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Overview of the Special Issue "$PM_{2.5}$ in Asia" for 2015 Asian Aerosol Conference

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About the 2015 AAC

The Asian Aerosol Conference (AAC), held every two years, is the most prestigious conference for aerosol researchers in Asian region. The 9th AAC (AAC 2015) was held by Japan Association of Aerosol Science and Technology (JAAST) on behalf of Asian Aerosol Research Assembly (AARA) from June 24 to 27, 2015 at Kanazawa, Japan. A total of 520 participants from 14 countries presented 430 papers, including 4 plenary lectures, 16 keynote speeches, 125 oral and 285 poster papers in the conference. There were 270 Japanese participants and 250 participants from abroad in which China (with 87 participants), Korea (with 77 participants) and Taiwan (with 57 participants) contributed to the most attendees. Among the papers presented in the conference, '$PM_{2.5}$ symposium', "atmospheric aerosols' and 'urban air quality' sessions addressed many important issues related to $PM_{2.5}$ and ambient aerosols in East Asian countries. The features of this conference is the inaugural presentation of six AARA fellows, bestowal of two Asian Young Aerosol Scientist Awards, and a half day symposium "Analysis of Aerosol by Young Asian Researchers" which was a great opportunity for the networking of young aerosol researchers in Asian region.

IN THE SPECIAL ISSUE

There are a total of 63 manuscripts submitted to this special issue for which only 26 papers are accepted after the peer-review process. More than half of the papers (16 papers) are related to $PM_{2.5}$, atmospheric aerosols and urban air quality reflecting the concern of $PM_{2.5}$ and air pollution issues in Asia region. The rest of the papers (10) address indoor aerosols, air toxics, health effects, control techniques and aerosol instrumentation etc.

Many cities in Asian countries have suffered from severe and long-term haze pollution events for many years. Shijiazhuang, the capital of Hebei Province, exemplifies such a city which is ranked as the 2nd most polluted city in China with frequent extraordinarily persistent haze. It is important to understand the potential sources for developing effective $PM_{2.5}$ control measures to cope with haze problems. To this aim, Chen *et al.* (2017) used backward air parcel trajectories and PSCF (potential source contribution function) analysis to identify the transport pathway and potential sources of $PM_{2.5}$. A significant regional impact on $PM_{2.5}$ at Shijiazhuang during the haze period was found, including the impacts from Beijing-Tianjin region and Shandong Province. The study points out the need for the development of $PM_{2.5}$ control measures on a regional scale. A series of pollution control measures has been adopted by Shijiazhuang government to effectively control regional $PM_{2.5}$ and improve the air quality recently, including the optimization and adjustment of energy and industrial structure, comprehensive industrial pollution treatment, vehicle exhaust pollution control, and elimination of outdated technology. The $PM_{2.5}$ concentrations had dropped considerably in recent years with the annual average of 157.0, 114.1, and 89.0 µg m^{-3} in 2013, 2014, and 2015, respectively (Wang *et al.*, 2017a).

Another examples occur in heavily polluted cities such as Zhengzhou and Beijing. The regional transport from the northeast and southeast of Zhengzhou (such as Puyang, Kaifeng, Zhoukou, and Xuchang in Henan province) was found to contribute significantly to the $PM_{2.5}$ pollution besides the influence of other complex factors such as primary emissions and secondary production from local sources, and meteorological conditions (Wang *et al.*, 2017b). Lang *et al.* (2017) investigated the long-term trend of $PM_{2.5}$ from 2000–2015 in Beijing and showed that the annual average $PM_{2.5}$ concentration generally decreased by 1.5 µg m^{-3} per

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year from 2000 to 2015 under the implementation of 16 phases' air pollution control measures. OC, soil dust and typical elements (Si, Ca, Fe, Mn, Cu, Pb and K) presented a downward trend while EC had almost no change before 2003, increased from 2003 to 2007, but decreased after 2007 due to the replacement of fossil fuel and control of biomass emission. The continuous rising of OC/EC and SOC/OC (secondary organic carbon, SOC) in recent years illustrated the secondary carbonaceous species pollution is becoming serious. $PM_{2.5}$ change trend indicated the emission mitigation measures implemented in Beijing have reduced the primary $PM_{2.5}$ effectively. However, the control of secondary components should be paid special attention in order to further improve the air quality in Beijing effectively.

