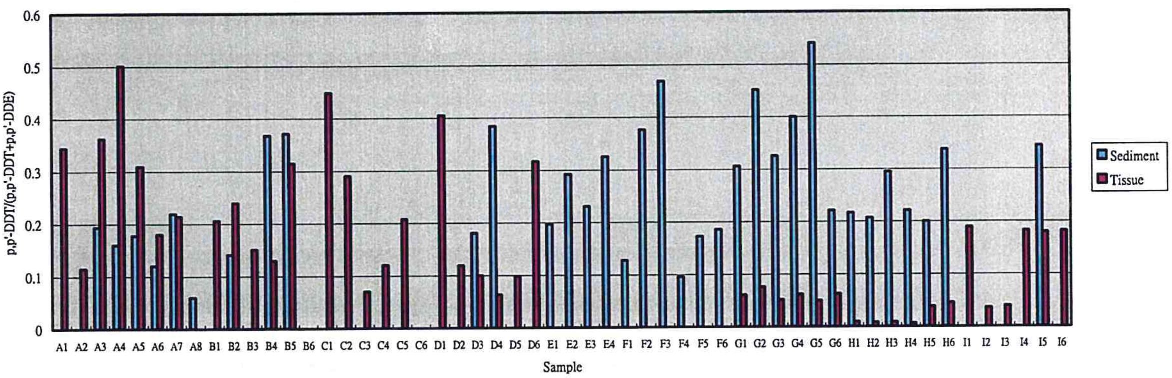
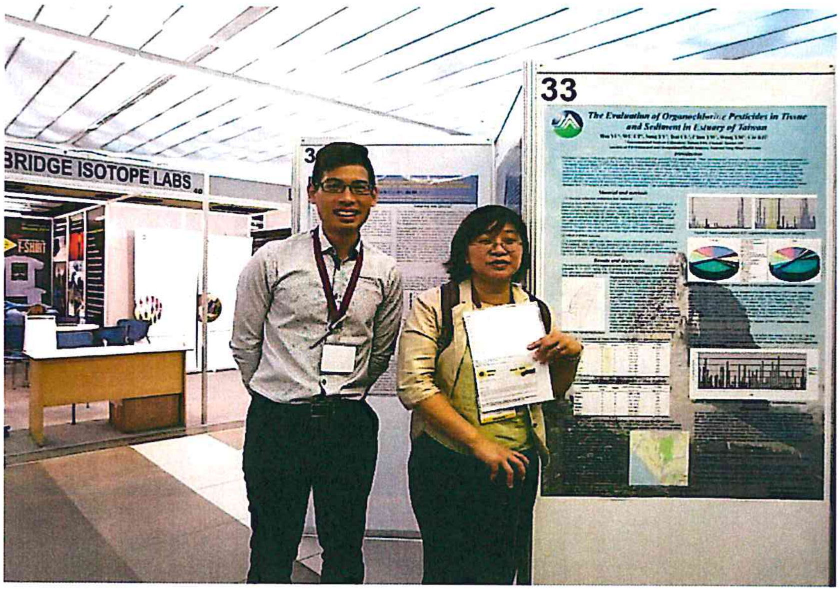


Figure 5 Index for evaluating the degradation of DDT in sediment and tissue.



Poster presentation: Monday 1 September 2013 17:20–18:30 hours

附件 2　本次參加會議之出國心得報告(2014.10.24)

出國心得進行業務簡報，與同仁進行知識分享