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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Internally mixed soot, sulfates, and organic matter in aerosol particles from Mexico City" *by* K. Adachi and P. R. Buseck

Anonymous Referee #1

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This paper discusses results from an analysis of TEM images of particles collected from aircraft over Mexico City. The paper concludes that most particles measured downwind contain internal mixtures, most of which are internal mixtures of soot. The paper reports original measurements and some new conclusions. I recommend publication after the following comments and suggestions are addressed.

1. Abstract and throughout text. The authors use the terms “soot” and “organic matter” separately without really defining either. Soot (from fossil-fuel sources) is a combination of black carbon aggregates coated with lubricating oil (organic matter), unburned fuel oil (organic matter), and some other chemicals (e.g., sulfate, depending on the sulfur content of the fuel). As such, “soot” is emitted as a mixture. The ratio of OM:BC in soot varies with particle size. Particles

smaller than the size of an individual BC spherule (e.g., 20 nm) contain no BC but are mostly liquid, containing unburned fuel oil and lubricating oil. Above 20 nm, BC is usually the dominant component. The authors should clarify their definition of soot and what it contains. Similarly, is the OM referred to primary or secondary OM? What is the difference between the OM that is externally mixed from soot and the OM emitted with soot?

2. Abstract. The authors state “More than 50% of the particles consisted of internally-mixed…” then state “Moreover, soot occurs in more than 60% of all particles…” This is confusing. Please just state something like, “about 55% of all particles contained soot coated by other material and 7% contained uncoated soot, so a total of 62% contained either coated or uncoated soot. The rest did not contain any soot.”

3. Section 2.2. It looks like the smallest particles on the sampler are 50 nm. This means that smaller particles were not picked up. Since small particles coagulate the fastest and faster after they begin to evaporate off the lubricating oil (Jacobson, Kittelson, and Watts, EST, 39, 9486, 2005), this could mean that many particles between 20-50 nm (the smallest BC particles) contain internal mixtures of BC plus smaller lubricating-oil or sulfuric-acid-water particles. Thus, the percentages found are applicable only to a limited size range above 50 nm. The authors should clarify this in the abstract and text and explain how the percentages might change if smaller particles were accounted for and why.

4. A map would be useful in addition to or as a replacement for Table 1 since it difficult to visualize where the measurements are being taken relative to MC from the lat/lons alone.

5. P. 9184. “…with median about 44 nm.” This is below the sampling limit of 50 nm. Please comment.

6. P. 9184. “…from vehicles, but some come from biomass burn-

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ing.” What about biofuel burning? Which is more prevalent, biomass or biofuel burning? Soot also comes from aircraft – this should be distinguished from surface vehicles.

7. P. 9185. “…soot with coating of OM…” Since soot contains an OM coating when it is emitted, this category needes to be redefined. Also, please distinguish between primary and secondary OM.

8. P. 9186. Is this method of determining radii (fitting ellipses) standard? If so, please provide a reference. If not, it would seem that a more standard method of defining radii should be used so that results here can be compared consistently with results from other studies.

9. P. 9188. It looks like the fractal dimension was specified. Can’t it be calculated using additional information from the TEM images?

10. P. 9189. “…they were compacted slightly during aging (Abel et al., 2003)” What is this reference being used to refer to? The fact that particles compact during aging in general or that the particles found in the present study compacted. This latter statement seems contradicted by p. 9188, where the text states, “those in our samples are not highly compacted.” Please clarify.

11. P. 9190. “Biomass burning…” Again, what about biofuel burning? Which one is more important in MC? There must be an emission inventory estimate for this.

12. P. 9191. How much sulfur is in MC diesel? Please provide approximate percentage of sulfur in diesel fuel in MC.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9179, 2008.