Identification of $PM_{2.5}$ sources in fast growing cities within Asia is an important scientific task from the air quality management viewpoint. Seneviratne *et al.* (2017) have constructed the source profiles of $PM_{2.5}$ in Kandy (Sri Lanka) based on the measurement of 17 major elements and BC, quantified the relative contribution of each source in different seasons using positive matrix factorization and explored the locations of the source contributions through conditional probability function analyses. The major sources of $PM_{2.5}$ in Kandy were identified to be soil, sea salt, vehicular emissions, biomass burning and industrial sources.

The chemical and physical transformation processes of aerosol in the air determine the characteristics and fate of atmospheric aerosols. Therefore, it is essential to understand these processes to develop effective policy measures against air pollution. In the study of Misawa *et al.* (2017), the mass concentration and chemical components of the particulate $PM_{2.5}$ were continuously observed using an automatic analyzer at Kumamoto on the west coast of Japan from October 2014 to March 2015. A greater number of high $PM_{2.5}$ days were observed in winter than in autumn. This seasonal change in concentrations was believed to be due to transboundary air pollution traveling from the Asian continent due to seasonal monsoons. The analysis of the chemical composition of $PM_{2.5}$ based on the analysis of sulfate (SO_4^{2-}) and sulfur dioxide (SO_2) concentrations supported this idea. The average concentration of chemical components showed that local air pollution also influenced air quality in Kumamoto. For simultaneous measurement of ambient water-soluble ions in $PM_{2.5}$ and precursor gases, Li *et al.* (2017) developed an automated system consisting of a particle-into-liquid sampler (PILS) and a parallel plate wet denuder (PPWD) coupled with an ion chromatography. The performance of the PPWD/PILS was validated by comparing it with the PDS (porous metal denuder sampler) and the accuracy of the system for precursor gases was found to outperform the other commercial systems. Field continuous data from this system allowed the examination of temporal variations of water soluble inorganic ions and precursor gases in details. For example, NH_3 was the most abundant precursor gas with the diurnal pattern peaking at low nocturnal boundary heights and during rush hours with local traffic emissions in Taipei. A reverse diurnal pattern for HONO in Taipei reflected the daytime photolysis and its nocturnal heterogeneous reaction. Correspondingly high concentrations of major ions and precursor gases were associated with the photochemical secondary aerosol formations and heavy traffic in Taipei.

Biomass burning, a major source of fine primary carbonaceous aerosols, tends to affect urban air quality in South Asia through the long-range transport of fire emissions. Ommi *et al.* (2017) have explored the high $PM_{2.5}$ concentrations observed at Rajshahi, an industrial city, relative to the other three cities in Bangladesh during the winter season of 2010 to 2012 using a combination of different techniques including source apportionment based on positive matrix factorization and satellite measurements of fire radiative power. The outcome of this work demonstrated the impact of biomass burning plumes originating from Nepal and Northern India on the air quality of Rajshahi. Verma *et al.* (2017) analysed $PM_{2.5}$ and PM_{10} aerosols from a semi-urban site of Agra, North-Central India for carbonaceous aerosols, low molecular weight monocarboxylic acids along with inorganic ions during April 2014 to August 2015. Correlation analysis of acetic acid (AA) and formic acid (FA) with major ions (Cl^-, NO^{3-}, SO_4^{2-}, K^+ and Ca^{2+}), EC, secondary organic carbon and trace gases (O_3 and CO) was performed to identify their primary or secondary origin. The results suggest that AA is mainly contributed by primary sources while FA originates from secondary sources. The study at 3 different air environments in southern Taiwan found that major $PM_{2.5}$ sources for the urban and industrial sites came from vehicular exhausts and industrial emissions while the background site was dominated by biomass burning and soil dusts (Yang *et al.*, 2017a).

