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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Characteristics and mixing state of amine-containing particles at a rural site in the Pearl River Delta, China" *by* Chunlei Cheng et al.

Anonymous Referee #3

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General:

This paper uses single-particle mass spectrometry to characterize particle-phase amines observed in a rural part of the Pearl River Delta in China. The analysis in this paper builds upon previous observations of amines to examine the types of amines observed and the role of acidity on the partitioning of particle phase amines using single particle mass spectrometry. Before the paper can be considered for publication, more information is needed about which amine markers were observed on the different particle types as I have reservations about the interpretation of the spectra that must be adequately addressed.

Major Comments:

I have several major concerns about this work that need to be addressed:

1. For the nitrate-rich particles observed in summer, m/z +46 is claimed to be an amine peak. However, several single-particle studies note the presence of m/z +46 in sea salt spectra due to the presence of 46Na2+ (e.g., Guazzotti et al., 2001; Gard et al., 1998; Gaston et al., 2011). Was m/z +46 the only "amine" ion peak noted in this particle type? If so, then this ion peak is likely a marker for sodium and not an amine. The text would need to be adjusted and conclusions about marine biogenic amines would need to be removed.

2. I have a similar concern for m/z +74 observed in biomass burning particles. This ion peak is also associated with KCl (e.g., 74KCl+) and may not be indicative of an amine. I suggest that the authors review Zauscher et al., 2013, which does show evidence of biomass burning particles containing amine markers.

3. The authors need to clarify if one amine is seen on the different particle types or multiple markers. I also suggest adding a figure showing the temporal trends for each amine marker.

4. The spectra in Figure 4 need to clearly show all of the amine markers observed on the different particle types.

Specific Comments:

Abstract:

1. It would be useful if the authors specified the percentage of amine containing particles that also contained sulfate and/or nitrate.

2. Lines 54-56: This sentence should be removed. If m/z +46 is the only marker on these aged sea salt particles, then it is likely due to 46Na2+

3. Lines 60-61: Is a 9% difference in RH enough to strongly affect the uptake of

amines? Could it be that the strength of the ammonium source has a seasonal variation?

Introduction

1. I suggest adding more references on amines and single-particle observations of amines. Please add Zauscher et al., 2013 in order to comment on biomass burning particles containing amines.

Methods

1. Lines 173-180: Which fragment goes with which amine? Many ATOFMS studies also note the presence of m/z +30, was this ion also observed? m/z +86 and m/z +118 are some of the most prevalent amines observed using ATOFMS, why wasn't m/z +118 searched for?

2. Lines 173-180: citations are needed for the ion peaks listed and the amines that they correspond to.

3. A search criterion for biomass burning aerosol was m/z -59 and m/z -73, please review Zauscher et al., 2013 for better search criteria for biomass burning aerosols.

Results

1. Figure 1 isn't very descriptive. I suggest showing this figure on a map with different sources pointed out so that the reader can see the seasonal impact of different potential sources of amines.

2. Figure 2 has too many traces. I suggest removing wind direction and better separating the amines and the RH. I also suggest showing a temporal trace for each amine marker.

3. Figure 3 needs standard error bars. Do different amine peaks show different diurnal trends?

4. Figure 4 needs amine markers clearly labeled on each particle type. I am also surprised to not see m/z +86 and m/z +118 as these are some of the most prevalent amine markers observed by single particle mass spectrometry.

5. From Figure 4, it appears as though m/z +74 is the only amine marker observed on biomass burning aerosols. m/z +74 is also a marker for KCl (e.g., 74KCl+) as noted in Zauscher et al., 2013 and may be misclassified as an amine in this work. Were any other amine markers observed on this particle type?

6. Figure 5 should clearly state that the x-axis is vacuum aerodynamic diameter.

7. Figure 6 could be a subtraction plot between the two seasons to better illustrate the seasonal difference in the mixing-state of the amine-containing particles.

8. The biomass burning spectra and ECOC spectra look the same. I think these should be the same particle type. See Ault et al., 2010 for representative ECOC spectra, which do not contain intense ions at 39K+.

9. Lines 277-279: chloride is not completely displaced and is detected as 81, 83Na2Cl+ and 93, 95NaCl2-.

10. Lines 281-283: I am not convinced that this is an observation of a marine-derived amine. The spectra clearly show aged sea salt particles, which should contain an ion peak at 46Na2+. Therefore, the peak at m/z +46 is likely not an amine.

11. Lines 333-334: could it be that the source strength of ammonium shows a seasonal cycle? This is a more likely explanation than differences in partitioning caused by a very small change in RH.

12. The authors are quite redundant about the displacement of ammonium by amines. This should be re-read and redundancies should be reduced.

Conclusions:

1. The authors should comment on which amine markers were most prevalent and

on which particle types. This would be an interesting conclusion that may also tie into different potential amine sources.

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