出國報告(出國類別：其他)

參加第 8 屆
國際食品分析最新進展研討會

服務機關：衛生福利部食品藥物管理署
姓名職稱：張嫻楨技士
派赴國家：捷克
出國期間：106 年 11 月 5 日至 11 月 13 日
報告日期：107 年 1 月 22 日

摘　要

「國際食品分析最新進展研討會(International Symposium on Recent Advances in Food Analysis, RAFA)」是近年食品分析領域成長快速的知名國際研討會，該研討會成立於 2003 年，每 2 年舉辦一次，希望藉由出席該研討會了解食品分析檢驗之最新趨勢，並與各國專家建立人脈，促進未來交流互訪，以與國際接軌。筆者於 106 年 11 月 7 日至 11 月 10 日奉派前往捷克布拉格參加 RAFA 第 8 屆會議，並於會中發表一篇壁報論文「Method of Test for Photoinitiators of Ink in Food」，展現本署於食品分析領域中之研究成果，並提高臺灣食品分析技術之能見度。研討會為期四天，共有 23 個專題，所有專題演講及廠商之儀器應用教學，總共安排有 138 場演講。壁報論文部分，共有 465 篇壁報論文發表。主題內容豐富且多元，涵蓋天然毒素、食品接觸物質、加工製程汙染物、農藥、動物用藥及食品攙偽等相關議題，與本署研究主題有高度相關。本次報告摘錄與本署近年研究有關之重點，包含：利用高解析度質譜儀進行非有意添加物質之解析方法、因應歐盟政策之食品及飼料中汙染物分析之挑戰及利用離子遷移光譜技術進行蛋製品新鮮度之快速篩檢方法等，共 4 篇專題演講及 2 篇壁報論文。由各演講及壁報論文可見高階檢驗儀器之應用已越來越普遍且快速篩檢方法之開發也越來越受到重視。藉由參加本次研討會，筆者於短時間內學習到許多檢驗新知，獲益良多。此外，也將相關資訊提供予本署同仁，以提升本署檢驗能力與技術層級，並與國際接軌。

目　次

壹、目的

「國際食品分析最新進展研討會(International Symposium on Recent Advances in Food Analysis, RAFA)」成立於 2003 年，固定每 2 年在捷克布拉格舉辦，今年為第八屆，此研討會是近年食品分析領域成長快速的知名國際研討會，參加者來自於世界各地，主要為學術界、產業界、管理機構及政府之代表，是歐洲食品分析領域重要的年度盛會。本屆研討會主題涵蓋天然毒素、食品接觸物質、加工製程汙染物、農藥、動物用藥及食品攙偽等相關議題，與本署檢驗業務高度相關，藉由出席該研討會可了解食品分析檢驗技術之最新趨勢，學習並引進最新尖端食品檢驗技術，以深耕國家實驗室之能力與技術層級，俾利與國際接軌。研討會活動形式包括專題演講、綜合討論及壁報論文展示等，透過活動中之互動交流，以與歐洲官方實驗室等單位專家建立聯繫管道，擴增國際人脈，促進未來實驗室互訪、邀請來台演講及技術交流等契機。

另外，亦藉由此次研討會發表本署於食品分析領域中一項研究成果「Method of Test for Photoinitiators of Ink in Food」(附錄 1)，以提高國內檢驗方法研究成果之能見度，展現臺灣食品分析技術的實力，爭取未來國際交流合作之機會。

貳、過程

本次於11月5日自台灣桃園機場出發,前往捷克布拉格參加RAFA研討會，研討會自 11 月 7 日開始，共有四天之會議行程。本次會議共約 760 人參與，參加者分別來自 51 個國家，皆為各國該領域檢驗之專家學者。第一天會議首先由主辦單位邀請之吉他手進行開場表演,以吉他旋律伴隨著投影畫面中捷克之人文美景為此次會議揭開序幕,接著由 RAFA 之主席 Jana Hajslova 進行開場介紹後，隨即開始第一天的專題演講。

為期四天的研討會議程(附錄 2)緊湊，共有 23 個專題，每一個專題又各有 4-6 場演講，所有專題演講及廠商之儀器應用教學，總共有 138 場演講，主題內容豐富且多元，與本署研究主題有高度相關，包括：天然毒素、食品接觸物質、農藥、動物用藥、汙染物、過敏原、重金屬、營養成分及食品摻偽等分析技術的探討。另外，也介紹許多新興技術於食品分析之應用，如奈米技術、影像技術及手機快速檢測技術。在食品管理層面部分，也邀請歐洲及中國官方代表分享歐洲及中國於食品管理、風險評估、檢驗方法之現況及未來趨勢發展。茲將各專題主題分類彙整如下，藉此有助瞭解現今檢驗安全分析領域熱門主題。

1. Food authenticity & Fraud
2. Analytical challenges faced by the food industry
3. Achievements of EU Reference Laboratories (EURLs) & International collaboration
4. Food contaminants & Residues
5. General food analysis
6. Food safety in China: past, present, and future
7. Step by step strategies for fast development of smart analytical methods
8. Natural toxins
9. Human biomonitoring in food quality and safety

10. Analysis of nanoparticles in food, cosmetics, and consumer products

11. Smart portable and personalised food analysis systems

12. Ambient mass spectrometry on food and natural products

13. DNA analysis for food control

14. Food safety issue beyond the EU

15. Data quality and smart data handling in food analysis

16. Novel high fidelity approaches and perspectives in food analysis

17. Biologically active, health promoting food components

18. Omics approaches in food analysis

19. Food analysis beyond imagination

20. Recent issues and policies

21. Novel technologies

在壁報論文部分，今年 RAFA 研討會共有 465 篇壁報論文發表，主題涵蓋 16 個食品分析主題，共分為兩個場次舉行。茲將各主題彙整如下：

1. Allergens

2. Authenticity, traceability, fraud

3. Bioanalytical methods for food control

4. Biologically active, health promoting food components

5. Flavour significant compounds

6. General food analysis

7. Major nutrient & vitamins

8. Novel foods & supplements

9. Omics including foodomics

10. Food contaminants (environmental)

11. Metals and metalloids

12. Migrants from food contact materials

13. Mycotoxin, Marine & Plant toxin

14. Processing contaminants

15. Residues-pesticides

16. Residues-veterinary drugs

因研討會內容豐富，主題繁多，於同一時段有 3~4 場演講同時進行，故無法參與全部演講，故摘錄與本署近年研究有關之重點整理如下：

一、專題演講：

(一) Elucidation of Non-Intentionally Added Substances (NIAS) Migrating from Polyester-Polyurethane Lacquers Intended for Food Contact Materials 【遷移自食品接觸材料用之聚酯聚氨酯樹脂塗漆之非有意添加物質(NIAS)解析 】

本篇講者是 Elsa Omer，來自法國 LABERCA 實驗室，演講內容主要是介紹利用 LC-Orbitrap-MS 解析聚酯聚氨酯樹脂塗漆中非有意添加物質之方法及結果。NIAS 為非有意添加物質，顧名思義，此類物質非為了特定目的而添加至食品接觸物質中，而是於食品接觸物質製造過程中自然產生，此類物質可能為不純物、汙染物、聚合物、反應副產物及中間產物等。國際間定義 NIAS 為分子量小於 1000 之化合物，因分子量小於 1000 之化合物易遷移至食品中，且易於被人體吸收，對人體危害風險較大。

