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Atmospheric
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Discussions

Interactive comment on "Impact of palmitic acid coating on the water uptake and loss of ammonium sulfate particles" *by* R. M. Garland et al.

R. M. Garland et al.

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We would like to thank Referee 5 for their careful reading of the manuscript and for their thoughtful comments. We have addressed their comments below; their original reviews are in italics with our responses following.

1. Introduction: more references should be added page 2049 line 2 especially the Tang et al. papers (such as Atmospheric Environment, Vol. 27A, no 4, 467-473, 1993).

Additional references have been added.

2. Results section, page 2051 line 7: The non decomposition of palmitic acid is con-

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firmed by its H-NMR spectra. The mass spectra obtained using the AMS are only shown for masses smaller than 100 amu (figure 4). Does the molecular peak 256 amu appear and confirm the presence of this molecule? Was the fragmentation pattern of pure palmitic acid also generated in the same conditions (AMS operating conditions) and compared to the one obtained in mixed particles? It would be interesting to have a little more details on how the AMS was operated (heater temperature, etc.). Related to this point, both figures 4 b and c are not necessary since the difference between the spectra is not that obvious.

Yes, the molecular peak at m/z 256 is present. The fragmentation pattern of pure palmitic acid was not generated, however the organic traces from the mixed aerosols were compared to the NIST spectrum of palmitic acid and the fragmentation patterns of the two were the same. The temperature of the vaporizer was set to 600°C. A description of the AMS was added to the experimental section and a discussion of the comparison between the NIST spectrum and our organic traces was added to both the experimental and results section. Figure 4c was shown to illustrate that we can control the amount of organic in the particles by changing the oven temperature. We have changed the text to clarify this.

3. Results section, page 2052 line 23: "spectra a-c" would be more appropriate than "figure a-c". Same comment for lines 25 and 26 on page 2052; line 14 of page 2053; line 1 page 2054.

We agree and the words have been changed.

4. Results section, page 2053 lines 17 to 20: would it be possible that pure ammonium sulfate particles are also present but vaporize quickly under the beam?

We believe we would have seen any ammonium sulfate particles in the mixed aerosol sample. While ammonium sulfate particles are destroyed in the electron beam, it is on a timescale (10 seconds) that can be seen by the TEM operator. After the particles are destroyed by the beam, they leave a residue that can be imaged. In addition, to scan the sample before imaging specific particles we used a lower intensity of the electron beam that did not destroy the ammonium sulfate particles. This has been added to the results section.

5. Results section, page 2054 line 7: using the word “strong” is not appropriate here for this technique by its own (see your last sentence page 2055 lines 15-17).

We agree and have removed “strong.”

6. Results section, page 2056 lines 8-10: how are the LWC values converted to growth factor? Does that explain the intermediate values obtained here for the deliquescence shown in figure 6? (Intermediate values versus a sharp sudden change observed when plotting growth factors).

The LWC values are only a ratio of IR peaks and thus are not quantitative. Thus, we cannot convert these numbers into a growth factor. We have now made this clear in the text.

7. Results section, page 2056 line 23: the sentence “Figure 7 ą E.” is a little bit conflicting; in the previous sentence you state that palmitic acid is a non-deliquescent material.

We do not believe that we see deliquescence of the palmitic acid aerosols, but rather water adsorbed to the surface of the aerosols. In order to clarify this point the caption on Figure 7 was changed.

8. Results section, page 2057 line 23: a reference should be added for the efflorescence RH of ammonium sulfate.

We have now added Onasch et al. 1999 and Cziczo and Abbatt 1999.

9. Conclusion section: the studies are performed for mixing ratios equal or smaller than 50 wtof more than 50 wtnon negligible on the latter cases. You may not conclude about the relevance of the study on an atmospheric basis.

The field studies we cited measured the total amount of organic, not just surface-active organics. The concentrations of these organics, i.e. fatty acids, are thought to be much lower, usually on the order of a monolayer of coverage of the aerosols (Gill et al. 1983; Ellison et al. 1999; Tervahattu et al. 2005). Mochida et al (2002) found that the coverage of fatty acids in sea salt aerosols was 0.3-14

Technical corrections:

Have changed the text according to the suggestions in the “Technical corrections” section.

Reference:

Ellison, G., A. Tuck and V. Vaida. "Atmospheric processing of organic aerosols." J. Geophys. Res., 104, D9: 11633-11641, 1999.

Fang, M., M. Zheng, F. Wang, K. To, A. Jaafar and S. Tong. "The solvent-extractable organic compounds in the Indonesia biomass burning aerosols-Characterization studies." Atmospheric Environment, 33, 5: 783-795, 1999.

Gill, P. S., T. E. Graedel and C. J. Weschler. "Organic films on atmospheric aerosol particles, fog droplets, cloud droplets, raindrops and snowflakes." Reviews of Geophysics and Space Physics, 21, 4: 903-920, 1983.

Graham, B., P. Guyon, P. Taylor, P. Artaxo, W. Maenhaut, M. Glovsky, R. Flagan and M. Andreae. "Organic compounds present in the natural Amazonian aerosol:Characterization by gas chromatography-mass spectrometry." J. Geophys. Res., 108, D4766: doi 10.1029/2003JD003990, 2003.

Middlebrook, A. M., D. M. Murphy and D. S. Thomson. "Observations of organic material in individual marine particles at Cape Grim during the First Aerosol Characterization Experiment (ACE 1)." J. Geophys. Res., 103, D13: 16475-16483, 1998.

Mochida, M., Y. Kitamore, K. Kawamura, Y. Nojiri and K. suzuki. "Fatty acids in the marine atmosphere: Factors governing their concentration and evaluation of organic films on sea-salt particles." J. Geophys. Res., 107, 4325: doi 10.1029/2001JD001278, 2002.

Tervahattu, H., J. Juhanoja, V. Vaida, A. F. Tuck, J. Niemi, K. Kupiainen, K. M and H. Vehkamaki. "Fatty acids on continental sulfate aerosol particles." Journal of Geophysical Research, 110, D06207: doi: 10.1029/2004JD005400, 2005.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 2047, 2005.