

Temporal trend of HUMic Like Substances-Carbon (HULIS-C) concentrations and major factor determining their concentrations in Seoul, Korea.

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HULIS is one of major fractions of water soluble organic carbon (WSOC) which constitute a major fraction of atmospheric aerosols, which constitutes a 20~70% of organic carbonaceous aerosol. HULIS consist of similar structural moieties to humic substances including aromatic ring structures with hydrocarbon side chains, hydroxyl, carbonyl, and carboxyl groups (Lin et al., 2010). Recently, the active study for the characteristics of HULIS in the atmospheric particles has been progressed due to possibility of significant contribution to the climate change both directly and indirectly (Graber and Rudich, 2006 ; Dinar *et al.*, 2006). However, still there is a lack of reliable information on the amount and characteristics of HULIS in the aerosol. In this study, temporal trend of the HULIS-C concentration in Seoul, Korea which is one of megacities in Northeast Asia region was observed, for the first time, and the amount of HULIS in WSOC was determined. In addition, the major factor for the formation of HULIS was investigated.

Four sampling periods were selected for fall (4 October to 3 November in 2012), winter (9 January to 28 February in 2013), spring (1 March to 30 April in 2013), and summer (12 August to 10 September in 2013) to investigate temporal trend of HULIS-C concentration. The measurements of PM_{2.5} using high volume air sampler was made at the Korea Institute of Science and Technology (37.60°N, 127.05°E) at Seoul, representative urban site, Korea. 3cm x 5cm (15cm²) of each PM_{2.5} sample filters were extracted with ultrapure water (18.2MΩ, 40mL) in ultrasonic bath for 60 min. The extracts were filtered with a 0.20 mm Teflon filter (PTFE, Hydrophilic, Advantec). 20mL Extracted from the sample is used as the HULIS analysis. Remainder of rest 20mL is used as the WSOC analysis. HULIS fraction was extracted using the solid phase extraction technique and WSOC and HULIS-C were analyzed using total organic carbon (TOC) analyzer. More details on the analytical methods can be found in Lin et al.(2010)

The average concentration of HULIS-C was 1.98 ± 1.10 C $\mu\text{g}/\text{m}^3$ and the highest concentration of HULIS-C was observed in winter, while, the HULIS-C concentration was lowest in summer. In Figure 1, the HULIS-C concentrations observed in this study were

compared with the previous studies. As shown in Figure 1, the HULIS-C concentrations in this study were about five times higher than those observed in several cities of Europe, whereas, comparable to or lower than those concentrations measured in cities of China. High amounts of HULIS-C in the atmosphere of Northeast Asia region were observed and the might related to frequent observation of brown cloud in this region. Further, we will investigate correlation of HULIS-C with the other species such as OC, EC, WSOC, various organic compounds and water-soluble ions, and finally suggest major factor determining HULIS-C concentration at Seoul, Korea.

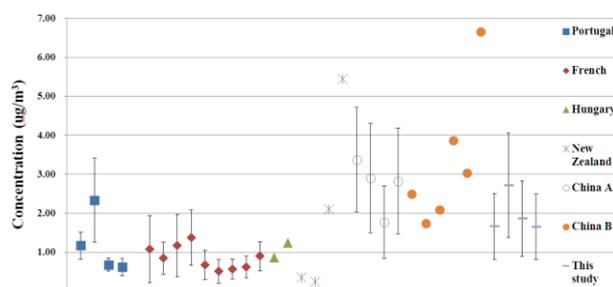


Figure 1. Comparison of HULIS-C concentrations in this study with the previous studies

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Lin, P., Huang, X.-F., He, L.-Y. and Yu, J. Z. (2010) *Journal of Aerosol Science*. **41**, 74-87.

Graber, E. R., and Rudich, Y. (2006) *Atmos. Chem. Phys.* **6**, 729-753.

Zheng, G., He, K., Duan, F., Cheng, Y., and Ma, Y. (2013) *Environmental Pollution*. **181**, 301-314.