本演講使用之實驗流程十分簡單，先將檢體剪成 0.5 dm^2 大小後，以乙腈溶劑進行 24 小時之溶出，再以 LC-Orbitrap-MS 進行質譜分析，最後將所得的質譜分析結果歸納整理，並與自建之 NIAS 資料庫進行比對(內有約 80,000 個化合物)。在質譜分析結果整理部分，首先，進行離子挑選，選出離子強度較強之離子共 37,558 個，其次，將檢體中與空白檢體相同的離子去除，使離子數降為 4,962 個，接著進行 deconvolution，將來自同一個物質之離子(例如：同位素、加合物及碎片離子等)進行歸類，共歸類為 2,845 個

物質，最後將此 2,845 個物質進行資料庫比對。在資料庫比對部分，可分為兩種策略：可預測及不可預測。可預測部分是參考檢體製造商提供之單體及內容物成分進行比對，2 件檢體共分別解析出 80%及 70%的物質，其中分別包含 14 及 17 種之環形聚酯單體。不可預測部分，則依照資料庫比對結果，並搭配層析及碎片資訊進行解析，其中多數聚酯化合物訊號被認為是由 3 種單體排列組合而成，另外，於 2 個檢體中，皆有疑似 caprolactam cyclic oligomers 之訊號。此方法以自建的 NIAS 資料庫比對 2 件塗漆檢體之溶出液，共分別解析出 80%及 90%之化合物，具有高可信度。利用高解析度質譜儀建立資料庫是本署未來研究的重點之一，本演講敘述之質譜結果歸納及資料庫比對之概念，可作為未來資料庫及篩檢方法建立之參考。

(二)Analytical Challenges for an Effective EU Policy on Contaminants in Food and Feed to Ensure a High Level of Animal and Human Health Protection【因應歐盟政策之食品及飼料中汙染物分析之挑戰，以確保動物及人類健康之高規格保障】

本篇講者是 Frans Verstraete，來自歐盟委員會(European Commission)之衛生暨食品安全總署(DG Health and Food Safety)，演講內容主要是介紹近年來歐盟於食品及飼料中汙染物之相關法規，以及檢驗分析上之挑戰。歐盟汙染物法規主要是因應新興汙染物之出現、食安事件之發生及風險評估之結果更新等而建立及修訂，而因應法規之修訂，檢驗方法開發也面臨許多新挑戰。以下將講者所提及之議題摘要整理如下：

(1) 由於全球氣候變化及極端氣候等，導致近年來歐洲穀物中黴菌毒素濃度增加，且傳統毒素之化學結構產生變異，生成新的形式，增加檢驗分析上之困難。

(2) 用於生產嬰兒食品之植物油及嬰兒食品中縮水甘油脂肪酸酯(Glycidyl fatty acid esters)之限量標準越來越低，導致檢驗方法之開發有極大之挑

戰。

(3) 礦物油(mineral oil)是近年來歐盟關注之議題，目前歐盟正著手進行食品中礦物油含量及來源調查，然而由於礦物油是混合物，組成複雜，故分析上不易準確定量。

(4) 為了有效地執行食品管理及風險評估，汙染物之分析檢驗方法必須要準確、靈敏且高效率，且花費也必須低廉。

本演講提及歐盟目前關注之議題，可作為本署未來方法開發及研究主題訂定之參考。

(三) Determination of Chlorinated Paraffins in Food and Feed Using GC-Orbitrap-MS【以 GC-Orbitrap-MS 檢驗食品及飼料中氯化石蠟】

本篇講者是 Kerstin Krätschmer，來自歐盟戴奧辛(dioxins)及多氯聯苯(polychlorinated biphenyl, PCB)參考實驗室，演講內容主要是介紹利用 GC-Orbitrap-MS 檢測食品及飼料中氯化石蠟(chlorinated paraffin)之方法。氯化石蠟是多種含有氯化烴物質的混合物，依其鏈長範圍可分為短鏈(C_{10-13})、中鏈(C_{14-17})及長鏈(C_{18-30})，其中短鏈氯化石蠟(Short-chained chlorinated paraffins, SCCP)可用作塑膠、橡膠、油墨、塗料、粘合劑和表面塗層材料的阻燃劑或增塑劑，用途十分廣泛。然而，由於 SCCP 能透過大氣、水、生物體等環境基質長距離遷移，並具有長期殘留性、生物蓄積性、半揮發性和高毒性等特性，易對環境且人類健康造成重大危害，故近年來被歸類於持久性有機污染物(Persistent Organic Pollutants, POPs)且被禁止使用，使得業者紛紛轉而使用中鏈氯化石蠟(medium-chained chlorinated paraffins, MCCP)以取代 SCCP。有鑑於此，為執行氯化石蠟之管理，歐盟則著手開發氯化石蠟之分析方法。

演講中 Kerstin Krätschmer 提到分析氯化石蠟主要會面臨以下挑戰：(1)氯化石蠟為混合物，組成複雜。(2)SCCP 與 MCCP 之層析分離效果不佳，

出鋒時間重疊，易互相干擾。(3)多氯聯苯等環境汙染物易造成干擾。因為分析之困難度，目前國際間對於氯化石蠟之分析方法仍未有共識。然而，近年來高解析度質譜儀發展迅速，利用其高解析度而可測得待測物之精確分子量，而將分析物與干擾物訊號分離，故 Kerstin Krätschmert 嘗試使用 GC-Orbitrap-MS 分析食品中之氯化石蠟。儀器解析度設為 60,000 及 120,000，掃描模式為 Full-scan 掃描，應用 GC-Orbitrap-MS 所開發之方法線性良好，線性範圍可達 25-10,000 ppb，回收率及重複性亦佳，可解決傳統質譜儀無法解決之問題。

(四) Ion Mobility Spectrometry: a Rapid Tool to Assess Eggproducts Freshness

【離子遷移光譜儀：評估蛋製品新鮮度之快速工具】

本篇講者是 Michele Suman，來自義大利 Barilla SpA 公司，演講內容主要是介紹利用離子遷移光譜儀快速檢測蛋及蛋製品新鮮度之方法。離子遷移光譜儀是近年來發展迅速的一項技術，其利用不同離子之質量、尺寸、形狀、電荷不同，而在電場及載流氣體下有不同的離子移動率，可將不同離子分離。由於此技術可依形狀將不同離子分離，故對於一般質譜儀所不能區分之同分異構物，也可使用此技術將之分離。

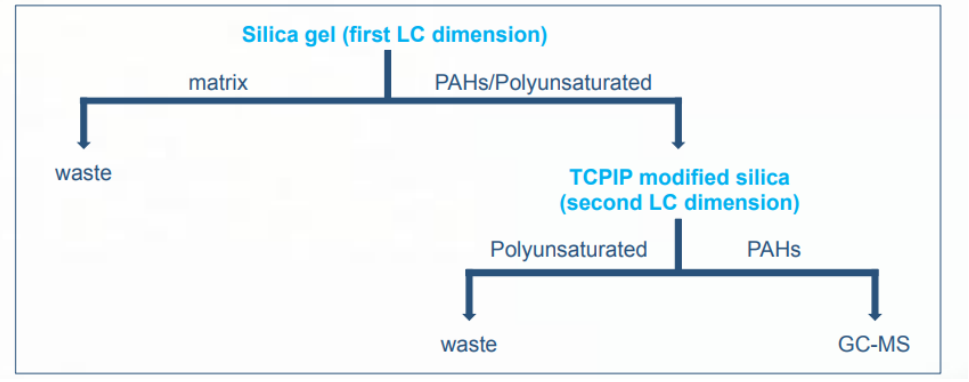
Michele Suman 利用氣相層析儀串聯離子遷移光譜儀(Gas Chromatograph-Ion Mobility Spectrometer, GC-IMS)分析蛋及蛋製品中揮發性成分於 GC-IMS 圖譜之分布，再進一步比對新鮮蛋及蛋製品與放置 1-5 天蛋及蛋製品之圖譜分布差異性，並將有差異之訊號挑出，配合統計軟體分析，找出不新鮮蛋及蛋製品之鑑別指標訊號，共找出 35 個指標訊號。另外，為了鑑定出指標訊號之成份，Michele Suman 再進一步利用固相微萃取法(solid-phase microextraction, SPME)搭配氣相層析質譜儀(Gas Chromatograph-Mass Spectrometry, GC-MS)進行分析，並比對 IMS 資料庫，鑑定出超過 20 個指標訊號之成份。

