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Overview of the Special Issue "Selected Papers from the 2014 International Aerosol Conference"

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ABOUT THE IAC-2014

An International Aerosol Conference (IAC), held once in every four years, is the largest and most prestigious professional meeting in the aerosol research community worldwide. The 9th IAC was organized by the Korean Association for Particle and Aerosol Research (KAPAR) on behalf of the International Aerosol Research Assembly (IARA) and held from August 31 to September 5, 2014 in Busan, Republic of Korea. A total of 1215 participants from 52 countries presented 1059 papers, including 529 oral and 530 poster presentations. More than a half (51%) of the presentations was from Asia followed by Europe (35%), and North America (15%). The presentations covered a wide range of aerosol-related studies. Among 17 topics, the theme 'atmospheric aerosols and air quality' had the most presentations (21% of the total number of papers presented), followed by 'aerosol chemistry' (10%), 'atmospheric aerosols and global climate' (9%), 'instrumentation' (8%) and 'aerosol physics' (8%). This suggests that air quality issues related to ambient aerosols is of a major concern, especially, in East Asian countries.

In addition to research presentations, various educational and social activities were carried out during the IAC-2014. There were tutorial lectures attended by 166 participants as well as several plenary and keynote lectures given by distinguished speakers. One of the popular social activities was a conference tour to the traditional Korean folk village and Buddhist temples, both are UNESCO world heritage sites. Also, there was a large and interesting exhibition from 29 companies and institutions related to aerosols.

IN THE SPECIAL ISSUE

This special issue of the journal includes 27 papers selected from the conference after a rigorous peer-review process. About half of them are related to the chemical and physical characteristics of ambient aerosols and toxic air pollutants, including PAH, $PM_{2.5}$, PM_{10}, ultrafine particles (UFPs) and bioaerosols, reflecting the importance of air pollution issue in Asia and around the world. The other half of the papers published in this special issue addresses indoor aerosols, control methods and devices, drug delivery and aerosol physics.

Northeast Asia is known for high emissions of anthropogenic air pollutants, mainly due to the consumption of a large amount of energy as well as a very large population. In 2014, China, Japan, and South Korea consumed 23.0% (1st in the world), 3.5% (5th), and 2.1% (9th) of the world total primary energy, respectively. In addition, the rate of the primary energy consumption in China is constantly increasing (currently at about 8% per year). More than a half of the world total coal is consumed in China. The huge amount of the generated energy produces an extraordinary emission of air pollutants.

Among air pollutants, ambient fine particles are known to cause increase of human mortality and morbidity as well as reduction of visibility. Aerosol emission into atmosphere is also associated with climate change. Smog or haze has become one of the serious concerns in East Asia, especially in Northeast Asia. Recently China, Japan, and South Korea have adopted new air quality standards for fine particles ($PM_{2.5}$, particulate matter with an aerodynamic diameter below 2.5 µm) to reduce the ambient concentrations of fine particles. However, unlike PM_{10}, the previous air quality standard for ambient particles, a major fraction of $PM_{2.5}$ mass is generated in the atmosphere via chemical reactions. To develop effective control strategies against $PM_{2.5}$, it is necessary (1) to understand the major chemical transformation processes of generation, transport, and removal of $PM_{2.5}$, (2) to validate the emission inventories and ambient levels of precursor species, and (3) to quantify the $PM_{2.5}$ transport from outside to the

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area of interest in addition to the conventional emission control measures against particles. These aspects are considered in the papers published in this special issue.

