台灣氣膠研究學會
Taiwan Association for Aerosol Research

Newsletter

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Announcement

- The 3th Board meeting will be held on march 11, 2017at National Kun Shan University Tainan City, Taiwan.
- 24nd International Conference on Aerosol Science & Technology will be held on 8-9 September 2017 at Tunghai University. More detailed information will be announced soon.

We would like to invite all of the members to share you research or new aerosol knowledge with us. Thank you very much for your support and help.

Best wishes to you and your family!

Contens

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The 3th Board meeting

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Research Interests

1. Pollution characteristics and diurnal variations in polybrominated diphenyl ethers in indoor and outdoor air from vehicle dismantler factories in southern Taiwan Polybrominated diphenyl ethers (PBDEs) are a class of the emerging persistent organic pollutants that have shown potential harmful effects in in-vivo and human studies. Our goal was to investigate 30 airborne PBDEs in day-to-night or indoor-to-outdoor in three vehicle dismantling factories located in southern Taiwan to assess worker risks. Thirty PBDEs including BDE-7, 15, 17, 28, 47, 49, 66, 71, 77, 85, 99, 100, 119, 126, 138, 139, 140, 153, 154, 156, 183, 184, 191, 196, 197, 203, 206, 207, 208, and 209 were analyzed using high-resolution-gas chromatography/high-resolution-mass-spectrometer. Levels of airborne Σ30PBDEs were 275, 336, 200 and 494 pg m–3 in indoor daytime, indoor nighttime, outdoor daytime, and outdoor nighttime, respectively, and their differences were not significant. BDE-209 was the predominant congener among the 30 PBDEs consisting of 82.5–97.9% of Σ30PBDEs in both indoor and outdoor air. Pollution characterizations of the PBDE patterns were similar in air samples except for the outdoor air in the nighttime. Diurnal variations in PBDEs in both indoor and outdoor air were not

observed. A principal component analysis was used to test for possible sources of PBDE contamination. BDE-209 in outdoor air was possibly contributed from PBDEs in indoor air, particularly from BDE-209. Characteristics of diurnal PBDE contamination in indoor and outdoor air in vehicle dismantling factories were linked to commercial technical OctaBDE (Bromkal 79-8DE) and DecaBDEs (Bromkal 82-0D and Saytex 102E) mixtures. The highest PBDE intakes of workers via inhalation were assessed as 41.8 and 32.7 pg kg–1 bw day–1 for male and female adults, respectively. It was hypothesized that airborne PBDEs in indoor factories are released from the surface of DecaBDE or OctaBDE technical formulations and influence outdoor air through ventilation or natural dispersion. However, occupational exposure through inhalation might be an important PBDE contamination pathway, but it is minor compared to PBDE dietary intake.

2. Human exposure to airborne aldehydes in Chinese medicine clinics during moxibustion therapy and its impact on risks to health

Many air toxicants, and especially aldehydes, are generated by moxibustion, which means burning Artemisia argyi. Our goal was to investigate indoor-air aldehyde emissions in Chinese medicine clinics (CMCs) during moxibustion to further evaluate the potential health risks, including cancer risk and non-cancer risk, to the medical staff and adult patients. First, the indoor-air-quality in 60 public sites, including 15 CMCs, was investigated. Four CMCs with frequent use of moxibustion were selected from the 15 CMCs to gather the indoor airborne aldehydes in the waiting and therapy rooms. The mean concentrations of formaldehyde and acetaldehyde in the CMCs' indoor air were 654 and 4230 mg m-3, respectively, in the therapy rooms, and 155 and 850 mg m-3, respectively, in the waiting rooms. The average lifetime cancer risks (Rs) and non-cancer risks (hazard quotients: HQs) of airborne formaldehyde and acetaldehyde among the CMC medical staff exceeded the acceptable criteria ($R < 1.00 \times 10\text{-}3$ and $HQ < 1.00$) for occupational workers. The patients' Rs and HQs were also slightly higher than the critical values ($R = 1.00 \times 10\text{-}6$ and $HQ = 1.00$). Our results indicate that airborne aldehydes pose a significant threat to the health of medical staff, and slightly affected the patients' health, during moxibustion in the CMCs.