此鑑定蛋及蛋製品新鮮度之方法便宜、簡單且快速，只需約 40 分鐘即可完成。由於利用 GC-IMS，可將分析物進行二維分離，分離效果佳，故檢體不需要經過前處理，可直接分析，大大減少檢驗時間。此方法未來可應用於生產線上，於食品加工前先進行原料新鮮度之檢測，以確保成品之品質。

二、壁報論文

(一) Simple, Fast, Innovative and Automated Determination of 27 Polycyclic Aromatic Hydrocarbons in Oils and Fats by LC-LC-GC-MS 【簡單、快速、創新且自動化地利用液相-液相-氣相層析質譜儀分析食用油及油脂中 27 種多環芳香烴化合物】

本篇研究為德國 Eurofins 公司發表的壁報論文，壁報內容是介紹使用液相-液相-氣相層析質譜儀於食用油及油脂中 27 種多環芳香烴化合物分析之應用。多環芳香烴化合物(PAHs)是常見的食品加工製程汙染物，由於其具有致突變性及致癌性，近年來備受國際注目。一般來說，食用油中多環芳香烴化合物之分析須使用皂化或以固相萃取匣進行淨化，再以氣相層析質譜儀(GC-MS)進行分析，此方法複雜且耗時。本篇壁報論文則試圖以 LC-LC-GC-MS 進行 PAHs 之分析，方法前處理流程十分快速簡單，只需稱重、添加內部標準品及搖晃混勻三個步驟，即可上機分析，將檢體的淨化交由 LC-LC-GC-MS 之 2 個 LC 管柱自動化完成，檢體淨化流程圖如下：



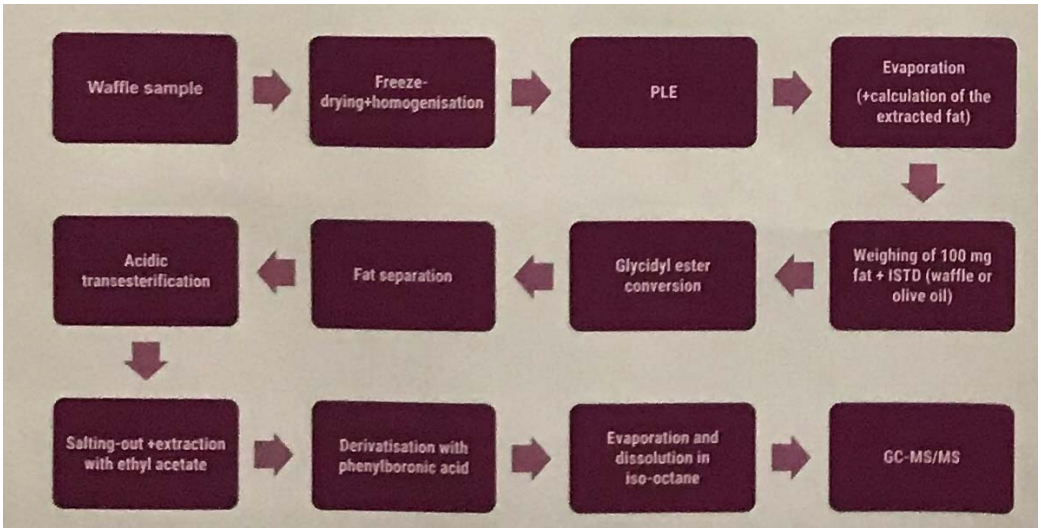
LC-LC-GC-MS 儀器中第 1 個 LC 管柱材質為矽膠(silica gel)，其可將食用油中基質干擾去除，第 2 個管柱材料為 tetrachlorophthalimidopropyl 修飾

之矽膠，可將多元不飽和化合物(polyunsaturated compounds)與 PAHs 分離，最後再由以 GC-MS 進行分析。

本篇使用此方法測試超過 200 件食用油及油脂檢體，包括葵花油、椰子油、橄欖油、芝麻油、菜籽油、核桃油、大豆油、可可脂及魚油等，並將檢驗結果與傳統 GC-MS 分析方法進行比較，結果顯示 LC-LC-GC-MS 分析方法具有較低的基質干擾，且準確度及精密度等皆符合歐盟確效規範。本署目前也正在著手進行PAHs之方法開發，本篇提供除傳統GC-MS及GC-MS/MS外，另一研究方向之參考。

(二) Determination of 3-MCPD, 2-MCPD and Glycidyl Fatty Acid Esters in Olive Oil and Waffle Using GC-MS/MS Method 【應用 GC-MS/MS 方法檢測橄欖油及鬆餅中 3-單氯丙二醇酯、2-單氯丙二醇酯及縮水甘油脂肪酸酯】

本篇研究為芬蘭食品安全局(Finnish Food Safety Authority Evira)發表的壁報論文，3-單氯丙二醇酯(3-monochloropropanediol esters, 3-MCPDEs)、2-單氯丙二醇酯(2-monochloropropanediol esters, 2-MCPDEs)及縮水甘油脂肪酸酯(glycidol esters, GEs)為食用油或油脂精製後常見之加工汙染物，本篇壁報論文介紹利用 GC-MS/MS 檢測 3-MCPDEs、2-MCPDEs 及 GEs 之方法。此方法前處理流程係參考歐盟聯合研究中心之標準物質及測量機構(European Commission, Joint Research Centre, Institute for Reference Materials and Measurements, EC-JRC-IRMM)所公告之標準作業程序，流程如下圖所示：



首先，將鬆餅檢體中油脂以加壓溶劑萃取法(pressurised liquid extraction, PLE)萃取出。接著，稱取油脂或食用油 100 mg，加入內部標準品，並進行轉酯化步驟，使檢體中 GEs 轉變成 3-單溴丙二醇(3-monobromopropanediol, 3-MBPD)。再來，於酸性條件下進行轉酯化使 3-MCPDEs 及 2-MCPDEs 生成 3-MCPD 及 2-MCPD。最後，將 3-MCPD、2-MCPD 及 3-MBPD 以 phenylboronic acid (PBA)衍生化後，以 GC-MS/MS 上機分析。此方法之專一性、選擇性、線性、重複性及準確度等皆符合確效要求，且定量極限為 3.3-5.7 μg/kg，符合歐盟法規需求。本署未來也計畫著手進行 3-MCPDEs、2-MCPDEs 及 GEs 檢驗方法之開發，本篇壁報論文具有極高之參考價值，已將此研究資訊提供相關同仁參考。

參、心得

此次參加 RAFA 研討會 4 天之議程，內容十分豐富，共有 138 場專題演講及 465 壁報論文。藉由聆聽各國專家學者之研究成果，獲得了許多食品分析檢驗之新知。另外，藉由參觀壁報論文展示，更很難得地可以有機會與各國專家互相交流意見。可惜的是因為專題演講場次太多了，同時段有 3~4 場演講同時進行，故無法聆聽所有的演講，但主辦單位很大方地將大會所有專題演講及壁報論文摘要之電子檔提供給與會人員，讓我可以將所有資訊帶回台灣，提供給署內相關同仁們參考。以下是參加完研討會之心得感想：

