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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Liquid-liquid phase separation in particles containing secondary organic material free of inorganic salts" *by* Mijung Song et al.

Anonymous Referee #2

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Summary. Previously, it was found that at high RH (>95%), α-pinene-derived SOM particles free of inorganic salts can undergo LLPS, while isoprene-derived SOM particles free of inorganic salts do not. In this paper, additional SOM particles free of inorganic salts where studied. It was found that SOM generated from ozonolysis of β-caryophyllene and limonene that are similar to α-pinene-derived SOM, while particles generated by photo-oxidation of toluene that are similar to isoprene-derived SOM. In addition to the LLPS information, the authors found a relationship between occurrence of LLPS and the average oxygen-to-carbon elemental ratio (O:C) of the organic material. Low O:C ratio resulted in LLPS. Publication is recommended with minor revisions.

Concerns.

On page 5, the authors mention that 20 – 80 micron diameter particles are required for LLPS. Is there a reference to that? Why is there a size dependence in the observations? In addition, is there a RH rate of change dependence? More discussion is needed.

While the observation of LLPS or no LLPS with SOM derived in various ways is interesting and important to the atmospheric chemistry community, the manuscript would be stronger with proposed explanations or discussions on *why*. Discussion on differences in α-pinene-derived SOM and isoprene-derived SOM structures, or the structures of the components studied here might have been helpful.

In Table 1, some MRH values are higher than the SRH values. This seems counter-intuitive. Discussion is needed justifying these observations.

How are the SOM mass concentrations at phase chance calculated (figure 2, x-axis)? Is the volume of the droplet known? What is the change in contact angle of the droplet with the surface, as a function of RH?

Typo.

Page 8 – 2nd line – "observed". It should be "observe".

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