

Interactive comment on “Role of glyoxal in SOA formation from aromatic hydrocarbons: gas-phase reaction trumps reactive uptake” by S. Nakao et al.

Anonymous Referee #3

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Review of “Role of glyoxal in SOA formation from aromatic hydrocarbons: gas-phase reaction trumps reactive uptake

This paper describes a series of photochemical smog chamber experiments conducted at high RH with toluene, which produces glyoxal as an intermediate. By comparison with experiments with added OH radical (H₂O₂ addition), they find that the glyoxal in this experiment increases SOA formation by adding OH radical rather than by reacting itself in the aqueous phase. The authors also demonstrate the uptake of glyoxal (without OH radical) into wet ammonium sulfate particles and indicate that the vapor pressure of the resulting particles is lower than 10E-8 Pa.

1. These experiments are carefully done. However, the conclusion of this paper does not take into consideration an important lesson that should have been gleaned from the

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examination of other recent papers. A discussion of the results of these experiments in comparison with the others is required.

Zhou et al. (xylenes and toluene; Atmospheric Environment, 45, 2011, 3882-3890) clearly demonstrated that the aerosol water concentration, rather than the RH, is critical to the formation of SOA through aqueous chemistry in wet particles. The type of aerosol seed, the concentration of that seed aerosol, and the RH together determine the liquid water concentration in the chamber. Kamens et al (toluene SOA; Atmospheric Environment, 45, 2011, 2324-2334) explain differences between the work of Crocker (2001) who concluded that RH had no effect on aromatic SOA and Volkamer (2009) who concluded that it has a dramatic effect on SOA from glyoxal (an aromatic intermediate). They concluded that Crocker's experiments were conducted at much lower liquid water content. The Kamens et al (2011) experiments found that more toluene SOA formed at higher liquid water concentrations. And when they conducted experiments with ambient seed particles and with ammonium sulfate seed particles adjusting RH to give the same liquid water concentration, more SOA forms from the ambient seed than from the ammonium sulfate seed.

2. Nakao et al must discuss their own results in the context of the Kamens and Zhou results. They must add the concentration of liquid water to Table 1. They must revise their title, as I believe they can only say that “gas-phase reaction trumps reactive uptake” for their experimental conditions (i.e., liquid water concentration). They must acknowledge and discuss the Kamens and Zhou results to put their work into context.

3. OH concentrations also matter to the aqueous chemistry in these experiments. Increasing OH radical can increase SOA through gas phase or aqueous phase chemistry.

4. page 30606 line 24 “particulates” should be “particulate matter”

5. what is the effect of retained water and sulfate on the reported glyoxal oligomer volatility?

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