一. 由各國之專題演講及壁報論文中可以發現應用高階檢驗儀器進行方法開發已越來越普遍，且由於儀器靈敏度及解析度之提升，降低了食品基質干擾之影響，使得檢驗方法之前處理步驟也趨向簡單、快速、自動化及高通量，大幅地提高檢驗之效率。

二. 為了能夠即時為民眾食品安全進行把關，各國對於食品之快速篩檢方法也越來越重視。高解析度質譜儀由於能提供化合物之精確分子量資訊，可用於非目標物之快速篩檢，預期將是未來研究之主流。

三. 除了實驗室之檢測方法外，於食品工廠及賣場直接進行之快速篩檢方法也是未來發展之趨勢，研討會中也出現利用可攜式裝置(如智慧型手機)進行快速篩檢之應用例子，雖然目前技術尚未成熟，但極具發展潛力。

本次很幸運地可以奉派參加 RAFA 研討會，見識到許多高端儀器、最新技術及檢驗方法，得到許多研究上之啟發，也了解到目前國際上關注之食安議題及檢驗方法發展之趨勢，真是獲益良多。於 RAFA 研討會中得到之所有資訊會再與署內同仁分享，以期許未來本署檢驗能力與技術層級能持續精進，並與國際接軌。

肆、建議

以下為參與研討會後提出之建議：

一. RAFA 研討會內容豐富且多元，且與本署研究主題高度相關。藉由參加研討會可於短時間內吸收許多檢驗新知，了解國際最新檢驗技術及發展趨勢，並可將相關資訊帶回署內與相關同仁分享，提升本署方法開發之能力與效能，建議持續派員參加。

二. 隨著國際貿易越來越興盛，各國間食品的流通也越來越頻繁，食品安全已不是單一國家的事情，需要各個國家共同努力。因此，建議應多與國際專家學者互相交流，建立溝通管道與合作機會，以交換國際最新資訊，提升並拓展本署研究水準跟上國際的腳步，當遇到困難與問題時，也可尋求幫忙與協助。

三. 科技日新月異，食品安全面臨之挑戰也日益嚴峻，於研討會中可發現許多高階儀器紛紛被應用於食品分析檢驗中，以解決許多以往分析檢驗上遇到的問題及困難。例如高解析度質譜儀，可提高分析之靈敏度，解決食品基質干擾等問題，並作為非目標物快速篩檢之方法，增加檢驗方法開發效率及檢驗量能。本署目前已有此儀器，並已嘗試用於化合物篩選及分析資料庫之建置，建議持續投注資源，開發此儀器更多之相關應用技術。

Method of Test for Photoinitiators of Ink in Food

Hsien-Chen Chang*, Yi-Ju Chen, Mei-Hua Chang, Chia-Ding Liao, Ya-Min Kao, Der-Yuan Wang, Hwei-Fang Cheng

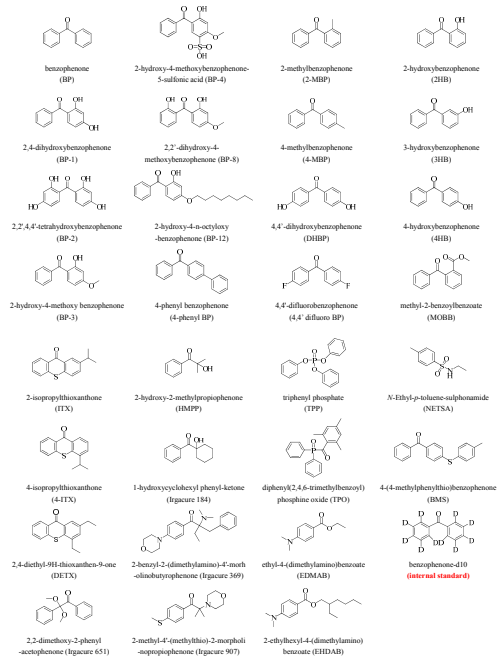
Taiwan Food and Drug Administration, 161-2, Kunyang St., Taipei City, Taiwan 11561

Introduction

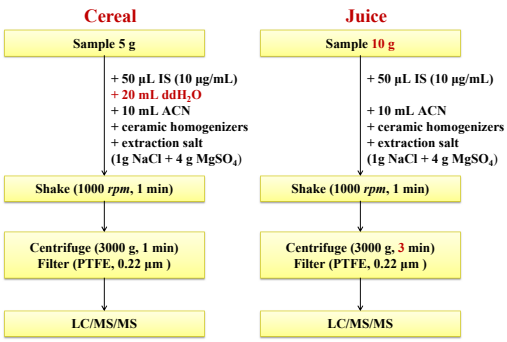
UV inks have been widely used to print on many kinds of food packaging materials, offering many advantages over traditional drying methods, such as fast-drying, space-saving and environmentally friendly…etc. Photoinitiators are one of important formula of ultraviolet (UV) inks, which initiating polymerization of binders in UV inks and resulting in fast harden of inks. However, many food contamination incidents about photoinitiators have occurred recent years. In 2005, the Rapid Alert System for Food and Feed (RASFF) raised the alert for isopropyl thioxanthone (ITX) contamination in baby milk, causing 30 million liters of milk withdrawal from European market. Besides, in 2009, ppm level of 4-methylbenzophenone (4-MBP) and benzophenone (BP) were also found in cereals. Up to now, there has not been any specific European legislation covered printing ink used in food contact materials. However, printing inks is regarded as parts of food packaging, so it should comply with the Framework Regulation (EC) No 1935/2004. Some photoinitiators were also listed in the authorised substances of Commission Regulation (EU) No 10/2011, since they could be used as additives in plastics materials. For example, the specific migration limit (SML) of BP was 0.6 mg/Kg. In addition, Swiss has drew up a "positive list" of substances permitted to be used in printing inks for food packaging. Some photoinitiators were also included in the list. In this study, a multiple-analysis method of 30 photoinitiators was established and a market surveillance of photoinitiators in breakfast cereal and packaged juice was also performed.

Method

1. Chemical and structure



2. Sample treatment



3. UPLC/MS/MS condition

Instrument	Waters XevoTM TQ-MS UPLC system		
Column	Kinetex PFP Column (100 × 2.1 mm, i.d. 1.7 µm, 30 ℃)		
Elute A	5mM NH_4HCO_2 in H_2O (pH 4)		
Eluent B	MeOH		
Flow rate	0.25 mL/min		
Injection volume	5 µL		
Elution gradient	time	A (%)	B (%)
	initial	70	30
	12.0	0	100
	17.0	0	100
	17.1	70	30
	20.0	70	30
Ion source	ESI positive		
Capillary voltage	3.30 kV		
Ion source temperature	150 ºC		
Desolvation temperature	450 ºC		
Desolvation flow rate	850 L/hr		
Scan mode	Multiple reaction monitoring (MRM)		

Result

The chromatogram of the analyzed photoinitiators, at a concentration of 100 ng/g in juice was showed in Figure 1. By using PFP column, good chromatographic separation, including ITX isomers and MBP isomers, was achieved (Figure 2). The method validation results of cereal and packaged juice matrix are showed in Figure 3, 4 and Table 1. The market surveillance results of cereals and packaged juice are showed in Table 2.

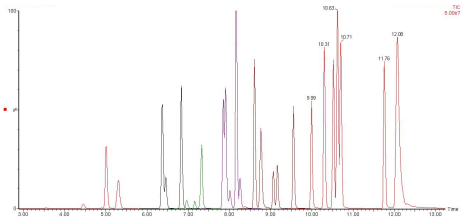


Figure1. Overlay chromatogram of the quantifier ions of 30 photoinitiators.