There are several mega-cities in Northeast Asia. To manage air quality in these mega-cities, several measures have been taken. This includes tough regulation related to the emissions from diesel vehicles in Tokyo and the coal usage and vehicular emissions in Beijing. In case of Seoul (an area of 605 km^2, current population of over 10 million, and the number of vehicles of almost 3 million in 2010), the 'Basic Plan on the Metropolitan Air Quality Management' was implemented in 2005. The original first phase of the Plan was to invest 4.73 trillion Won (4.3 billion USD) which would lead to a substantial reduction of the ambient concentrations of PM_{10} and NO_2. With the initiation of the second phase in 2015, $PM_{2.5}$ and ozone have been designated as the target air pollutants. Cooperation in Northeast Asian countries in both science and policy is essential to further improve air quality in the region and respond to the climate change related issues since the mega-cities in Northeast Asia have a lot in common with respect to air quality management given a very high ambient dust level and a drastic increase of the number of vehicles.

Along these lines, the paper presented by Jung *et al.* (2015) is of particular interest as it discusses the relationship between the energy consumption in Northeast Asia and the air quality in a mega-city such as Seoul. Local transportation and coal consumption for coke oven in China were identified as the major sources of PAHs in the Seoul area during 2002–2003 and 2006–2007, according to results of chemical mass balance (CMB) modelling fed with the measurement data of particulate PAHs. During 2002 to 2003, the contribution from local transportation was higher than that from coke oven, and it decreased during 2006 to 2007 due to the stringent policies aiming at vehicular emission reduction in Seoul. This study suggests that the impacts of China on the air quality of Seoul will potentially keep increasing for years ahead since the consumptions of coal in general and in coke oven, in particular, are increasing.

Several papers published in this special issue address physical and chemical properties of ambient aerosols. Among them are a study on the relationship between chemical composition of $PM_{2.5}$ and light extinction at Beijing, China (Wang *et al.*, 2015) and an investigation of the relationship between the size distribution of PM_{10} and optical properties along with BC data collected in Lanzhou, China (Pu *et al.*, 2015). The chemical and physical transformation processes involving airborne particles determine the characteristics and fate of atmospheric aerosols; therefore, it is essential to understand these processes for developing effective air pollution control policy measures. The IAC-2014 special issue includes several studies on this topic, such as the measurement of the secondary organic aerosol formation at a site in the Indo-Gangetic Plain, India (Rastogi *et al.*, 2015) and a modelling effort on the impact of sea-salt emissions on aerosol chemical formation and deposition over Pearl River Delta, China (Liu *et al.*, 2015a). Liu *et al.* (2015b) investigated the secondary inorganic aerosols (SIA) during a heavy haze episode that occurred in Beijing between September 20th and27th, 2011. Relatively stable synoptic conditions and regional transport from the polluted areas in the south and southwest of Beijing favored the formation of haze during which a significant increase of the $PM_{2.5}/PM_{10}$ ratio was observed accompanied by substantial elevation of concentrations of secondary inorganic pollutants (SO_4^{2-}, NO_3^- and NH_4^+). A sharp increase in the sulfur oxidation ratio (SOR) and nitrogen oxidation ratio (NOR) indicated that secondary processes significantly strengthened the haze episode. Talifu *et al.* (2015) extensively studied the micro-morphological characteristics of $PM_{2.5}$ in the Kuitun-Dushanzi petrochemical area of the Xinjiang Uygur Autonomous Region, China. The individual particle types contributing to the $PM_{2.5}$ fraction were identified as mineral particles (regular and irregular), spherical particles (coal-fired fly ash and some secondary particles), soot aggregates, as well as others (unclassified). Vehicle exhaust and waste gas emitted from a power plant were defined as primary sources of mineral aerosols with seasonal variations of the concentration. Kumar *et al.* (2015) investigated the size change of sodium combustion aerosols of high concentrations with ambient relative humidity and observed that sodium combustion aerosols size grow due to hygroscopic growth in the initial period of times of about 20 minutes followed by Brownian coagulation. An empirical equation was developed to match the experimental data for particle diameters.

