CHARACTERIZATION OF PAHS IN DIFFERENT SIZED ASHES ORIGINATED FROM BURNING OF EIGHT BIO-FUELS ACROSS BEIJING-TIANJIN-HEBEI, CHINA

Lei Wang[1], Jinggong Wang[1], Xiuping Guo[1], Aiqin Liu[1], Caixiu An[1], An Liu[1], Zhiyong Li[2]
[1]Hebei Research Center for Geoanalysis, Baoding, China
[2]School of Environmental Science and Engineering, North China Electric Power University, Baoding, China

Introduction:

The different sized bottom ashes originated from burning of straws of cotton (COT), corn (COR), millet (MIL), soybean (SOY), sorghum (SOR) and sesame (SES), firewood walnut (WAL), and corn cob (COC) were collected across the Beijing-Tianjin-Hebei (BTH) region of China for the analysis of 18 PAHs using GC/MS system. A total of 5 sizes including 93–148 μm ($PM_{93–148}$), 67–93 μm ($PM_{67–93}$), 53–67 μm ($PM_{53–67}$), 40–53 μm ($PM_{40–53}$), and < 40 μm ($PM_{–40}$) were involved and marked as a, b, c, d, and e, respectively.

Objective:

This study aimed to obtain the following information: 1) the size distribution of total PAHs and individual PAH congeners for eight BFs; 2) compare the similarity of PAHs profiles among ashes of different sizes within one BF and among different BFs in order to simplify the source apportionment of atmospheric PAHs; 3) identify the indicatory PAHs for the 8 bio-fuels (BFs).

Methods:

The ashes were collected from Zaotai stoves across rural areas of BTH using a stainless steel shovel rinsed with n-hexane before sampling. We aimed at the same combustion conditions as those in actual cooking. The combustion started by igniting biomass with natural gas, and the BFs were burned down until the fire went out. The 8 samples for the 8 BFs were collected from each one of 8 sampling sites, and a total of 320 samples were obtained. Each BFs sample was divided into 5 differently sized parts. Finally, the 320 BFs samples were stored at –20℃ before analysis. The 18 PAHs were analyzed using the Agilent 7890B GC/5977B MS for which the selected ion mode (SIM) was adopted. 18 PAHs were detected in this study, including naphthalene (NA), acenaphthylene (ACL), acenaphthene (AC), fluorine (Fl), benzo(g,h,i)perylene (BgP), phenanthrene (PHE), anthracene (AN), fluoranthene (FA), pyrene (PY), benzo(a)anthracene (BaA), chrysene (CHR), benzo(b)fluoranthene (BbF), benzo(k)fluoranthene (BkF), benzo(e)pyrene (BeP), benzo(a)pyrene (BaP), indeno(1,2,3-cd)pyrene (IP), dibenzo(a,h)anthracene (DBA), and coronene (COR).

Results:

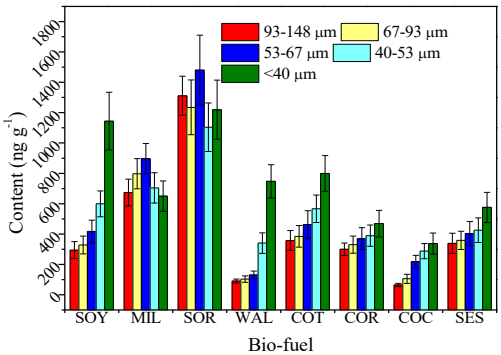

Fig. 1. Size distribution of total contents of 18 PAHs for 8 BFs.

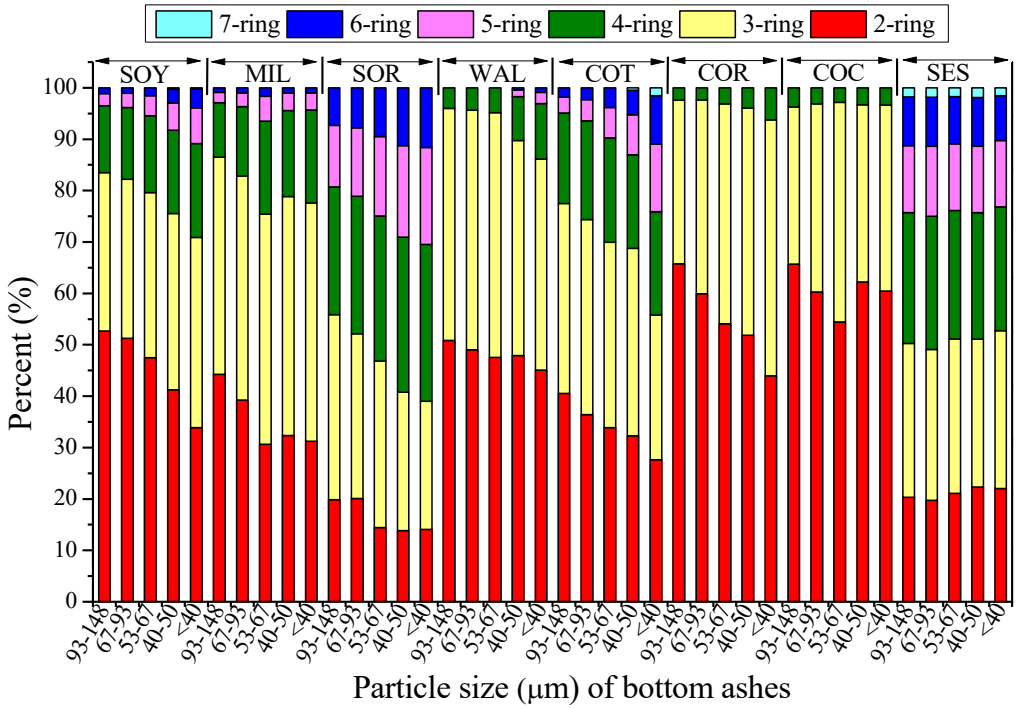

Fig. 2. Composition of ring sized PAHs in different sized ashes for 8 BFs.

Conclusions:

The Σ_{18}PAHs for 6 BFs including SOY, WAL, COT, COR, COC, and SES were all negatively correlated with the particle size of the BAs, while those for MIL and SOR didn't display this trend. The BAs from all BFs were dominated by LMW-PAHs, especially the BAs from COR, COC, COT, and WAL. The PAH profiles for the different sized BAs within MIL, SOR, COC, COR, and SES were similar based on lower CD values, while the other 3 BFs did not show this trend. The indicatory PAHs for 8 BFs were significantly different from those of other industrial stacks. They were BbF and BgP for SOY, MIL, COR, SOR and COC, and were AC and FL for WAL, COT, and SES.

References:

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