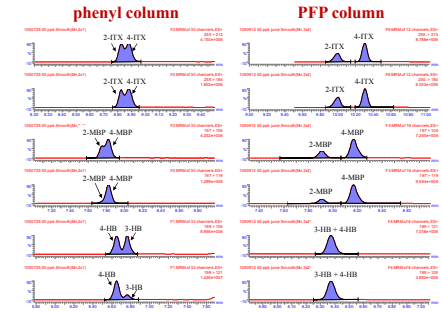


Figure 2. Chromatographic separation of two isomers with phenyl and PFP column.

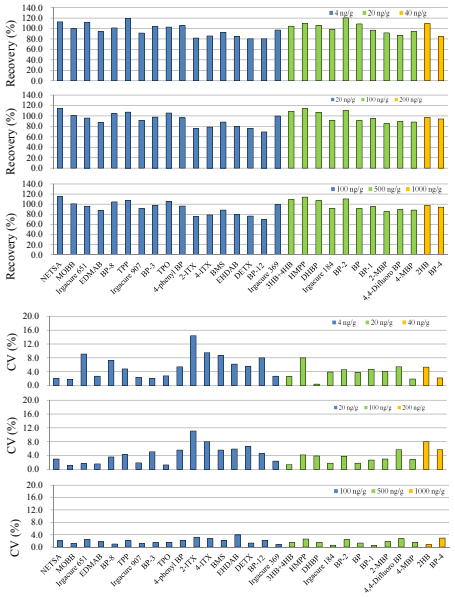


Figure 3. Method validation results of cereal matrix.

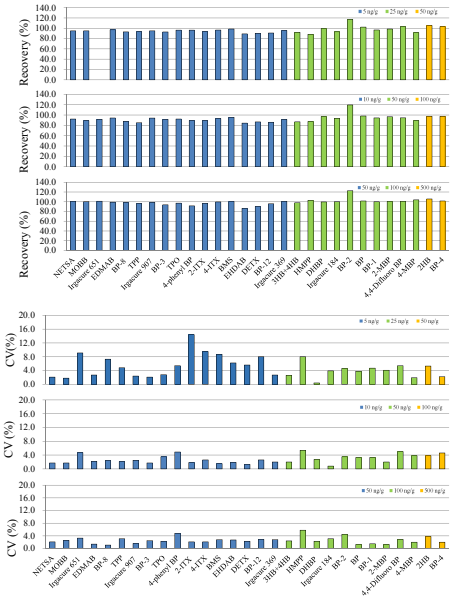


Figure 4. Method validation results of packaged juice matrix.

Table 1. LOQ of 30 photoinitiators in this method.

Compound	Cereal LOQ (mg/kg)	Juice LOQ (mg/kg)	Compound	Cereal LOQ (mg/kg)	Juice LOQ (mg/kg)
BP	0.020	0.010	BP-2	0.010	0.010
2-MBP	0.010	0.010	BP-4	0.040	0.050
4-MBP	0.010	0.010	2HB	0.040	0.050
DHBP	0.010	0.010	3HB+4HB	0.010	0.010
BP-1	0.010	0.010	HMPP	0.020	0.025
BP-3	0.002	0.002	BMS	0.002	0.002
BP-8	0.004	0.002	DETX	0.002	0.002
BP-12	0.002	0.002	4-phenyl BP	0.004	0.002
2-ITX	0.004	0.002	NETSA	0.002	0.002
4-ITX	0.002	0.002	Irgacure 184	0.020	0.010
MOBB	0.002	0.002	Irgacure 369	0.002	0.002
EDMAB	0.002	0.002	Irgacure 651	0.002	0.010
EHDAB	0.002	0.002	Irgacure 907	0.002	0.002
TPP	0.002	0.002	TPO	0.002	0.002
4,4-Difluoro BP	0.020	0.010			

Table 2. Market surveillance results.

	Package type	Quantity	Result
Cereal	can	1	ND
	laminated aluminum foil bag	1	ND
	paper box	3	1 case: TPP (0.013 mg/kg) 2 cases: ND
Juice	plastic bottle	4	ND
	drink carton	6	1 case: BP-3 (0.006 mg/kg) Irgacure 184 (0.086 mg/kg) MOBB (0.153 mg/kg) DETX (0.002 mg/kg) 5 cases: ND

Conclusion

1. Fast LC-MS/MS method allowing for simultaneous determination a total of 30 photoinitiators in breakfast cereals and packaged juice were developed. The average recoveries are 62.0-120.3 % and CVs are 0.4-14.4 % in cereals. The average recoveries are 84.4-122.9 % and CVs are 0.5-9.5 % in juice.
2. The market surveillance results of five breakfast cereals and ten packaged juice were as follows: 0.013 mg/kg TPP was detected in one breakfast cereal, and BP-3, Irgacure 184, MOBB and DETX were detected in one packaged juice, ranged from 0.002 to 0.153 mg/kg.

RAFA 2017 – PROGRAM AT A GLANCE

Time / Date	TUESDAY November 7, 2017	WEDNESDAY November 8, 2017	THURSDAY November 9, 2017	FRIDAY November 10, 2017
7:30–8:00			**Vendor seminars** (7:45–8:30)	
8:00–8:30	**Registration for the conference** Foyer of the Clarion Congress Centre			
8:30–9:00				
9:00–9:30	**Workshop** **Vibrational spectroscopy and chemometrics for monitoring of food and feed products and contaminants´ detection** Virgo hall	**Session 1** **Food authenticity & Fraud I** Zenit hall **Session 2** **Analytical challenges faced by the food industry** Nadir hall **Session 3** **Workshop** **Achievements of EU Reference Laboratories (EURLs) &** **International collaboration I** Leo & Virgo halls	**Session 11** **Nuratal toxins I** Zenit hall **Session 12** **1st European workshop** **Human Biomonitoring in Food Quality and Safety** Nadir hall **Session 13** **2nd European workshop** **Analysis of nanoparticles in food, cosmetics and consumer products** Leo & Virgo halls	**Session 21** **Novel high fidelity approaches and perspectives in food analysis** Zenit & Nadir halls **Session 22** **Biologically active, health promoting food components** Aquarius & Taurus halls **Session 23** **Omics approaches in food analysis** Leo & Virgo halls
9:30–10:00				
10:00–10:30	**Workshop** **Novel platform for multidisciplinary assessment of food and feed safety** Leo hall			
10:30–11:00		**Exhibition** Coffee break Foyer / Meridian / Tycho & Kepler halls	**Exhibition** Coffee break Foyer / Meridian / Tycho & Kepler halls	
11:00–11:30		**Session 4** **Food authenticity & Fraud II** Zenit hall **Session 5** **Food contaminants & Residues I** Nadir hall **Session 6** **Workshop** **Achievements of EU Reference Laboratories (EURLs) &** **International collaboration II** Leo & Virgo halls	**Session 14** **Natural Toxins II** Zenit hall **Session 15** **Smart portable and personalised food analysis systems** Nadir hall **Session 16** **4th European AMS workshop** **Ambient Mass Spectrometry on food and natural products** Leo & Virgo halls	**Exhibition** Coffee break Foyer / Meridian halls
11:30–12:00				**Summary Session** **Food analysis beyond imagination** Zenit & Nadir halls
12:00–12:30				
12:30–13:00		Lunch Conference centre restaurant Veduta	Lunch Conference centre restaurant Veduta	
13:00–13:30				**Closing address, Poster Awards** Zenit & Nadir halls

