Near-source and Transported Biomass Burning Aerosols from Indochina to Taiwan

Chung-Te Lee[1*], Charles C.-K. Chou[2], Guenter Engling[3], Zhong-Ting Chuang[1], and Neng-Huei Lin[4]

[1]Graduate Institute of Environmental Engineering, National Central University, Jhongli, Taiwan
[2] Research Center for Environmental Changes, Academia Sinica, Taipei, Taiwan
[3]Division of Atmospheric Sciences, Desert Research Institute, Reno, NV 89512, USA
[4]Department of Atmospheric Sciences, National Central University, Jhongli, Taiwan
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Presenting author email: ctlee@cc.ncu.edu.tw

Every spring, biomass burning (BB) occurs extensively in the mountain area of northern Indochina. The produced BB plume is uplifted to the elevated atmosphere and transported by prevailing westerly from Indochina to East Asia. As the plume distributes broadly during transport, it will affect solar radiation budget when mixing with clouds to result in an effect on regional climate change. This study aims to characterize aerosol chemical properties both in near-source BB region and transported downstream area.

Atmospheric aerosol was observed intensively at Lulin Atmospheric Background Station (LABS, 2,862 m a.s.l.) in Taiwan and Mt. Doi Ang Khang (DAK) in Chiangmai (Thailand, 1,536 m a.s.l.) from 1 March to 13 April 2015. Figure 1 shows that $PM_{2.5}$ mass levels at LABS and DAK are averaged at 21.1 ± 9.6 and 88.7 ± 36.1 μg m^{-3}, respectively. The mass fraction of $PM_{2.5}$ in PM_{10} at LABS and DAK are 82% and 78%, respectively; which indicates the dominance of $PM_{2.5}$ on PM_{10}. During intensive BB period, $PM_{2.5}$ organic carbon (OC) as a group is dominant at the upstream DAK, while Anion group becomes comparable with OC group at the downstream Mt. Lulin.

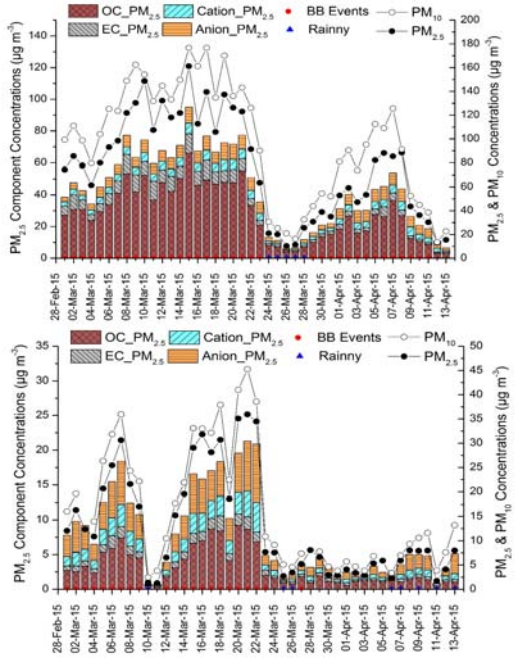

Figure 1. Aerosol mass levels and grouped chemical properties observed at Mt. Doi Ang Khang (upper) and Mt. Lulin (lower) in 2015.

To evaluate the enhancement or degradation of a specific aerosol component during long-range transport (LRT), this study proposes, analogous to enrichment factors (Kemp et al., 1976), the utilization of a "Modification Factor" (MF) as follows.

$$MF = \frac{(\frac{C_i}{nss-k^+})_{downstream}}{(\frac{C_i}{nss-k^+})_{upstream}}$$

In the above equation, the relative standard is nss-K^+, C_i is any aerosol component for evaluation except nss-K^+. For MF>1, the evaluated component is considered to be enhanced during LRT. In contrast, the evaluated component is considered to be degraded during LRT when MF<1.

Figure 2 shows that that all water-soluble inorganic ions, EC2, EC3, all di-acids and their salts were enhanced during long-range transport because the MF values were greater than unity. In contrast, all organic fractions, EC1-OP, water-soluble organic carbons, water-insoluble organic carbons, and anhydrosugars were degraded during LRT as the MF values were lower than unity.

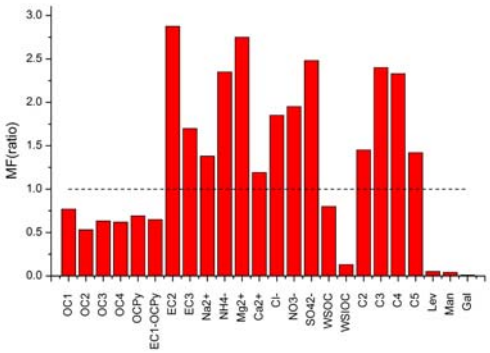

Figure 2. MF values of aerosol chemical species after long-range transport from Mt. Doi AnKhang to Mt. Lulin.

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Kemp, A.L., Thomas, W., Dell, R.L., et al. (1976) *Journal of the Fisheries Research Board of Canada* **33**, 440-462.