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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Strong anthropogenic control of secondary organic aerosol formation from isoprene in Beijing" *by* Daniel J. Bryant et al.

Anonymous Referee #3

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In this work, the authors have quantified a number of organic tracers, primarily organosulfates or nitroxyorganosulfates in order to better the contribution of isoprene-derived secondary organic aerosol (iSOA) to organic aerosol carbon in the atmosphere. They found that iSOA formation in urban Beijing is strongly controlled by anthropogenic emissions. This work provides new valuable field data to better understand the sources of ambient aerosols in an urban polluted environment. I support the publication of this work in ACP and have some comments for the authors' consideration.

Comments Line 43, "The coelution of the inorganic ions in the extracts caused matrix effects that impacted two authentic standards differently." This is very good finding. However, the authors do not further elaborate this point here. What is the potential

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Discussion paper

significance of matrix effects on the quantification of the species in this work?

Line 51, “These results indicate for the first time that iSOA formation in urban Beijing is strongly controlled by anthropogenic emissions and results in extensive conversion to heterogeneous OS products”. Could the authors further elaborate the correlation between the formation of iSOA controlled by the emissions of anthropogenic pollutants and formation of OSs in a more quantitative way? How significance or any numbers based on their field observations and data?

Line 336, “This indicates that there are significant local emissions of isoprene impacting the measurement site and therefore a high potential for the formation of iSOA in this urban environment.” Could the authors further comment whether the sampling site be a representative site for the typical urban environment in most parts of Beijing? Could the observations and results presented in this work largely reflect the title of this paper “Strong anthropogenic control of secondary organic aerosol formation from isoprene in Beijing”?

Line 342, “The full list of iSOA tracers, along with their measured m/z and molecular formula is shown in Table 1, ordered by descending average concentration (weighted by filter sampling time and reported in ng m-3) during the campaign” What are the uncertainties of the reported concentrations? Please present the uncertainties.

Line 360, “A strong matrix effect was observed for the 2-MT-OS, with the concentration measured by standard addition calibration 8.6 to 10 times higher than when using the external calibration carried out on the same day.” This is an important finding. Why? Could the authors explain these results?

Line 404, “Zero-dimensional box modelling indicates on some days up to 35 % of the isoprene-derived RO2 radicals can react with HO2 in the afternoon (Newland et al., 2019).” Please kindly note that this paper is under review or has been accepted for publication.

Line 425, “Therefore, these spikes in 2-MT-OS could be a result of either higher 2-MT-OS in regional aerosol transported to the site or a high isoprene emission source to the south west of the site (i.e. producing IEPOX locally) that then reacts with increased regional sulfate pollution.” Any field evidences or model predictions show that the IEPOX can be effectively produced locally? What are the contributions from the regional transport? The effects of anthropogenic emission on iSOA formation observed in this work are local, regional or a combination of both effects.

Line 450, “The ratio of 2-MT-OS:2-MG-OS observed in Beijing is compared to previous studies in Table 2 and is considerably lower than measurements taken in a range of isoprene dominated environments (South East US, 2-MT-OS:2-MG-OS = 17, Budisolistiorini et al., 2015.; Amazon, 2-MTOS:2-MG-OS = 13-118, Glasius et al., (2018).; Atlanta, 2-MT-OS:2-MG-OS = 33, Hettiyadura et al., (2019)) reflecting the strong impact of urban NO emission on iSOA formation.” I agree with this argument. However, how could we use this ratio to quantify the effect of NO emission on iSOA formation or OS formation in different regions?

Line 505, “Some of the NOS observed peaked in the daytime and some were enhanced at night. In total they had a mean concentration of 24 ng m-3 during the campaign. The sources and formation of these species will be discussed in a separate publication.” I am okay with this. However, could the authors briefly elaborate how the detection of NOS help to better understand the effect of anthropogenic emission on the iSOA formation in this work?

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