Time / Date	MONDAY November 6, 2017	TUESDAY November 7, 2017	WEDNESDAY November 8, 2017	THURSDAY November 9, 2017
12:30–13:00	Satellite event Horizon 2020 brokerage event "Sustainable Food Security" (12:00–19:00)	Registration for the conference Foyer of the Clarion Congress Centre Vendor seminars (12:45–13:30)		
13:00–13:30			Exhibition Poster session I Vendor seminars (13:30–14:15) Vendor seminars (14:45–15:30) SMART LAB FoodIntegrity OPEN DAY	Exhibition Poster session I Vendor seminars (13:30–14:15) SMART LAB FoodIntegrity OPEN DAY Info event METROFOOD-RI (14:45–16:00)
13:30–14:00		Opening ceremony Zenit & Nadir halls		
14:00–14:30				
14:30–15:00		Plenary session I Recent issues & Policies Zenit & Nadir halls		
15:00–15:30				
15:30–16:00		Exhibition Coffee break Foyer / Meridian halls	Exhibition Coffee break Foyer / Meridian / Tycho & Kepler halls	Exhibition Coffee break Foyer / Meridian / Tycho & Kepler halls
16:00–16:30	Registration for the conference Foyer of the Clarion Congress Centre	Plenary session II Novel technologies Zenit & Nadir halls	Session 7 Workshop Food contami-nants & Residues II Zenit hall Session 8 General food analysis I Nadir hall Session 9 Food Safety in China: Past, Present and Future Leo & Virgo halls Session 10 Interactive seminar Step by step strategies for fast developme nt of smart analytical methods Aquarius & Taurus halls	Session 17 General food analysis II Zenit hall Session 18 DNA analysis for food control Nadir hall Session 19 Seminar Food safety issues beyond the EU Leo & Virgo halls Session 20 Tutorial Data quality and smart data handling in food analysis Taurus hall
16:30–17:00				
17:00–17:30				
17:30–18:00				
18:00–18:30				
18:30–19:00		Welcome Cocktail Foyer / Meridian halls		
19:00–19:30				
19:30–20:00				
From 20:00				Symposium Dinner Convent of St. Agnes of Bohemia, Prague downtown

Coffee breaks will be located in the Foyer / Meridian / Tycho & Kepler halls. **Conference lunches** will be served in the conference centre restaurant Veduta.

106年赴捷克參加「第8屆國際食品分析最新進展研討會」出國分享報告

報告日期：106年12月7日

報告人：張嫻楨技士

出國地點：捷克布拉格

國際食品分析最新進展研討會

- International Symposium on Recent Advances in Food Analysis (RAFA)

RAFA History

	No. of participants / countries	VENUE
• 2003 : 1th RAFA	250 / 27	Prague MASARYK college conference centre
• 2005 : 2th RAFA	320 / 35	
• 2007 : 3th RAFA	380 / 37	DIPLOMAT hotel conference centre
• 2009 : 4th RAFA	550 / 55	
• 2011 : 5th RAFA	650 / 47	CLARION congress hotel Prague
• 2013 : 6th RAFA	800 / 63	
• 2015 : 7th RAFA	800 / 65	
• **2017 : 8th RAFA**	**760 / 51**	

捷克布拉格

Chair & Co-chair

UNIVERSITY OF CHEMISTRY AND TECHNOLOGY PRAGUE

Prof. Jana Hajslova
University of Chemistry and Technology
Prague, Czech Republic

WAGENINGEN UNIVERSITY & RESEARCH

Prof. Michel Nielen
RIKILT, Wageningen University & Research
The Netherlands

5

Program

2017/11/7-11/10

TUESDAY November 7, 2017

Registration for the conference
Foyer of the Clarion Congress Centre

Workshop
Vibrational spectroscopy and chemometrics for monitoring of food and feed products and contaminants' detection
Virgo hall

Workshop
Novel platform for multidisciplinary assessment of food and feed safety
Leo hall

TUESDAY November 7, 2017

Registration for the conference
Foyer of the Clarion Congress Centre

Vendor seminars (12:45-13:30)

Opening ceremony
Zenit & Nadir halls

Plenary session I
Recent issues & Policies
Zenit & Nadir halls

Exhibition
Coffee break
Foyer / Meridian halls

Plenary session II
Novel technologies
Zenit & Nadir halls

Welcome Cocktail
Foyer / Meridian halls

WEDNESDAY November 8, 2017

Session 1 — Food authenticity & Fraud I — Zenit hall
Session 2 — Analytical challenges faced by the food industry — Nadir hall
Session 3 — Workshop — Achievements of EU Reference Laboratories (EURLs) & International collaboration I — Leo & Virgo halls

Exhibition
Coffee break
Foyer / Meridian / Tycho & Kepler halls

Session 4 — Food authenticity & Fraud II — Zenit hall
Session 5 — Food contaminants & Residues I — Nadir hall
Session 6 — Workshop — Achievements of EU Reference Laboratories (EURLs) & International collaboration II — Leo & Virgo halls

Lunch
Conference centre restaurant Veduta

WEDNESDAY November 8, 2017

Exhibition
Poster session I
Vendor seminars (13:30-14:15)
Vendor seminars (14:45-15:30)
SMART LAB
FoodIntegrity OPEN DAY

Exhibition
Coffee break
Foyer / Meridian / Tycho & Kepler halls

Session 7 — Workshop — Food contaminants & Residues II — Zenit hall
Session 8 — General food analysis I — Nadir hall
Session 9 — Food Safety in China: Past, Present and Future — Leo & Virgo halls
Session 10 — Interactive seminar — Step by step strategies for fast development of smart analytical methods — Aquarius & Taurus halls

Program

2017/11/7-11/10

THURSDAY November 9, 2017

Vendor seminars (7:45-8:30)

Session 11 — Nurotal toxins I — Zenit hall
Session 12 — 1st European workshop — Human Biomonitoring in Food Quality and Safety — Nadir hall
Session 13 — 2nd European workshop — Analysis of nanoparticles in food, cosmetics and consumer products — Leo & Virgo halls

Exhibition
Coffee break
Foyer / Meridian / Tycho & Kepler halls

Session 14 — Natural Toxins II — Zenit hall
Session 15 — Smart portable and personalised food analysis systems — Nadir hall
Session 16 — 4th European AMS workshop — Ambient Mass Spectrometry on food and natural products — Leo & Virgo halls

Lunch
Conference centre restaurant Veduta

THURSDAY November 9, 2017

Exhibition
Poster session I
Vendor seminars (13:30-14:15)
SMART LAB
FoodIntegrity OPEN DAY
Info event METROFOOD-RI (14:45-16:00)

Exhibition
Coffee break
Foyer / Meridian / Tycho & Kepler halls

Session 17 — General food analysis II — Zenit hall
Session 18 — DNA analysis for food control — Nadir hall
Session 19 — Seminar — Food safety issues beyond the EU — Leo & Virgo halls
Session 20 — Tutorial — Data quality and smart data handling in food analysis — Taurus hall

Symposium Dinner
Convent of St. Agnes of Bohemia, Prague downtown

FRIDAY November 10, 2017

Session 21 — Novel high fidelity approaches and perspectives in food analysis — Zenit & Nadir halls
Session 22 — Biologically active, health promoting food components — Aquarius & Taurus halls
Session 23 — Omics approaches in food analysis — Leo & Virgo halls