Li *et al.* (2015) investigated the seasonal variation and spatial distribution of PM_{10} at Kinmen, Matsu, and Penghu Islands in the Taiwan Strait during a period of 2008–2012. The authors found that the average PM_{10} concentrations at the Kinmen islands were generally higher than those determined at other sampling sites due to superimposition phenomenon during the air pollution episodes at Kinmen Islands and Xiamen region. The most abundant water-soluble ionic species of PM_{10} were SO_4^{2-}, NO_3^- and NH_4^+, indicating that PM_{10} was mainly composed of secondary inorganic aerosols. Source apportionment results suggest that the vehicular exhaust represented the main source of PM_{10} followed by industrial boilers, secondary aerosols, soil dusts, biomass burning, petrochemical plants, steel plants, oceanic spray, and cement plants at the island and coastal sampling sites in the Taiwan Strait.

A long-term PM study at an urban site, Klang Valley, Kuala Lumpur, between 2002 and 2011 was conducted by Rahman *et al.* (2015). A PMF (Positive Matrix Factorization) analysis identified five sources for $PM_{2.5}$ with vehicular emission being the primary source of haze air PM (contributed about 35% to the $PM_{2.5}$ mass). Long term measurements of $PM_{2.5}$ and UFPs for daily average mass concentration at three urban air monitoring stations were performed from 2011 to 2013 by Lin *et al.* (2015). Results showed that daily average UFPs mass concentrations in spring and summer were higher than those in autumn and winter due to the impacts by heavy traffic emission and new particle formation event. The average number and surface area concentration ratios of UFPs to those of $PM_{2.5}$ at these stations were 89.0 ± 5.5% and 42.1 ± 12.8%, respectively, although UFPs mass concentration was only 7.9 ± 4.4% of $PM_{2.5}$. This study suggests that UFPs contribute significantly to the health-relevant $PM_{2.5}$ aerosol fraction and warrant a serious attention to the UFP emission and formation in future research.

Rain is known as a powerful way to remove aerosol particles from the atmosphere. At the same time, rain events during monsoon were found to increase the concentrations of culturable biological particles in ground-level air environments. The experimental work presented by Kang *et al.* (2015) revealed that such increase might be caused by the transportation of bioaerosols by falling raindrops from higher altitude to the ground, where the bioaerosols accumulate, as well as by the decrease in UV irradiation intensity during rain events.

There is a potential relationship between toxicity and different source-specific parameters of ambient $PM_{2.5}$ (i.e., organic/elemental carbon, fossil fuel and biomass burning related components of BC, and heavy metals). The study by Filep *et al.* (2015) revealed that cyto- and genotoxicity of ambient $PM_{2.5}$ were strongly emission source dependent. It was found that the higher the ratio of the biomass burning related carbonaceous aerosol the higher the cytotoxicity, and the higher the ratio of the fossil fuel related carbonaceous aerosol the higher the genotoxicity.

The dispersion of naturally occurring asbestos (NOA), found as a natural component of rocks and soils, has become an increasingly important issue as asbestos is classified as a carcinogen. The paper by Lee *et al.* (2015) focused on finding effective treatment methods to reduce the hazard posed by NOA by changing its characteristics. Unprocessed chrysotile-containing soils and rocks were treated using heat, and heat-oxalic acid combination methods. The investigators reported that the optimal treatment condition for chrysotile-containing soils and rocks was 1 M oxalic acid at 250°C for 1 hour. This study provides valuable information for improving the safety characteristics of existing NOA disposal methods.

Studies have indicated that particles originated from wood burning represent a major source of elevated winter-time PM in many parts of the world yet there is a lack of real-life PM emission factors. Coulson *et al.* (2015) analyzed the real-life PM_{10} emission data from in-situ woodstoves and found considerable variation both within and between campaigns. PM_{10} emission factors from in-situ tests were reported to exhibit a log-normal distribution with a geometric mean (± standard deviation) of 9.8 g kg^{-1} (± 2.4 g kg^{-1}) and 3.9 g kg^{-1} (± 3.8 g kg^{-1}) (dry wood), respectively, for older and low-emission stoves. Based on statistical analysis, Coulson *et al.* concluded that variation in emissions is inherent in the way woodstoves are used in real life and that regulators will need to allow for a range of emissions in management plans as a definitive emission factor may not be possible.

