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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Origin and Transformation of Ambient VOCs during a Dust-to-Haze Episode in Northwest China" *by* Yonggang Xue et al.

**Yonggang Xue et al.**

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We are highly grateful to the reviewer, and your comments are highly helpful to further improvement of our manuscript and further study. The comments were fully considered, and related improvement were finished in the new version of manuscript.

Comment: This manuscript presents a case study on the origin and transformation of ambient volatile organic compounds (VOCs) during an episode of dust-to-haze in a city in northwestern China. It presents the variations of VOCs, oxygenated VOCs, PM2.5 and its chemical components (i.e., ions, carbonaceous fractions and elements) during this interesting transition of dust-to-haze. It also highlights the possible reactions



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of VOCs under the influence of source contribution, ambient conditions as well as the heterogeneous reactions promoted by particle elements. The manuscript is well prepared and fits the scope of the journal. It could be considered for publication after the following concerns are clarified.

(1) The authors suggested the formation of secondary organic aerosols by the reactions of VOCs during the haze period. It could be true due to the significant increases of organic carbon during the haze period. However, I would suggest more efforts should be made to clarify this point. Somehow I would also suggest that it might be necessary to be highlighted in the text as well as in the title.

Response: The suggestion is highly accepted, the point of formation of SOA by the VOCs during the haze period if replenished in the part of 3.4. Seen in Line 277-282(in the new version), “A similar trend was seen for OC (Figure 6b), and content of particulate OC increased from 11.1 since dust event period to 47.1 in the haze period. In another aspect, the ratio of OC/EC increased from 1.3 to 4.9 in the dust-to-haze episode. The previous studies on the characterization of particles from traffic emission reported OC/EC values in the range of 0.28 to 0.92 in the diesel vehicles, and the OC/EC values were reported >2 in the gasoline vehicles. In addition, the OC/EC was reported in the range of 0.9 to 1.6 in the urban region in the city of Guangzhou. In the present study, the consistent increase of OC/EC would prove the formation of SOA in the dust-to-haze episode. ”

(2) In the part of Section 3.2, I found it was quite difficult to read through this part. The influences of sources (seems not explicit), boundary layer, long-range transport and photochemical reactions were discussed but not in a clear manner, which made me very difficult to follow the conclusions.

Response: the suggestion is accepted, and this part is reorganized, as seen in section 3.2. As seen in line 201-202, “To evaluate the impact of sources types on the variation of VOCs in the dust-to-haze episode, diurnal variation of VOCs was depicted. ” was

replenished. Line 209-212, “In addition, winter heating activities was relatively active because of low temperatures during the transitional period, and this limited the possibility of reduced emission amounts. Hence the variations of sources strength was eliminated from the major factor caused the extremely low concentration and relative aged composition of ambient VOCs. ” was replenished. Line 213, “Variation of physical dispersion was also eliminated.” was replenished.

(3) L224-226: The variations of the ratios of trans/cis-2-butene are discussed here. The finding/suggestion by the authors seems not really true if we have a close look at Fig. 4. For example, the increase in the rush hour seems not always the case during this observation. The increases could also be observed during the time periods of 19:00-22:00 and 11:00. In this case, it should be more careful to draw any conclusions e.g. to highlight the importance of photochemical reactions and promotion of dust particles.

Response: In the present study, fast decrease of the ratios of trans/cis-2-butene in the dust-to-haze episode. In the new version of manuscript, correlation analysis of trans/cis-2-butene verse sampling time was done in the dust-to-haze episode, and significant correlation were observed with a R2 of 0.6, and with a slope of 0.027/h, in spite of the interference of rush hour emission. As mentioned in the comment, scatter peak of the ratios of trans/cis-2-butene were observed in the periods of 19:00-22:00 and 11:00. In our previous work of the characterization of VOCs in the roadside environment, peak of ambient VOCs were sometimes observed in 8h-12h, which indicated tardive rush hours in the city of Xi’an. In addition, VOCs peaks were always observed in the midnight, and relative high density of high duty trucks that were used for Construction waste collection. Hence, the traffic emission of VOCs in the city of Xi’an is relative specific, which would be the reason of scatter peaks of the ratios of trans/cis-2-butene were observed in the periods of 19:00-22:00 and 11:00.

(4) As mentioned above, the linkage of VOCs to PM2.5 and its chemical components in Section 3.4 should be discussed in a more clear and explicit manner. I think catalysis of particle metal could be very important during the formation of haze and it should be

studied here. By the way, I found Cl- was elevated at night (see Fig. 6) and it might show the contribution of biomass burning in northern areas of China.

Response: we also believe the catalysis of particle metal could be very important during the formation of haze, and the linkage if VOCs to PM2.5 was further replenished in the section 3.4 (line 277-282). As mentioned by the reviewer, the content of Cl- was indeed higher in the night than daytime, this should be ascribed to heating activities (biomass or coal combustion). and this description was replenished in line 269.

(5) L102-106: Quartz filter seems not an ideal filter media for XRF analysis due to the uneven surface. The authors should present more details of their XRF analysis.

Response: In the present study, Quartz filter were used for PM2.5 samples collection, due to the demand of analysis of carbon content and water soluble ions. While quartz filter can not be used to analyze the content of some element with XRF, like Si. As a result, the content of particulate Si in the present study was not reported.

(6) minor mistakes: L158: It should be “the potential sources. . .are characterized”. L241: “through”should be deleted.

Response: the comment was fully accepted, and further improvement was done in line 158 in new version of manuscript.

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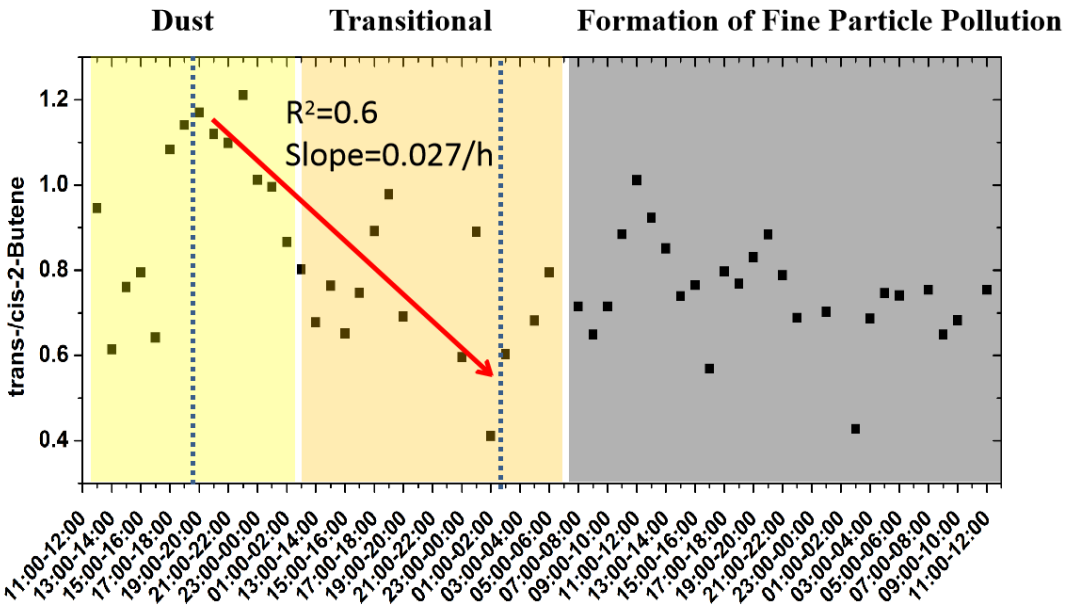


**Fig. 1.**



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