3. Indoor level of polybrominated diphenyl ethers in the home environment and assessment of human health risks

It has been demonstrated that human exposure to polybrominated diphenyl ethers (PBDEs) might be associated with several adverse health effects. Dietary and microenvironmental sources are considered to be the main routes of PBDE exposure. The study aimed to investigate PBDEs in residential indoor and outdoor air and further to assess the health risks in family members of different ages. Indoor and outdoor air samples from houses in residential areas were simultaneously collected for analysis of BDE-47, 99, 100, 153, 154, 183, 196, 197, 203, 206, 207, 208, and 209 by high-resolution gas chromatography/high-resolution mass spectrometry. PBDE concentrations were non-significantly higher indoors (81.1 pg/m3) than outdoors (42.7 pg/m3) ($p = 0.513$). For the outdoor air, the mean PBDE level was lower in air outside houses than in air from industrial and urban areas. Levels of Σ14PBDEs and BDE-209 in house indoor air were no higher in Taiwan than other countries. The daily intake of non-dietary PBDEs from house air and dust in Taiwan was highest in the toddlers (1–2 years old; 8.22 ng/kg b.w./day) and lowest in the male adults (≥ 20 years old; 0.562 ng/kg b.w./day) among family members. For Taiwanese, the risks of non-cancer (hazard quotient: HQ) and cancer (cancer risk: R) with neurobehavioral effects of exposure to non-dietary PBDEs in the home environment were assessed to be lower than the critical values of 1.00 and 1.00 × 10–6 for HQs and Rs, respectively. In conclusion, levels of indoor PBDEs and non-dietary daily intake were found to be low in home environments in Taiwan. This result suggests that PBDEs in the home environment are not harmful to family members from the newborn to the elderly if we only consider the neurobehavioral effects.

4. Fate of polychlorinated dibenzo-p-dioxins and dibenzofurans during the thermal treatment of electric arc furnace fly ash

Thermal treatment is often employed to recover the metals contained in electric arc furnace (EAF) fly ash, which is considered a major source of PCDD/Fs. After the present treatment, the mass and volume of untreated material (EAF fly ash + cullet) were significantly reduced by 44.2 and 89.2%, respectively; meanwhile the density increased significantly by 476%. These results indicate that the mass and volume of EAF fly ash can be effectively reduced to benefit the further disposal in landfill. Additionally, this study also investigated the fate of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) during the thermal treatment. For the EAF fly ash with an original PCDD/F content of 1414 ng I-TEQ/kg, 99.58% solid destruction efficiency (SDE) was achieved with thermal treatment at 1450°C. The total PCDD/F I-TEQ contents in ingot and slag were thus reduced to 9.83 and 6.44 ng I-TEQ/kg, respectively. The residual PCDD/F I-TEQ content in slag was far below the soil disposal limit in Taiwan (1000 ng I-TEQ/kg). After PCDD/Fs were decomposed in a secondary combustion chamber at 1200°C, the thermal treatment without air pollution control devices (APCDs) displayed an overall 91.28% destruction removal efficiency (DREW/OAPCD). Furthermore, the total PCDD/F I-TEQ concentrations in the cooling unit, filter and PUF cartridge were reduced to 1340, 131 and 383 pg I-TEQ/Nm3, respectively. Notably, their total amount, 1736 pg I-TEQ/Nm3, exceeded the emission limit in Taiwan (400 or 1000 pg I-TEQ/Nm3). The cooling unit and filter used as APCDs in this study could significantly lower the PCDD/F I-TEQ. The amount of residual PCDD/Fs captured in the PUF cartridge, was low enough (< 400 pg I-TEQ/Nm3) to be directly emitted into the atmosphere. Consequently, the thermal treatment with APCDs in this study was able to effectively reduce the PCDD/F contents in EAF fly ash, while the metal contents were recovered as the ingot.

Aerosol Information Update

2006年至2010年特定期間臺北及高雄地區氣溶膠之特性分析

(Characteristics of ambient aerosol during cultural activities and yellow dust storms in Metropolitans Taipei and Kaohsiung from 2006 to 2010)

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摘要:臺灣臺北市、新北市與高雄市是主要三大都會區，不但人口密度高，亦有頻繁之工商及民俗活動，而使氣溶膠濃度與成分會有不同的變化。此外臺灣位於亞洲季風帶，冬季與夏季受到季風的影響，氣溶膠濃度會有不同的變化。又因南北地理位置的影響，當冬季與春季沙塵暴來臨時，北部地方氣溶膠濃度上升通常是早於南部地區。因氣溶膠成因有自然排放與人為排放，來源包含長程傳輸與本地污染源，因而難以控管，故了解氣溶膠濃度變化與產生來源是本研究之重點。

本研究使用臺灣環保署於新北市新莊區新莊測站及高雄市大寮區輔英測站之超級測站氣溶膠資料(2006年至2010年)，包含：$PM_{2.5}$、PM_{10}、硫酸鹽、硝酸鹽、有機碳、元素碳濃度；亦使用新

莊與大寮普通測站之空氣污染物資料，如：一氧化碳、一氧化氮、二氧化氮、臭氧與二氧化硫；本研究使物種如：$nss^{-}K^{+}$、NO^{3-}、OC_3、EC1-OP、levoglucosan等特別凸顯。非生質燃燒(NBB)類型的水溶性離子比例則高於BB類型，表示偏向受到人為污染。利用碳成分優勢物種、char-EC/soot-EC及OC/EC比值，也可確認BB類用之臺灣中央氣象局之氣象站資料，包含：每小時之溫度、雨量、相對濕度與風速；本研究之特定期間包含：元旦、除夕與農曆春節、中元節、中秋節、國慶日與沙塵暴期間。藉由以上資料整理後，分別進行趨勢分析、自我迴歸整合移動平均模式(Autoregressive Integrated Moving Average model, ARIMA)預測$PM_{2.5}$濃度及主成份分析(Principal components analysis,PCA)。