A fundamental understanding of secondary aerosols is needed for reducing $PM_{2.5}$ levels at a city scale. In this context, the fate and transport of precursor gases related to secondary $PM_{2.5}$ is widely studied. Dodla *et al.* (2017) investigated the spatial and temporal dispersion of SO_2 and NO, the precursor gases of particulate-sulfate and nitrate, emanating from two major coal-fired thermal power plants in Andhra Pradesh, India, using an integrated modeling approach of the Advanced Research Weather Research & Forecasting (ARW) model and Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model. Zhang *et al.* (2017a) examined the hourly particulate matter mass concentrations and meteorological parameters between June 2013 and March 2016 in Beijing, Xi'an, Shanghai and Guangzhou and identified two different patterns of $PM_{2.5}$ episodes. The accumulative rise in air pollution was found to be characterized by a prolonged slow $PM_{2.5}$ growth rate (3–5 $\mu g\ m^{-3}\ h^{-1}$), and could eventually lead to middle level pollution (ambient $PM_{2.5}$ mass concentration of about 150 $\mu g\ m^{-3}$), accompanied with an uncertain temporal variation in SO_2, NO_2, O_3 and CO concentrations. The abrupt rise process was found to be associated with a short-term high aerosol growth rate (>10 $\mu g\ m^{-3}\ h^{-1}$), and could eventually form severe air pollution ($PM_{2.5}$ mass concentration exceeds 250 $\mu g\ m^{-3}$) with a constant increase in gaseous pollutants concentrations. The average relative humidity (RH) was observed to have a less impact on the rise of $PM_{2.5}$ concentration, while the fluctuation in RH was found to have a strong correlation with the rise in $PM_{2.5}$ concentration. The levels and composition of PM_{10} and $PM_{2.5}$ in Asian cities are dependent not only on their emission sources but also on meteorological parameters, the local geological characteristics and land use type. A comprehensive approach is therefore needed to understand the levels and potential impacts of particulate air pollution under varied climatic conditions. Munir *et al.* (2017) have analyzed various aspects of $PM_{2.5}$ including $PM_{2.5}/PM_{10}$ ratios and association with meteorological parameters using data collected in Makkah, Saudi Arabia which is influenced by arid climatic conditions throughout a year. The outcome of the study may be helpful for developing an effective air quality management plan in arid regions.

Jin *et al.* (2017) presented the chemical characteristics of diesel particulate matter (DPM) from a heavy-duty diesel engine tested using an engine dynamometer following ETC (European Transient Cycle). The study found that Ca, Si, Na and Al were the major components of the element mass while total carbon (elemental carbon + organic carbon) was 90% of total DPM mass. Three ring p-PAHs were the major components (66%) of total p-PAHs mass followed by four-ring (18%) and two-ring (16%).The fluoranthene/(fluoranthene + pyrene) ratio was 0.62, indicative of diesel vehicle emissions.

