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Interactive comment on "Characterization of urban amine-containing particles in Southwestern China: seasonal variation, source, and processing" *by* Yang Chen et al.

Yang Chen et al.

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Dear Reviewer,

The authors are sincerely thankful for your valuable comments and suggestion regarding this manuscript, and we appreciate the positive comments and encouragement from the reviewer. We prefer to respond to your comments and questions point-to-point. The manuscript has been proofed by a native English-speaking Scientist from Canada.

Interactive Comment on "Characterization of urban amine-containing particles in

Southwestern China: seasonal variation, source, and processing" by Yang Chen et al. Anonymous Overall, this paper describes the observed amine-containing atmospheric aerosol particles sampled with a single particle mass spectrometer in Chongqing. The authors make the case that amine-containing particles are different in various locations in which they have been sampled globally, and therefore that it is necessary to investigate the amine-containing particles in every possible location for potential new insights. This paper describes the amine-containing particle types observed, the dependence of the amine components on air-mass origin, the dependence on relative humidity, etc. Overall, the paper provides a good snapshot of amine chemistry in this location in two seasons. It needs to be thoroughly proofread and the grammar corrected throughout – the edits are mostly relatively minor and will not be enumerated here.

Specific Comments:

Line 75: The authors state that "how high relative humidity (RH) affects the atmospheric processing of amine-containing particles needs investigation." They should elaborate about why this investigation is necessary – what does one learn from it?

The incoherence has been fixed with a statement in the last paragraph (Line 79-82): In previous studies, reported high RH conditions and fog processing were favorable for the enhancement of trimethylamine in the particle phase. Zhang et al. (2012) reported a similar scenario in Guangzhou, China.

Section 2.1: A map would be helpful, especially in interpretation of the polar plots shown later. It could be in the SI.

Yes, we have appended a sampling site map in the SI and cited in the text (Line 99).

Line 90: The instrument needs to be described. If it is a commercial instrument, provide vendor and model. If it is laboratory-built, indicate this. I presume it is the former.

We have provided the information on the manufacturer and model number (Hexin Inc. Guangzhou, China, model: 0515) in Section 2. 2 (Line 103).

Line 103 and subsequent uses: When m/z is written, both the m and the z should be italicized, but the / should not be, to conform with mass spectrometry standards.

We have changed the style of m/z in the text.

Lines 118 – 120: This is a standard data plot format and does not need to be described in the methods section.

Accepted and changes have been made.

Line 123: Is the percentage quoted here (12.7

We have changed the sentence for clarity (Line 138-140):

“The percentage of amine-containing particles was 12.7

Line 131: “Digital mass spectrum” needs to be defined in the text, not just the caption of Figure 1.

The definition has been added into the text.

Line 137: When referring to “mixing ratio,” are the authors suggesting that 44

Affirmative, we have changed this part.

Lines 147 – 150 and Figure S2: The description in the text doesn’t match the figure. It should say that the normalized ion intensity of the winter-time particles was subtracted from that of the summer-time particles, and that a positive value indicates the normalized ion intensity was greater in the summer, whereas a negative value indicates that the normalized ion intensity was greater in the winter. Also, the authors should specify how the peak area was normalized.

The authors are very thankful for this instruction. And we have changed the sentence (Line 164-170): “ Prior to comparison, the ion peak was normalized using the method developed by Qin et al. (2012). Briefly, the peak area of each m/z was divided by the total mass spectral peak area matrix. The normalized ion intensity of the wintertime

particles was subtracted from that of the summertime particles. A positive value indicates the normalized ion intensity was greater in the summer, whereas a negative value indicates that the normalized ion intensity was greater in the winter.”

Line 162: Was this aging occurring in both seasons?

Yes, the amine-containing particles were aged in both two seasons. In previous studies, a peaking larger than 0.5 μm suggested that the particle type was aged (Chen et al., 2017).

Line 167: Replace “suggested” with “indicates.”

It is accepted and changed (line 187).

Table 1: This should go into the SI, as these ion assignments are common in the single-particle mass spectrometry literature.

It is accepted and changed.