研究結果顯示，氣溶膠之月平均濃度普遍看來皆有季節特性，大都呈現夏季濃度較低，冬季與春季較高。ARIMA模式預測$PM_{2.5}$濃度結果顯示臺北地區預測$PM_{2.5}$濃度所需參數只需$PM_{2.5}$與PM_{10}，而高雄地區需$PM_{2.5}$、PM_{10}、一氧化碳與臭氧；高雄地區預測相似程度較臺北地區佳。而一氧化碳與臭氧，很可能對高雄地區$PM_{2.5}$質量濃度佔有一定量之貢獻。

沙塵暴氣溶膠之時序變化來看，當沙塵暴來臨時，根據不同地區其濃度峰值、影響時間亦有所不同。就特殊事件之時序變化結果而言，元旦跨年煙火氣溶膠濃度相對於類似性質之雙十國

慶煙火較不明顯；除夕與農曆春節，氣溶膠濃度有明顯之峰值；中元節活動氣溶膠峰值較不明顯，但仍可發現氣溶膠濃度於中元節傍晚時可能受到祭祀活動影響有上升之現象；中秋節於新莊測站可發現氣溶膠濃度於當日，或前一日傍晚便開始上升，可能受到烤肉活動所影響。

PCA模式中以沙塵暴事件而言，臺北地區第一主成份大多以氣溶膠所組成(變異數:39.18%~49.45%)，而高雄地區第一組成份則以其他空氣污染物(一氧化碳、一氧化氮、二氧化氮、臭氧與二氧化硫)組成(變異數:40.83%)。就特殊事件而言，臺北地區受到特殊事件之影響會較高雄地區來得大，在元旦、除夕與農曆春節與中元節，臺北的第一組成份多由氣溶膠所組成(變異數: 45.31%~54.28%)；而高雄之元旦即除夕與農曆春節亦由氣溶膠所組成（變異數: 29.10%~46.87%)。由以上之結果，可以研判特殊事件氣溶膠之影響高於沙塵暴。

由沙塵暴與特殊事件氣溶膠平均濃度比值中可以發現，當沙塵暴來臨時$PM_{2.5}$濃度增量幅度較PM_{10}濃度來得小，而特殊事件$PM_{2.5}$濃度大多會隨著PM_{10}濃度上升，因此可知道特殊事件人類行為對$PM_{2.5}$濃度佔一定量之貢獻。

定量噴霧液於不同管徑氣管內管之輸送效果研究

(DURING THE DIFFERENT DIAMETER ENDOTRACHEAL TUBE METERED AEROSOL DELIVERY EFFECT)

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摘要:嬰兒慢性肺疾病是指所有於新生兒時期因肺部傷害所導致最終的肺部異常變化。因肺部呼吸道阻力很高，因此常合併反覆性喘鳴。給於短效吸入性的Beta2-adrenergic agonist可有效緩解支氣管攣縮，而換氣改善換氣量。或者使用吸入類固醇為抗發炎藥物，除了降低支氣管擴張劑的使用率、改善換氣量、並降低氧氣濃度及縮短呼吸器使用天數。

本實驗目的主要為模擬使用正壓機械性換氣經不同氣管內管直接噴入裝置於吸藥輔助器的吸入性皮質類固醇-Duasma藥劑，並以高效能液相層析法(high performance liquid chromatography)所呈現的訊號值分布變化探討經過不同內徑氣管內管，所供應的藥物是否能有較多的劑量進入下呼吸道。實驗推估,氣管內管的管徑越大,藥物輸送量成正比例的增加。

重要會議日期

會議日期	會議名稱	會議地點
May 29-31, 2017	14th International Atmospheric Sciences and Applications to Air Quality (ASAAQ) Conference http://www.igacproject.org/events/14th-international-atmospheric-sciences-and-applications-air-quality-asaaq-conference	Strasbourg, France
June 5-8, 2017	A&WMA's 110th Annual Conference & Exhibition Bridging Environment, Energy & Health https://www.awma.org/Files/ACE2017/ACE%202017%20Preliminary%20Program%203-8.pdf	Pittsburgh, PA
July 3-6, 2017	Asian Aerosol Conference 2017 http://aac2017.w3.kanazawa-u.ac.jp/	Jeju, Korea
August 7-8 2017	2017 T&T International Aerosol Conference	Prince of Songkla University, Thailand
August 27 - September 1, 2017	European Aerosol Conference 2017 (EAC) https://www.pmiscience.com/science/conferences/european-aerosol-conference-2017-(eac)	Zurich, Switzerland

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