# Essential role of O2-bridged bicyclic compounds in formation of secondary organic aerosol

January 11 2022, by Zhang Nannan

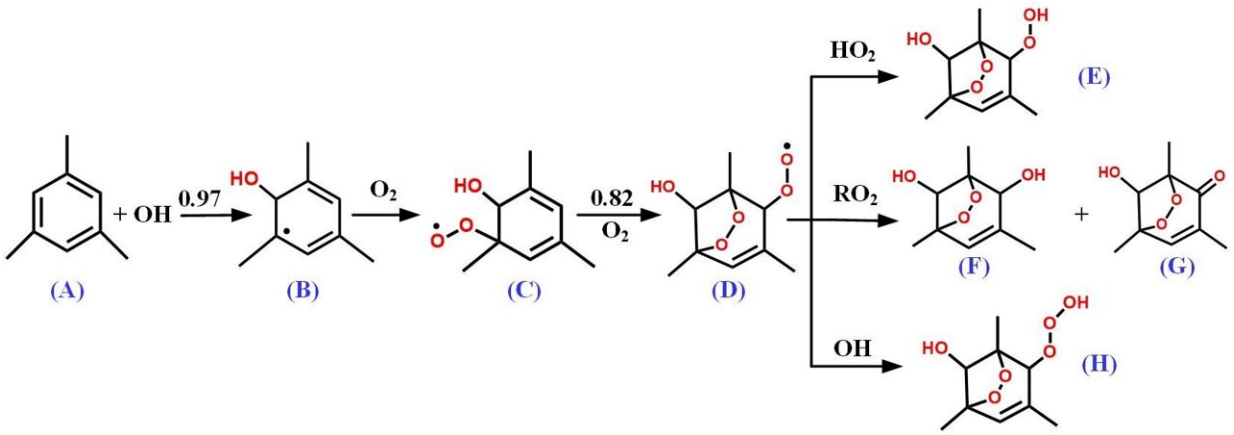


Fig. 1 The major reaction routes of the OH initiated photo-oxidation of 1,3,5-TMB under NOx free conditions. Credit: Lin Xiaoxiao

Volatile organic compounds (VOCs) are important precursors for secondary organic aerosol (SOA) formation. As a significant aromatic compound of VOC, 1,3,5-trimethylbenzene (1,3,5-TMB, $C_9H_{12}$) mainly comes from vehicle exhaust, solvent use and industrial emissions. The oxidation reaction of 1,3, 5-trimethylbenzene is mainly initiated by hydroxyl radical (OH) in atmosphere.

Prof. Zhang Weijun and his team at the Hefei Institutes of Physical Science of the Chinese Academy of Sciences (CAS) have recently proved that $O_2$-bridged bicyclic peroxy radicals are very important reaction intermediates in the oxidation process of 1,3, 5-TMB.

They found that the reactions could produce high mass bicyclic products with a low volatility, and play an essential role in the formation of SOA.

Chemical composition of SOA was detected from the oxidation reaction of 1,3, 5-TMB using a home-made vacuum ultraviolet photoionization aerosol mass spectrometer. With the help of deuteration experiments, they clearly observed the presence of high-mass $O_2$-bridged bicyclic products in the particle phase.

Combined with theoretical study, the formation mechanism of the $O_2$-bridged bicyclic compounds have been illuminated.

These results gave direct evidences of the essential role of peroxy radical chemistry in the SOA formation.

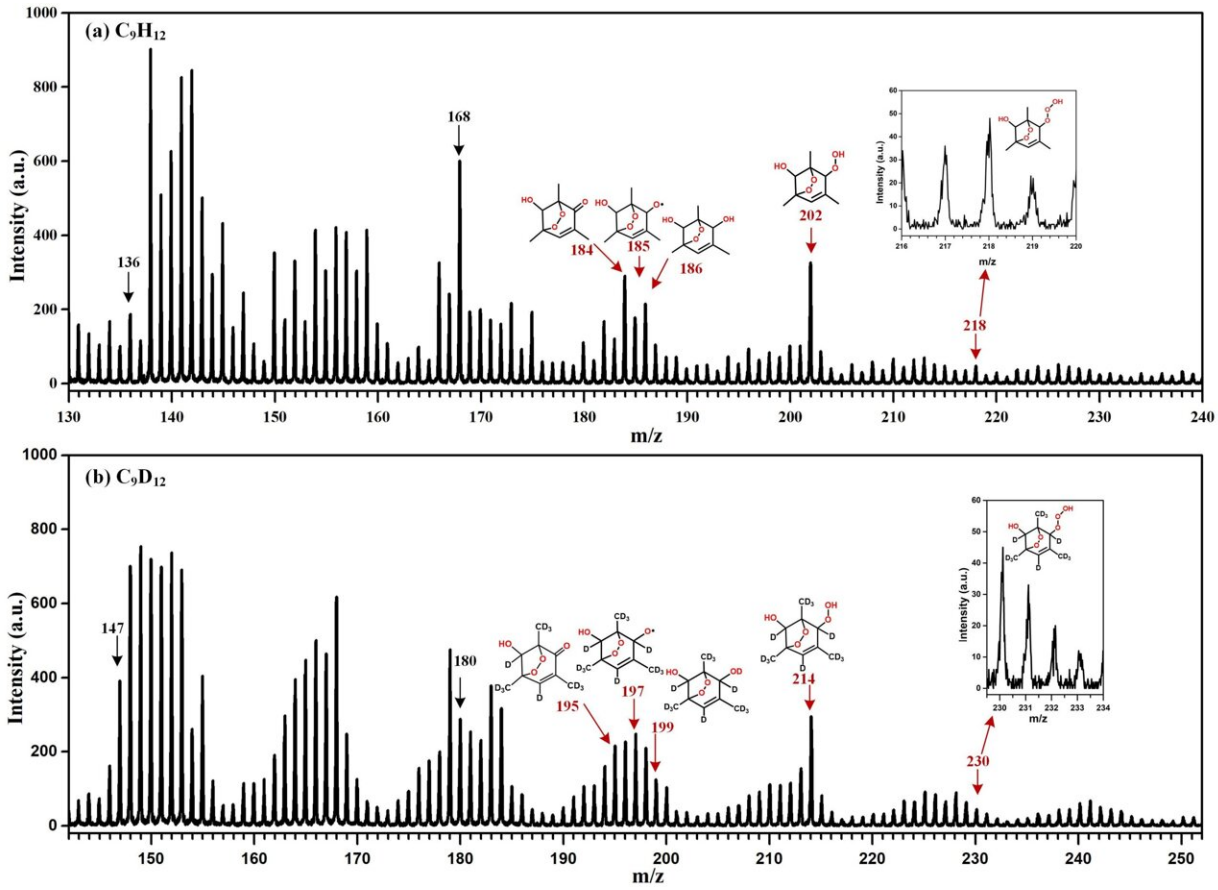


Fig. 2 The major reaction routes of the OH initiated photo-oxidation of 1,3,5-TMB under NOx free conditions. Credit: Lin Xiaoxiao

**More information:** Xiaoxiao Lin et al, Direct observation of the particle-phase bicyclic products from OH-initiated oxidation of 1,3,5-trimethylbenzene under NOx-free conditions, *Atmospheric Environment* (2021). DOI: 10.1016/j.atmosenv.2021.118914

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