This study of Gulia *et al.* (2017) evaluated the distribution patterns of $PM_{2.5}$ and NO_2 and their frequency of exceedances over air quality standards at two urban air pollution hotspots in Delhi (APH-1) and Chennai (APH-2) cities. The Results indicate that NO_2 concentrations were best fitted with lognormal and log logistic distribution models respectively, for winter and summer seasons at APH-1. It implies that the distribution pattern of NO_2 show significant influence of meteorology and their reactive nature in two different climatic conditions. However, lognormal distribution was best fitted to $PM_{2.5}$ concentration of winter and summer seasons at both APHs due to its less reactivity and particle nature compared to NO_2, which is gaseous. Atmospheric remote sensing offers a unique opportunity to compute estimates of fine particulate concentrations ($PM_{2.5}$) in densely populated countries, where there is a lack of adequate spatial–temporal coverage of air pollution monitoring. The paper by Bilal *et al.* (2017) proposes a new approach for monitoring and predicting $PM_{2.5}$ in complex terrains using satellite aerosol optical depth (AOD) at 500 m resolution retrieved from a Simplified Aerosol Retrieval Algorithm (SARA) and binning of meteorological variables. The results demonstrate that the SARA binning model is better than existing AOD models for detailed spatio-temporal monitoring of $PM_{2.5}$ concentrations in urban areas.

Perfluoroalkyl substances (PFASs) are the new types of emerging persistent organic pollutants (POPs) to be regulated on a global scale. However, the extent of atmospheric pollution by PFASs is still unclear because their distribution in the environment is not well understood. Ge *et al.* (2017) developed a new sampling and analysis method using nanosamplers to provide the levels of PFASs in atmospheric particles including $PM_{2.5}$ and to provide more information about size segregated PFAS concentrations. Results indicated that indoor sources may not be the only main contributor to the levels of PFASs in the roadside air. Automobile exhaust may be also a contributor. In Hsinchu, Taiwan, Yang *et al.* (2017b) found that the major BaP_{eq} contributors were BaP, BbF, INP, and DBA. BaP which accounted for 49.0% of BaP_{eq} concentrations in $PM_{2.5}$ in all four seasons, and pointed out that the annual average lifetime excess cancer risk of $PM_{2.5}$-bound PAHs (1.60×10^{-5}) was higher than that specified in the United States Environmental Protection Agency guidelines (10^{-6}). The two major sources were stationary emission sources and unburned petroleum and traffic emissions accounting for 90.3% of $PM_{2.5}$-bound PAHs.

Epidemiological, in vitro, and in vivo studies have demonstrated that some metals in aerosols have various health effects. To further understand the oxidative abilities of $PM_{2.5}$ samples from different sources, Fujitani *et al.* (2017) conducted DTT (dithiothreitol) assay and found that the environmental $PM_{2.5}$ samples from the traffic site during summer had the highest oxidative ability. The oxidative abilities of the environmental aerosol samples were higher than those of laboratory-generated aerosols, owing to the presence of transition metals in the environmental samples in which four transition metals (Cu, Fe, Ni, and Mn) accounted for most of the DTT consumption, and the contribution of these metals was particularly high at the traffic site. In New Delhi, the capital city of India, concentrations of regulated air pollutants often exceed the Indian national ambient air quality standards (INAAQS). In the study of Sahu and Kota (2017), regulated air pollutant concentrations in New Delhi during 2011 to 2014 were collected and it was found that $PM_{2.5}$ concentrations exceed the INAAQS during 85% of the days. The short term impact of $PM_{2.5}$ concentrations on non-disease specific mortality in New Delhi was assessed and the results indicated that the excessive risk associated with $PM_{2.5}$ estimated was 0.57, which was higher than the other regulated pollutants. The study found a projected 6.2 and 6.5% decrease in mortality by meeting the $PM_{2.5}$ Indian standards and WHO set limits, respectively.

Besides ambient air pollution, indoor air quality is a significant issue since people spend almost 85–90% of their time indoors. Ambient $PM_{2.5}$ can penetrate indoors through the building envelope, affecting the indoor $PM_{2.5}$ concentrations. Choi and Kang (2017) investigated the infiltration of ambient $PM_{2.5}$ through the building envelop in eleven apartment housing units in Korea by using a blower-door depressurization procedure. The results showed that the average infiltration factor of all the test housing units was 0.65 ± 0.13 (average ± standard deviation). In addition, the results from the relation of the building airtightness data to the infiltration factors suggested that a leaky housing unit with high ACH50, or a high specific effective leakage area (ELA), would be more significantly influenced by the ambient $PM_{2.5}$. Incense burning in temples is a common and popular ritual in India and other Asian countries. Goel *et al.* (2017) assessed the quantity and size segregated distribution of particulate matter in temples of