Line 176: Should “mostly” be “typically”? I am not certain the meaning of this sentence, otherwise.

It should have been “typically”. Amine-containing particles were more abundant during winter than summer (line 195).

Line 188: “Amine” should have an e on the end.

We have changed this typo.

Figure 2: If there are specific times that the authors want to draw the readers’ attention to, highlighting the range of days would be helpful.

Thank you for this suggestion, we do not have a specific period to address, but tried to introduce a general description in both two seasons.

Lines 220 – 225: This section is somewhat confusing. The authors seem to be saying that there are two sources for DPA-containing particles, but more evidence should be

cited from the mass spectra, not just the direction from which the wind was blowing.

We have added more description and citation into this paragraph (Line 247-253).

“Moreover, as shown in Figure S2, the mass spectra of the amines were present with aromatic hydrocarbon fragments, such as C4H3+ (m/z 51), C5H3+ (m/z 63), C6H5+ (m/z 77), and C9H8+ (m/z 116), as well as with alkanes fragments such as C4H7+ (m/z 55), C4H9+ (m/z 57), and C5H9+ (m/z 69). The chemical composition of DPA-containing particles contained markers associated with traffic emissions. In addition, a similar amine-containing particle type has been reported in the literature (Dall’Osto et al., 2016).”

Line 252: Isn’t RPA usually defined on a per-particle basis, rather than within a time bin? How this is calculated should be clearly stated, earlier in the paper.

We have fixed this issue and added this part of instruction into Section 2.3. Please see line 134-135 for details.

Lines 262 – 264: The statement about DEA is confusing and should be reworded.

We have modified the sentence into: When DEA reacts with HCl, H2SO4, and HNO3, it tends to form aminium salts, which are soluble in aerosol water (Line 293-294).

Line 269: If the particles were sampled through a drier, as stated in the methods, then of course no information about particle water content will be available.

We are sorry to say that there was no information on aerosol water content, and we have specified this in the text (Line 299-301):

“Indeed, due to the nature of SPAMS, the amount of aerosol water content and pH were unavailable, making it difficult for further analysis.”

Line 294: It should read “SPAMS” rather than “SPMAS.”

We have changed this typo (Line 327).

Lines 296 – 299: This section would make more sense before the discussion in lines 273 – 288. Since we combined the Results and discussion, this adjustment could probably influence the flow of the text. We prefer an independent section for this part.

Line 309: Reword this, as it doesn’t make a lot of sense.

We have modified this part of the sentence (Line 339-341)

“Amines could enter the A-OC particle type via dissolution in the aerosol water content or uptake due to absorptive uptake on the OC aerosol (Pankow, 2015).”

Line 311 and below, and Figure 6: The authors include A-ECOC as a particle type, but it is not obvious where the EC components are – the typical EC ions are not visible. This should be clarified.

We have modified Figure 6 and sentence, adding the label of EC component (i.e., m/z 36, 48, 60) for clarity (Line 345).

Line 325: The authors mixed up Na+ and K+ when they refer to “potassium (m/z 23).” It seems that either ion could be referred to here.

We have modified this sentence, adding both ions into the text (Line 359-360).

Line 326: The Ca-containing particle that is described looks a lot like dust. Can the authors make a strong case that it is traffic and not dust?

Yes. An ion signal of zinc (m/z 64) was observed in the positive mass spectrum. Zn is a marker for tire wear on road (Grigoratos and Martini, 2015; Thorpe and Harrison, 2008). Thus, the authors preferred the particle type was from traffic, not dust (line 360-362).

Line 341 and 346: The authors need to say more about how they are making the case that certain amines are both from vegetation and traffic. In the text, they refer to DPA being from both sources, and here in the conclusions they refer to DEA.

The authors also proposed that DEA-containing particles were also both from vegetation and traffic with two directions (northwest and southwest); please see the two paragraphs from line 242.

Section 4: The conclusions do not summarize the conclusions made throughout the paper and should be expanded.

Please see the revised text.

Again, we appreciate the reviewer for the comments which helped the authors to improve this manuscript.

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