Cooking process is known to contribute significantly to the ambient PM, particularly $PM_{2.5}$. The paper by Wang *et al.* (2015) characterized $PM_{2.5}$ emission from four different Chinese cooking styles. It was found that barbecue emitted the highest $PM_{2.5}$ concentration while home cooking had the highest emission amounts (kg $PM_{2.5}$/year) and the highest emission factors (g $PM_{2.5}$/kg-oil consumed). The predominant chemical composition in $PM_{2.5}$ was organic carbon (OC) and barbecue displayed the highest mass fractions of organic acids in cooking fume.

In addition to the ambient air quality, indoor air quality has been recognized as a significant issue, especially considering that people in many countries spend almost 85–90% of their time indoors. The paper by Hussein *et al.* (2015) compared the workdays and weekend pattern of particle number (PN) and mass (PM) concentrations in four offices in Jordan. The authors concluded that regularly occupied offices exhibit a daily pattern characterized by high aerosol concentrations during working hours. As expected, the presence of carpets was found to be associated with the elevated particle concentration. Human activities were shown to cause an increase in particle mass and number concentrations due to re-suspension of dust particles, particularly in carpeted offices.

The prevalence of SBS-related symptoms among hospital workers was investigated in the paper presented by Chang *et al.* (2015) who found CO_2, PM_{10}, $PM_{2.5}$, bacteria and total VOCs had significant effects on SBS-related symptoms among hospital workers similar to those reported in other studies conducted with the office workers.

Indoor exposure to airborne microorganisms has been associated with various adverse health outcomes. Consequently, the characterization of bioaerosols in urban built environments has attracted considerable attention. This topic was addressed by Sidra *et al.* (2015) who studies indoor bioaerosols in residences in Pakistan. The authors observed a measurable seasonal bioaerosol variation in the kitchens while this variation was less pronounced in the living rooms; the authors also reported a direct association between temperature and bacteria and fine PM but not between temperature and fungi. Ventilation was also found to produce a significant impact upon PM levels. To quantify indoor bioaerosols, various samplers have been used, but mostly impingers and impactors. In recent years, several electrostatics-based bioaerosol samplers have been introduced, including a field-deployable electrostatic precipitator (ESP) with superhydrophobic surface developed by Han *et al.* (2015). The device showed reasonably high collection efficiency when challenged with laboratory-generated bioaerosols. The testing in an outdoor environment, demonstrated the ability of the new device to rapidly detect airborne microorganisms utilizing an ATP-based detection principle. The instrument allows detecting airborne microorganisms more rapidly compared to traditional bioaerosol collectors tested in the quoted study.

Various techniques are presently being developed to produce aerosol materials deployable for air pollution control. For example, catalytic materials capable of purifying polluted air can be produced by aerosol synthesis as demonstrated in the paper presented in this special issue by Zahaf *et al.* (2015). In their study, silica-supported platinum (Pt/SiO_2) and alumina-supported platinum (Pt/Al_2O_3) were prepared by spray pyrolysis method. The sintering effect on Pt particles over Al_2O_3 at high temperature (~250°C) was found to be more prominent than that over SiO_2 suggesting a stronger interaction between Pt particles and SiO_2 support as compared to the one between Pt particles and Al_2O_3 support. The experimental evaluation of selective reduction of nitrogen monoxide by propene at 250°C demonstrated that NO_x conversions to N_2O and N_2 in Pt/SiO_2 and Pt/Al_2O_3 catalysts take place at efficiencies of 29.8% and 55.8%, respectively.