Kanpur city, India, using the Micro Orifice Uniform Deposit Impactor (MOUDI). Mass concentration values for all samples were high, and more than 99% of the numbers of particles generated were $PM_{2.5}$. Kalaiarasan *et al.* (2017) estimated the sources of indoor $PM_{2.5}$ particles in schools adjacent to urban and suburban roadways. The major sources were found to be Paved Road Dust, Soil Dust, Gasoline Vehicle Emissions, Diesel Vehicle Emissions and Marine Source Emissions. Among these, vehicular emissions contribution was found to be higher for the schools located close to roadways rather than the school located at a considerable distance from highway. The difference in source type contribution at each school clearly depicts the difference in nature of location and type of activities in the vicinity of the sampling sites.

$PM_{2.5}$ particles, whether they are infiltrated from outside ambient environment or generated from indoor sources, need to be removed. Electret filters have been used widely to collect particles because of their low pressure drop and high collection efficiency, however, the collection efficiency of these filters decreases over time due to charge degradation. By combining a unipolar corona charger with an electret filter, Sambudi *et al.* (2017) found that the efficiency for uncharged particles of 70 nm in diameter increased from 34% to 99.8% with electret field of 1.9 kV cm^{-1}. The ozone concentration was negligible under optimum conditions for particle collection. Significant $PM_{2.5}$ emission reduction can be achieved by technological improvement (Ma *et al.*, 2017). Due to the increase in the installed capacity and the application of low NO_x burner alone, $PM_{2.5}$ emission factor without adopting other air pollution control devices was found to decrease from 0.153 kg t^{-1} (the 100 MW unit) to 0.123 kg t^{-1} (the 300 MW unit). By improving the electrostatic precipitator (ESP), $PM_{2.5}$ emission factor was further decreased from 0.014 kg t^{-1} (the unit with a normal ESP) to 0.003 kg t^{-1} (the unit with a cold-side ESP and a wet flue gas desulphurization (WFGD)). However, the application of flue gas denitrification and desulfurization devices may alter $PM_{2.5}$ compositions and their emissions.

Finally in this special issue, the paper by Zhang *et al.* (2017b) describes the development of a sharp-cut sampling device for nanoparticles which are the most abundant in ambient aerosols by number concentration. The device consists of an inertial filter combined with a single-nozzle impactor. Calibration study showed that the device has sharper collection efficiency at a less pressure drop compared to the previous inertial filter

CONCLUDING REMARK

The AAC 2015 held in Kanazawa, Japan, is a very successful conference which attracted 520 participants to exchange and advance the recent knowledge on aerosols and air quality in Asia and around the world. Based on the well-accepted special issue published after IAC 2012 (International Aerosol Conference) (Kim *et al.*, 2015), the editor-in-chiefs decided to publish a special issue for the AAC 2015 as well. This special issue publishes 26 papers selected from the conference in which important findings in the chemical and physical characteristic of $PM_{2.5}$ and atmospheric aerosols, urban air and indoor air quality researches, and novel control technologies offer great help and insights to policy makers to adopt and implement effective control strategies. Guest editors would like to thank the authors for their contributions and the hard review work provided by reviewers.

To continue the success of this important Asian event in the field of aerosol science and technology, the 10^{th} AAC (AAC 2017) will be held in Jeju Island, South Korea from July 3 to 6, 2017. Anyone who works on aerosol-related researches are most welcome to submit abstracts to the conference. More details about the AAC 2107 can be found at the AARA web site: http://www.aaraonline.org/

REFERENCES

Bilal, M., Nichol, J.E. and Spak, S.N. (2017). A new approach for estimation of fine particulate concentrations using satellite aerosol optical depth and binning of meteorological variables. *Aerosol Air Qual. Res.* 17: 356–367.