Exhibition
Coffee break
Foyer / Meridian halls

Summary Session
Food analysis beyond imagination
Zenit & Nadir halls

Closing address, Poster Awards
Zenit & Nadir halls

Total 138 lectures
25% of young scientists oral presentations

7

Lectures

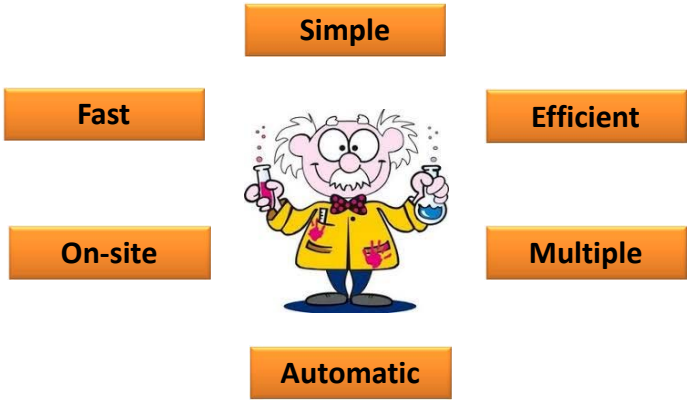
SESSIONS ADDRESSING RECENT AND EMERGING (BIO)ANALYTICAL STRATEGIES IN FOOD QUALITY AND SAFETY CONTROL:

- Mycotoxins, marine and plant toxins
- Migrants from food contact materials
- Processing contaminants
- Pesticide & veterinary drug residues
- Industrial contaminants
- Allergens
- Metals & metalloids
- Major nutrients & vitamins
- Flavour significant compounds
- Authenticity & food fraud
- Omics including Foodomics
- Food forensics
- Bioactive compounds
- Nanoparticles in food
- Novel foods & supplements
- Organic crops & foodstuffs
- Human biomonitoring (new)
- Smart sensors (new)

QA/QC & Chemometrics & Data interpretation

8

Analytical Method Tendency



9

Recent Advances

- High resolution MS/MS
- Ion mobility spectrometry
- LC-LC-GC-MS, 2D GC-MS
- Smartphone analyzers…….etc.

Elucidation of Non-Intentionally Added Substances (NIAS) Migrating from Polyester-Polyurethane Lacquers Intended for Food Contact Materials

Elsa Omer
LUNAM Université, Oniris, LABERCA, Nantes, France

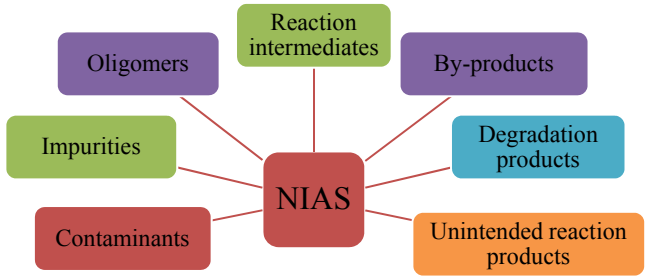
- Rapid and effective strategy for NIAS elucidation.
  1. LC-HRMS
  2. In-house database (> 80,000)
  3. > 80 % of the cumulated intensities were characterised (cyclic oligomers)
  4. High confidence level

11

NIAS

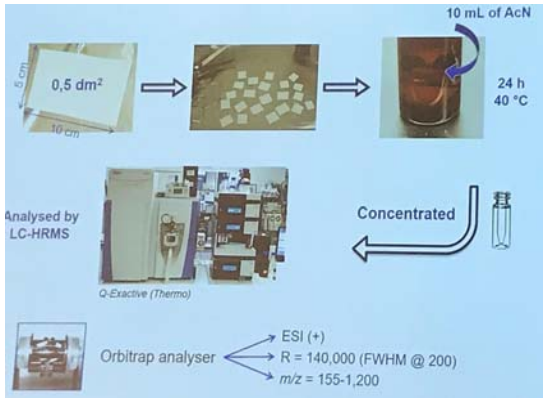
- NIAS= Non-Intentionally Added Substances

Mw < 1,000 D → high diffusion properties
→ considered as absorbed by body



Sample preparation

Blank
Lacquer 1
Lacquer 2



13

Data analysis

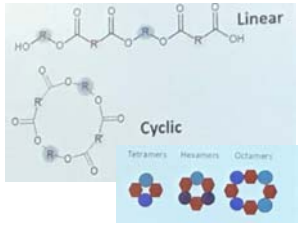
1. Fingerprint acquisition: LC-HRMS
   - Blank(n=3), Lacquer 1(n=3), Lacquer 2 (n=3)
2. Peak picking (n=37,558 ions)
3. Alignment (n=4,962 ions)
   - Align sample signals in common→ppm & Rt
4. Deconvolution (n=2,845 substances)
   - Isotope (^{13}C)
   - Adduct (H^+, Na^+, $NH4^+$…)
   - fragments

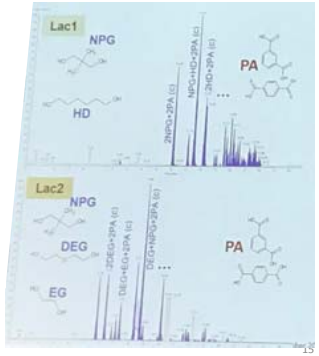
   group of ions = 1 substance
5. Comparison to in-house database (> 80,000)

14

Results

- Predictable = based on known formulation monomers
  - Lacquer 1：80%
  - Lacquer 2：70%



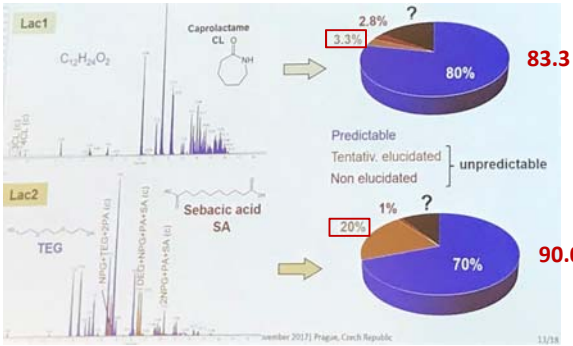


15

Results

- Unpredictable:

Chromatographic consistency
Fragmentation consistency



16

Simple, Fast, Innovative and Automated Determination of 27 Polycyclic Aromatic Hydrocarbons in Oils and Fats By LC-LC-GC-MS

Eurofins WEJ Contaminants GmbH, Germany

Axel Semrau GmbH & Co. KG, Germany

- Advantages
  - Fast and easy sample preparation
  - Automated sample clean-up
  - Without obvious matrix interferences

17

Method

Sample preparation: weigh oil into vial→ add IS → vortex 10s

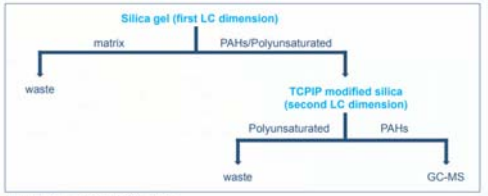
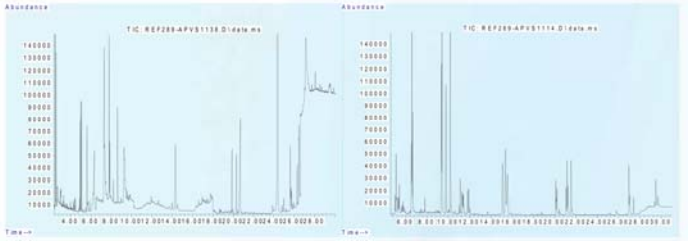


Figure 1 Scheme of LC-LC-GC-MS analysis

LC-System:	1260 Infinity II HPLC, Agilent Technologies
First column:	Allure Si HPLC column (250 mm × 2.1 mm, 5 µm, 60 Å), Restek
Second column:	Chromspher Pi (80 mm × 3.0 mm, 5 µm, 120 Å), Agilent Technologies
Eluent A:	Hexane
Eluent B:	Dichloromethane
Injection Volume:	67 µL
Interface:	Chronect LC-GC, Axel Semrau
GC-System:	7890B, Agilent Technologies
MS-System:	5977B MSD, Agilent Technologies
GC-Column:	PAH Select (15 m x 0,15 mm, 0,10 µm), Agilent Technologies