To continue the air pollution control theme, Jackiewicz and Werner (2015) demonstrated that nanofiber filters are effective for nanoparticle removal. The investigators produced polypropylene fibrous filters (polypropylene filter mats) with diameters ranging from 0.47 to 9.62 µm using a modified melt-blown technique. The authors showed that by reducing the diameter of fibers in the filter mat, it is possible to increase the efficiency of the separation of both solid and liquid nanoparticles from the air with a higher pressure drop. The filtration efficiencies showed no difference for particles of different morphologies, and the data were successfully interpreted using the Partially Segregated Flow Model, which takes into account the polydisperse distribution of fiber diameters in the filter. The classical filtration theory was found to significantly overestimate the experimental data of the filtration efficiency. Pleated filter cartridges have been widely used to remove particles in conventional ventilation systems, thermal power generation facilities and marine power plants. The paper by Chen *et al.* (2015) established an association between the dust type and the dust holding capacity as well as the cleaning effectiveness of a pleated filter cartridge. If the pleated filter cartridge is used for removing atmospheric aerosols with high percentage of ultrafine particles, this study found that ASHRAE test dust is a better choice because of its short filtration cycle duration.

In a continuing effort to develop an advance understanding of simultaneous mercury adsorption and a PM removal using an ESP principle, Clack (2015) applied a computer modelling to simulate the simultaneous removal of PM and gaseous Hg pollutant in precipitators. It was reported that wall-bounded mechanisms of Hg removal by PAC (Pulverized Activated Carbon) are generally quite small compared to the in-flight mechanism of Hg removal. The findings highlight the need to optimize control processes originally designed for a single pollutant but often deployed for a dual-pollutant control.

Separation and capture of aerosol particles for air purification or aerosol sampling purposes are often conducted using cyclones, which allow for a considerable processing capacity while being inexpensive and easy to operate. In the course of investigation of the particle collection efficiency of cyclones used to control $PM_{2.5}$, it was found that the positions of the particles at the entrance section have a significant effect on the collection efficiency. Using numerical modelling, Ma *et al.* (2015) demonstrated that an additional particle arrangement device installed in front of a cyclone (a so-called reverse-rotation cyclone) can move particles radically outward in the entrance section and enhance the particle collection efficiency.

The other important topic addressed in this special issue is the delivery of aerosol drugs through the respiratory system as a way to manage the obstructive airway diseases. The paper by Farkas *et al.* (2015) describes an application of advanced computational methods for characterizing the deposition distribution of two marketed aerosol drugs in the respiratory tract. The authors identified inter-individual differences in terms of the regional particle deposition. The study highlighted the need for an adequately-designed, customized drug selection and delivery.

To improve the knowledge of the dynamic behavior of aerosols consisting of agglomerates, Zhang *et al.* (2015) verified the effect of the Taylor expansion order on the accuracy of the Taylor-series expansion method of moment (TEMOM) model. It was reported that the existing TEMOM model with a third-order Taylor expansion was the most reliable model for solving population balance equations for agglomerates undergoing Brownian coagulation. The paper is of importance to understand dynamic behavior of $PM_{2.5}$ and UFPs in ambient air.

CONCLUDING REMARKS

The IAC-2014 held in Busan, Korea, was a truly successful international meeting that attracted 1215 participants who exchanged the latest scientific information and enhanced their knowledge about various aspects of aerosol research, including physical and chemical properties of aerosols, particle sampling and analysis, ambient and indoor air quality assessment and control, characterization of airborne particles of biological origin, aerosol drug delivery and others. The special issue publishes 27 papers selected from the numerous conference presentations. This overview summarizes the most important findings described in these papers. The guest editors would like to thank the authors for their contributions and to the referees for their thorough reviews and critical comments.

To further build on the foundation established by the previous aerosol conferences, the aerosol researchers are looking forward to the next IAC that will be held in St. Louis, USA on September 2–7, 2018. The host organization is AAAR under the auspice of the International Aerosol Research Assembly (IARA).

REFERENCES

Chang, C.J., Yang, H.H. and Wang, Y.F. (2015). Prevalence of Sick Building Syndrome-Related Symptoms among Hospital Workers in Confined and Open Working Spaces. *Aerosol Air Qual. Res.* 15: 2378–2384.