Chen, F., Zhang, X., Zhu, X., Zhang, H., Gao, J. and Hopke, P.K. (2017). Chemical characteristics of $PM_{2.5}$ during a 2016 winter haze episode in Shijiazhuang, China. *Aerosol Air Qual. Res.* 17: 368–380.

Choi, D.H. and Kang, D.H. (2017). Infiltration of ambient $PM_{2.5}$ through building envelope in apartment housing units in Korea. *Aerosol Air Qual. Res.* 17: 598–607.

Dodla, V.B.R., Gubbala, C.S. and Desamsetti, S. (2017). Atmospheric dispersion of $PM_{2.5}$ precursor gases from two major thermal power plants in Andhra Pradesh, India. *Aerosol Air Qual. Res.* 17: 381–393.

Fujitani, Y., Furuyama, A., Tanabe, K. and Hirano, S. (2017). Comparison of oxidative abilities of $PM_{2.5}$ collected at traffic and residential sites in Japan. Contribution of transition metals and primary and secondary aerosols. *Aerosol Air Qual. Res.* 17: 574–587.

Ge, H., Yamazaki, E., Yamashita, N., Taniyasu, S., Zhang, T., Hata, M. and Furuuchi, M. (2017). Size specific distribution analysis of perfluoroalkyl substances in atmospheric particulate matter–development of a sampling method and their concentration in meeting room/ambient atmosphere. *Aerosol Air Qual. Res.* 17: 553–562.

Goel, A., Wathore, R., Chakraborty, T. and Agrawal, M. (2017). Characteristics of exposure to particles due to incense burning inside temples in Kanpur, India. *Aerosol Air Qual. Res.* 17: 608–615.

Gulia, S., Nagendra, S.M.S. and Khare, M. (2017). Extreme events of reactive ambient air pollutants and their distribution pattern at urban hotspots. *Aerosol Air Qual. Res.* 17: 394–405.

Jin, T., Lu, K., Liu, S., Zhao, S., Qu, L. and Xu, X. (2017). Chemical characteristics of particulate matter emission from a heavy-duty diesel engine using ETC cycle dynamometer test. *Aerosol Air Qual. Res.* 17: 406–411.

Kalaiarasan, G., Balakrishnan, R.M., Sethunath, N.A. and Manoharan, S. (2017). Source apportionment of $PM_{2.5}$ particles: Influence of outdoor particles on indoor