Results

GC-MS LC-LC-GC-MS



Matrix interference decrease

19

Results

GC-MS LC-LC-GC-MS

Analyt	Assigned value [ppb]	Limits [ppb]	Routine method [ppb]	LC-LC-GC-MS [ppb]
Anthracene	3,1	0,79 - 5,4	2,4	3,4
Benzo[a]anthracene	5,6	4,6 - 6,6	6,0	5,2
Benzo[b]fluoranthene	14,7	10,1-19,4	17,0	13,7
Benzo[k]fluoranthene	13,5	11,4-15,7	15,0	13,2
Benzo[a]pyrene	16,2	6,5-25,8	17,0	15,4
Chrysene	5,4	3,5-7,4	5,3	5,3
Dibenzo[a,h]anthracene	9,6	3,4-15,8	9,4	8,8
Fluoranthene	32,4	27,0-37,9	35,0	32,0
Indeno[1,2,3-cd]pyrene	37,5	25,2-49,7	45,0	33,3
Phenanthrene	20,9	6,2-35,6	19,0	19,4
Pyrene	10,5	3,8-17,2	10,0	10,4

LC-LC-GC-MS Validation data

Parameter	Value
Intra-Day Precision	0,1-7,8%
Linearity	$R^2 > 0,995$
Recovery	66-96%
LOQ	0,03-0,07 ppb [2]

20

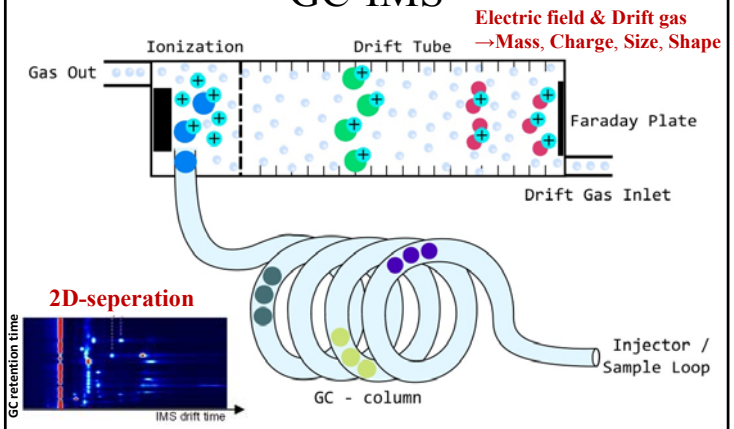
Ion Mobility Spectrometry: A Rapid Tool To Assess Eggproducts Freshness

Michele Suman
Advanced Laboratory Research
Barilla SpA, Italy

- Ion Mobility Spectrometers (IMS)
  - Mapping and analysis of complex volatiles composition in egg
  - Identification of specific marker spots for egg freshness
  - Quality control for food industry
  - Advantage: low cost, easy to use, rapid and robust

21

GC-IMS



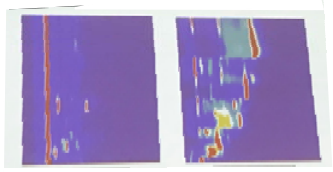
22

Experimental Design

- Sample analysis
  - T1= 0 hours
  - T2= 1 days at RT
  - T3= 2 days at RT
  - T4= 3 days at RT
  - T5= 4 days at RT
  - T6= 5 days at RT
- 52 egg products samples

23

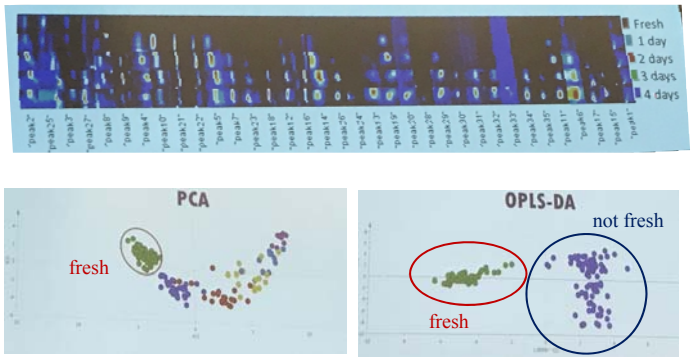
Sample Preparation



about 40 min

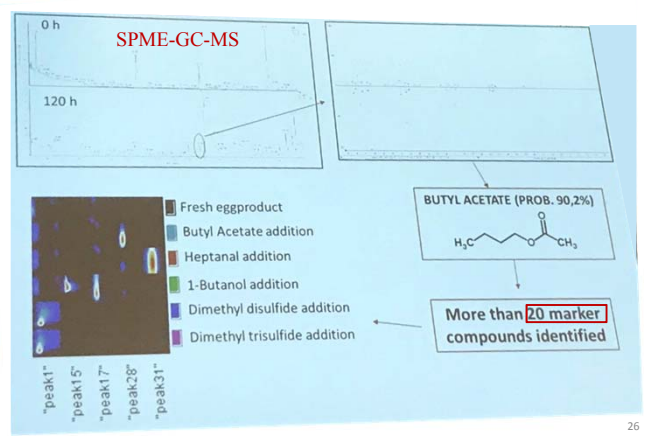
24

Results



25

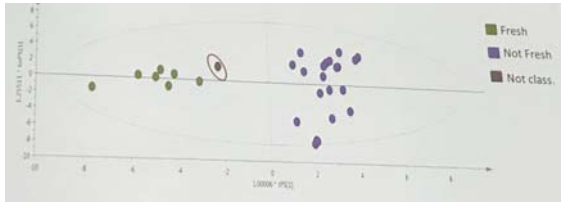
Spots Identification



26

Model Validation

7 New eggproducts samples → Same experimental design



97% of samples correctly predicted by the model.

27

FoodSmartphone project

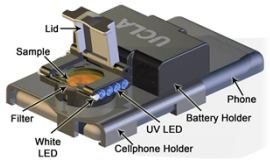
Prof. Michel Nielen
RIKILT, Wageningen University & Research The Netherlands

- Pesticides
- Mycotoxins
- Marine toxins
- Allergens
- Food spoilage organisms
  (11 PhDs, 11 topic)

- smartphone-based (bio)analytical sensing and diagnostic tools

28

FoodSmartphone project



- Integrate three sensor:
1. near IR spectrometer (950-1900nm)
2. UV-VIS(450-900nm)
3. micro camera

- rapid pre-screening
- on-side analysis
- wireless data transfer to the clouds

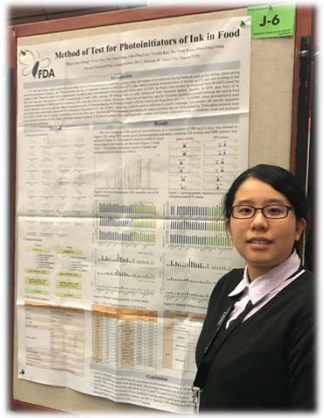
29

Posters

Method of Test for Photoinitiators of Ink in Food

Almost 465 posters in 2 poster sessions

- Major nutrients & vitamins
- Novel foods & supplements
- Food contaminants (environmental)
- Metals and metalloids
- Migrants from food contact materials
- Mycotoxin, Marine & Plant toxin
- Processing contaminants
- Residues-pesticides
- Residues-veterinary drugs……etc.



30

Thanks for your attention

34