Chen, Z., Bao, B., Zhu, W. and Lin, Z. (2015). Effect of Test Dust on Performance Test for a Pleated Filter Cartridge. *Aerosol Air Qual. Res.* 15: 2436–2444.

Clack, H.L. (2015). Simultaneous Removal of Particulate Matter and Gas-Phase Pollutants within Electrostatic Precipitators: Coupled In-Flight and Wall-Bounded Adsorption. *Aerosol Air Qual. Res.* 15: 2445–2455.

Coulson, G., Bian, R. and Somervell, E. (2015). An Investigation of the Variability of Particulate Emissions from Woodstoves in New Zealand. *Aerosol Air Qual. Res.* 15: 2346–2356.

Farkas, Á., Jókay, Á., Füri, P., Balásházy, I., Müller, V., Odler, B. and Horváth, A. (2015). Computer Modelling as a Tool in Characterization and Optimization of Aerosol Drug Delivery. *Aerosol Air Qual. Res.* 15: 2466–2474.

Filep, Á., Drinovec, L., Palágyi, A., Manczinger, L., Vágvölgyi, C., Bozóki, Z., Hitzenberger, R. and Szabó, G. (2015). Source specific Cyto- and Genotoxicity of Atmospheric Aerosol Samples. *Aerosol Air Qual. Res.* 15: 2325–2331.

Han, T., Zhen, H., Fennell, D.E. and Mainelis, G. (2015). Design and Evaluation of the Field-Deployable Electrostatic Precipitator with Superhydrophobic Surface (FDEPSS) with High Concentration Rate. *Aerosol Air Qual. Res.* 15: 2397–2408.

Hussein, T., Dada, L., Juwhari, H. and Faouri, D. (2015). Characterization, Fate, and Re-Suspension of Aerosol Particles (0.3–10 µm): The Effects of Occupancy and Carpet Use. *Aerosol Air Qual. Res.* 15: 2367–2377.

Jackiewicz, A. and Werner, Ł. (2015). Separation of Nanoparticles from Air Using Melt-Blown Filtering Media. *Aerosol Air Qual. Res.* 15: 2422–2435.

Jung, D.B., Cho, Y.S., Kim, I.S., Lee, J.Y. and Kim, Y.P. (2015). Impact of Energy Consumption in Northeast Asia to the Particulate PAHs Levels and Composition at Seoul. *Aerosol Air Qual. Res.* 15: 2190–2199.

Kang, S.M., Heo, K.J. and Lee, B.U. (2015). Why Does Rain Increase the Concentrations of Environmental Bioaerosols during Monsoon? *Aerosol Air Qual. Res.* 15: 2320–2324.

Kumar, A., Subramanian, V., Baskaran, R. and Venkatraman, B. (2015). Size Evolution of Sodium Combustion Aerosol with Various RH%. *Aerosol Air Qual. Res.* 15: 2270–2276.

Lee, J., Yoon, C., Ham, S. and Tsai, P.J. (2015). Optimal Treatment Condition for Changing Characteristics of Naturally Occurring Asbestos. *Aerosol Air Qual. Res.* 15: 2332–2345.

Li, T.C., Yuan, C.S., Lo, K.C., Hung, C.H., Wu, S.P. and Tong, C. (2015). Seasonal Variation and Chemical Characteristics of Atmospheric Particles at Three Islands in the Taiwan Strait. *Aerosol Air Qual. Res.* 15: 2277–2290.

Lin, G.Y., Lee, G.R., Lin, S.F., Hung, Y.H., Li, S.W., Wu, G.J. and Tsai, C.J. (2015). Ultrafine Particles and $PM_{2.5}$ at Three Urban Air Monitoring Stations in Northern Taiwan from 2011 to 2013. *Aerosol Air Qual. Res.* 15: 2305–2319.

