SECONDARY ORGANIC AEROSOL FORMATION FROM THE OXIDATION OF ANTHROPOGENIC VOLATILE ORGANIC COMPOUNDS

D. Pavlidis[1,*], A. Simonati[1,2], K. Florou[2], C. Vasilakopoulou[1,2], A. Matrali[1,2], C. Kaltsonoudis[2] and S. N. Pandis[1,2]

[1] 26500, Patras, Greece, Department of Chemical Engineering, University of Patras
[2] 26504, Patras, Greece, Institute of Chemical Engineering Sciences (FORTH/ICE-HT)
*Presenting author email: damianos1999@gmail.com

ABSTRACT

Secondary organic aerosol (SOA) is produced in the atmosphere from the condensation of low-volatility products of the oxidation reactions of volatile organic vapors (VOCs) in the particulate phase. SOA is the dominant component of organic aerosol (OA) in urban, continental and remote locations[1,2] and has a significant effect on human health, climate and visibility[3]. Recent studies have suggested that the intermediate volatility organic compounds (IVOCs), which have been neglected for decades, may have an important role in the SOA formation[1] . Current atmospheric chemical transport models often do not include these vapors and tend to underpredict the measured SOA levels [1,4]. In this work, the SOA production from individual anthropogenic large VOCs and IVOCs was studied in a series of smog chamber experiments. The SOA yields of each IVOC precursor as it reacts with the hydroxyl radicals (OH) under high NO_x conditions were quantified and the SOA composition was investigated. The experiments took place at the Foundation for Research and Technology-Hellas (FORTH) atmospheric simulation chamber. The instrumentation used includes a scanning mobility particle sizer (SMPS) to measure the particle number distribution, an aerosol mass spectrometer (AMS) to quantify the particle mass concentration and composition, and a proton transfer reaction mass spectrometer (PTR-MS) to monitor the organic vapor concentrations. Thermal desorption gas chromatographu was also used for the offline analysis of the gas-phase products of the reactions. The organic compounds that were studied are anthropogenic aromatic compounds such as 1,3,5-trimethylbenzene, 1,3,5-triethylbenzene, and 1,3,5-tri-tert-butylbenzene, and cyclic alkenes like amylcyclohexane, hexylcyclohexane, nonylcyclohexane and decylcyclohexane. From the experiments it was found that all examined compounds produce significant. The study results can be used in chemical transport models improve our understanding about the contribution of these precursors to the formation of SOA in urban areas and the identification of their products in field measurements.

KEYWORDS: SOA, VOCs, aromatic, cyclic alkenes

REFERENCES

[1] Tkacik, D. S., Presto, A. A., Donahue, N. M., & Robinson, A. L. (2012). *Environmental Science and Technology* 46: 8773–8781.

[2] Chan, A. W. H., Kautzman, K. E., Chhabra, P. S., Surratt, J. D., Chan, M. N., Crounse, J. D., Kürten, A., Wennberg, P. O., Flagan, R. C., & Seinfeld, J. H. (2009). *Atmos. Chem. Phys* 9: 3049-3060.

[3] Huang, M., Lin, Y., Huang, X., Liu, X., Guo, X., Hu, C., Zhao, W., Gu, X., Fang, L., & Zhang, W. (2015). *Atmospheric Pollution Research* 6: 209–219.

[4] Li, W., Li, L., Chen, C. li, Kacarab, M., Peng, W., Price, D., Xu, J., & Cocker, D. R. (2018). *Atmospheric Environment* 178: 109–117.