environment of schools using chemical mass balance. *Aerosol Air Qual. Res.* 17: 611–625.
Kim, Y.P., Grinshpun, S.A., Asbach, C. and Tsai, C.J. (2015). Overview of the special issue "Selected papers from the 2014 International Aerosol Conference", *Aerosol Air Qual. Res.* 15: 2185–2189.
Lang, J., Zhang, Y., Cheng, S., Zhou, Y., Chen, D., Guo, X., Li, X., Xing, X., Chen, S. and Wang, H. (2017). Trends of $PM_{2.5}$ and chemical composition in Beijing, 2000-2015. *Aerosol Air Qual. Res.* 17: 412–425.
Li, Z.Y., Liu, Y.S., Lin, Y., Gautam, S., Kuo, H.C., Tsai, C.J., Yeh, H., Huang, W., Li, S.W. and Wu, G.J. (2017). Development of an automated system (PPWD/PILS) for studying $PM_{2.5}$ water-soluble ions and precursor gases: Field measurements in two cities, Taiwan. *Aerosol Air Qual. Res.* 17: 426–433.
Ma, Z., Li, Z., Jiang, J., Deng, J., Zhao, Y., Wang, S. and Duan, L. (2017). $PM_{2.5}$ emission reduction by technical improvement in a typical coal-fired power plant in China. *Aerosol Air Qual. Res.* 17: 636–643.
Misawa, K., Yoshino, A., Takami, A., Kojima, T., Tatsuta, S., Taniguchi, Y. and Hatakeyama, S. (2017). Continuous observation of the mass and chemical composition of $PM_{2.5}$ using an automatic analyzer in Kumamoto, Japan. *Aerosol Air Qual. Res.* 17: 444–452.
Munir, S., Habeebullah, T.M., Mohammed, A.M., Morsy, E.A., Rehan, M. and Ali, K. (2017). Analysing $PM_{2.5}$ and its association with PM_{10} and meteorology in the arid climate of Makkah, Saudi Arabia. *Aerosol Air Qual. Res.* 17: 453–464.
Ommi, A., Emami, F., Zíková, N., Hopke, P.K. and Begum, B.A. (2017). Trajectory-based models and remote sensing for biomass burning assessment in Bangladesh. *Aerosol Air Qual. Res.* 17: 465–475.
Sahu, S.K. and Kota, S.H. (2017). Significance of $PM_{2.5}$ air quality at the Indian capital. *Aerosol Air Qual. Res.* 17: 588–597.
Sambudi, N.S., Choi, H.J., Lee, M.H. and Cho, K. (2017). Capture of ultrafine particles using a film-type electret filter with a unipolar charger. *Aerosol Air Qual. Res.* 17: 626–635.
Seneviratne, S., Handagiripathira, L., Sanjeevani, S., Madusha, D., Waduge, V.A.A., Attanayake, T., Bandara, D. and Hopke, P.K. (2017). Identification of sources of fine particulate matter in Kandy, Sri Lanka. *Aerosol Air Qual. Res.* 17: 476–484.
Verma, N., Satsangi, A., Lakhani, A. and Kumari, K.M. (2017). Low molecular weight monocarboxylic acids in $PM_{2.5}$ and PM_{10}: Quantification, seasonal variation and source apportionment. *Aerosol Air Qual. Res.* 17: 485–498.
Wang, G., Cheng, S., Lang, J., Yang, X., Wang, X., Chen, G., Liu, X. and Zhang, H. (2017a). Characteristics of $PM_{2.5}$ and assessing effects of emission–reduction measures in the heavy polluted city of Shijiazhuang, before, during, and after the ceremonial parade 2015. *Aerosol Air Qual. Res.* 17: 499–512.
Wang, S., Yu, S., Li, P., Wang, L., Mehmood, K., Liu, W., Yan, R. and Zheng, X. (2017b). A study of characteristics and origins of haze pollution in Zhengzhou, China, based on observations and hybrid receptor models. *Aerosol Air Qual. Res.* 17: 513–528.
Yang, H.Y., Tseng, Y.L., Chuang, H.L., Li, T.C., Yuan, C.S. and Lee, J.J. (2017a). Chemical fingerprint and source identification of atmospheric fine particles sampled at three environments at the tip of Southern Taiwan. *Aerosol Air Qual. Res.* 17: 529–542.
Yang, T.T., Hsu, C.Y., Chen, Y.C., Young, L.H., Huang, C.H. and Ku, C.H. (2017b). Characteristics, sources, and health risks of atmospheric $PM_{2.5}$-bound polycyclic aromatic hydrocarbons in Hsinchu, Taiwan. *Aerosol Air Qual. Res.* 17: 563–573.
Zhang, L., Cheng, Y., Zhang, Y., He, Y., Gu, Z. and Yu, C. (2017a). Impact of air humidity fluctuation on the rise of PM mass concentration based on the high-resolution monitoring data. *Aerosol Air Qual. Res.* 17: 543–552.
Zhang, T., Takahashi, H., Hata, M., Toriba, A., Ikeda, T., Otani, Y. and Furuuchi, M. (2017b). Development of a sharp-cut inertial filter combined with an impactor. *Aerosol Air Qual. Res.* 17: 644–652.

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