Liu, Y., Zhang, S., Fan, Q., Wu, D., Chan, P., Wang, X., Fan, S., Feng, Y. and Hong, Y. (2015a). Accessing the Impact of Sea-Salt Emissions on Aerosol Chemical Formation and Deposition over Pearl River Delta, China. *Aerosol Air Qual. Res.* 15: 2232–2245.

Liu, X., Sun, K., Qu, Y., Hu, M., Sun, Y., Zhang, F. and Zhang, Y. (2015b). Secondary Formation of Sulfate and Nitrate during a Haze Episode in Megacity Beijing, China. *Aerosol Air Qual. Res.* 15: 2246–2257.

Ma, L., Fu, P., Wu, J., Wang, F., Li, J., Shen, Q. and Wang, H. (2015). CFD Simulation Study on Particle Arrangements at the Entrance to a Swirling Flow Field for Improving the Separation Efficiency of Cyclones. *Aerosol Air Qual. Res.* 15: 2456–2465.

Pu, W., Wang, X., Zhang, X., Ren, Y., Shi, J.S., Bi, J.R. and Zhang, B.D. (2015). Size Distribution and Optical Properties of Particulate Matter (PM_{10}) and Black Carbon (BC) during Dust Storms and Local Air Pollution Events across a Loess Plateau Site. *Aerosol Air Qual. Res.* 15: 2212–2224.

Rahman, S.A., Hamzah, M.S., Elias, M.S., Salim, N.A.A., Hashim, A., Shukor, S., Siong, W.B. and Wood, A.K. (2015). A Long Term Study on Characterization and Source Apportionment of Particulate Pollution in Klang Valley, Kuala Lumpur. *Aerosol Air Qual. Res.* 15: 2291–2304.

Rastogi, N., Patel, A., Singh, A. and Singh, D. (2015). Diurnal Variability in Secondary Organic Aerosol Formation over the Indo-Gangetic Plain during Winter Using Online Measurement of Water-Soluble Organic Carbon. *Aerosol Air Qual. Res.* 15: 2225–2231.

Sidra, S., Ali, Z., Sultan, S., Ahmed, S., Colbeck, I. and Nasir, Z.A. (2015). Assessment of Airborne Microflora in the Indoor Micro-Environments of Residential Houses of Lahore, Pakistan. *Aerosol Air Qual. Res.* 15: 2385–2396.

Talifu, D., Wuji, A., Tursun, Y., Kang, H., Hu, Y., Guo, Y. and Shao, L. (2015). Micro-Morphological Characteristics and Size Distribution of $PM_{2.5}$ in the Kuitun-Dushanzi Region of Xinjiang, China. *Aerosol Air Qual. Res.* 15: 2258–2269.

Wang, G., Cheng, S., Wei, W., Wen, W., Wang, X. and Yao, S. (2015). Chemical Characteristics of Fine Particles Emitted from Different Chinese Cooking Styles. *Aerosol Air Qual. Res.* 15: 2357–2366.

Wang, H., Tian, M., Li, X., Chang, Q., Cao, J., Yang, F., Ma, Y. and He, K. (2015). Chemical Composition and Light Extinction Contribution of $PM_{2.5}$ in Urban Beijing for a 1-Year Period. *Aerosol Air Qual. Res.* 15: 2200–2211.

Zahaf, R., Jung, J.W., Coker, Z., Kim, S., Choi, T.Y. and Lee, D. (2015). Pt Catalyst over SiO_2 and Al_2O_3 Supports Synthesized by Aerosol Method for HC-SCR DeNOx Application. *Aerosol Air Qual. Res.* 15: 2409–2421.

Zhang, X., Yu, M., Liu, Y. and Seipenbusch, M. (2015). Verification of Expansion Orders of the Taylor-Series Expansion Method of Moment Model for Solving Population Balance Equations. *Aerosol Air Qual. Res.* 15: 2475–2484.

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