This manuscript presents a fairly detailed characterization of secondary organic aerosol (SOA) derived from the oxygenated aromatic precursors catechol and guaiacol. The authors propose that SOA derived from catechol and guaiacol has physical and chemical characteristics similar to atmospheric humic-like substances (HULIS) and therefore may serve as a model for atmospheric HULIS in future experiments. While the topic of the paper is in accord with the theme of ACP, there exist significant deficiencies that must be addressed prior reconsideration for publication in ACP. Comments below are categorized into technical and scientific points.

- Technical Points: The following section addresses technical deficiencies of the written document. The summary below represents a sample of the typical problems and is by no means a comprehensive listing.
 - 1) Use of abbreviations and acronyms:
 - a) Abstract: CNC-DMPS is used before it is defined.
 - b) The acronym HULI-SOA is presented (page 17372, line 29) without being previously defined. It is probably more accurate to define humic-like substances secondary organic aerosol as HULIS-SOA than HULI-SOA.
 - c) TPP-MS is presented (page 17377, line 26) before being defined. The term "temperatureprogrammed-pyrolysis mass spectroscopy" is stated in the abstract and the authors could introduce the acronym there. The authors should also use either "temperatureprogrammed" or the unhyphenated analogue consistently throughout the document.
 - d) Field-emission-gun scanning electron microcopy should be consistently hyphenated as FEG-SEM or FEGSEM throughout the document.
 - 2) References: There are many statements in the submission that need to be referenced:
 - a) Page 17384, beginning on line 25. "Very important functional groups in the aerosol particles are carboxylic acids and lactones." The levels of carboxylic acids in SOA have been determined in several publications including by Fisseha et al. [*Fisseha et al.*, 2004], wherein the high-levels of carboxylic acids in SOA derived from an aromatic precursor (i.e. 1,3,5-trimethylbenzene) are discussed. Other recent works that quantify carboxylic acid levels in SOA, especially when derived from aromatic precursors should also be cited. I am less familiar with the quantification of lactones in SOA, but if this has been quantified or estimated in prior works these publications should be also cited.
 - b) The authors should cite a paper that presents the details of the characterization of the Bayreuth aerosol smog chamber. The authors should also use one convention of hyphenation of "smog chamber" and similar terms.
 - c) Page 17372, beginning on line 1: "Mass fluxes of 30–270 Tg year⁻¹ are estimated to be emitted per year by tropospheric oxidation of biogenic and anthropogenic volatile organic compounds (Andreae and Crutzen, 1997)." While this may be the seminal paper in this area, a great deal has been learned about the sources and global flux of aerosols, including SOA, in the last decade. The authors may want to revise their mass flux estimates for SOA in accord with recent reviews on this subject [*Hallquist et al.*, 2009; *Kanakidou et al.*, 2005; *Kroll and Seinfeld*, 2008], and also specify if they are citing bottom-up or top-down (inverse) estimates because there is often significant disparity between these types of estimates.
 - d) Page 17373, beginning on line 21: "In the recent past several field studies of SOA have been performed using aerosol mass spectroscopy as a powerful tool identifying a myriad of compounds." The authors should reference the use of aerosol mass spectrometry (AMS) for identifying compounds in SOA, including recent reviews and other comprehensive works that address this important application of AMS [*Canagaratna et al.*, 2007; *Hallquist et al.*, 2009; *Jimenez et al.*, 2009; *Sullivan and Prather*, 2005; *Zhang et al.*, 2007].

- e) Page 17387, beginning on line 10: "Especially ATR-FTIR spectra of synthetic HULI-SOA from catechol and guaiacol show many common features with reported natural HULIS according to structural elements and functional groups." This sentence needs to have references for "many common features with reported natural HULIS". Also, the construction of this sentence is awkward.
- f) Page 17387, beginning on line 22: "But the measured medium H/C ratio of 1 is too low for atmospheric HULIS. The reported values are between 1.6 and 1.7." The second sentence needs to be referenced. This referencing and associated discussion should be fairly comprehensive because the comparison of the H/C ratio presented in this work with other reported values is of importance for establishing the veracity of employing catechol and guaiacol derived SOA as a model for atmospheric HULIS. (I address scientific aspects of this and related sections below in "Scientific Points.")
- g) Page 17378, beginning on line 28: "The medium mass of organic molecules in the particles of 300–450 Da is close to natural HULIS samples." Similar comments as presented in point (f) are applicable for this statement.
- a) Page 17372, beginning on line 7: "Aerosol chamber studies have been applied to investigate particle formation and processing (linuma et al., 2004)." I believe the authors are specifically referring to α -pinene derived SOA. In that case a single reference (that is not a review on SOA or α -pinene derived SOA) is inadequate because there are numerous papers on the SOA particle formation and processing from this important biogenic precursor. The authors can either give several specific references (preceded by an "e.g.") or refer the readers to some of the recent reviews on SOA that discuss α -pinene derived SOA [Hallquist et al., 2009; Kroll and Seinfeld, 2008].
- 3) Other Technical Problems:
 - a) The chemical structures of catechol and guaiacol are not shown and should be presented as a figure or as an inset on an extant figure. The molecular weight of these compounds should be stated.
 - b) The purity of catechol and guaiacol should be stated if known. This is especially important because of the impurities noted by the authors as determined by ultrahigh resolution mass spectrometry (page 17378, beginning on line 19).
 - c) If "Labsphere" is the name of a corporation it should be capitalized throughout the document.
 - d) Table 2: The term "catechol dark" is italicized while the rest of the terms in that column are not.
 - e) Figure 2: The abbreviation for " C_{Ae} " for particle mass concentration should be replaced by the more commonly used abbreviation C_{OA} . If the authors want to retain the abbreviation C_{Ae} they should define it in text.
 - f) Page 17374, beginning on line 2: "Organic matter is semi-volatile and thus readily exchanges between gas and aerosol phase." This statement is incorrect. Organic matter observed in particles has a range of volatilities that includes nonvolatile, semivolatile, and intermediatevolatility compounds. An excellent discussion of the volatility distribution of organic compounds in particles under atmospheric conditions is given by Robinson and coworkers [Robinson et al., 2007].
- II) Scientific Points: The following section addresses scientific deficiencies in the reported work.
 - 1) Aromatic SOA: I do not understand why the authors discuss α-pinene derived SOA and abnegate any explicit discussion of SOA derived from other aromatic precursors, including benzene, toluene, xylene, and 1,3,5-trimethylbenzene.

- a. These compounds are more structurally similar to the featured analytes (i.e. catechol and guaiacol) compared to α -pinene, and have been the focus of many chamber-based SOA studies (e.g. [*Fisseha et al.*, 2004; *Jang and Kamens*, 2001; *Kalberer et al.*, 2004; *Ng et al.*, 2007])
- b. Has SOA derived from any of these or other aromatic precursors been shown to have any of the physical or chemical characteristics similar to atmospheric HULIS? This is an important point to address in the discussion because the aforementioned aromatics are more frequently employed in chamber-based SOA studies than catechol and guaiacol and are also more important anthropogenic volatile organic compound (VOC) emissions.
- 2) Humidity: How was the relative humidity (RH) regulated in the smog chamber? How was RH determined? How accurate is the RH? Why was a RH of 25% the highest RH value employed in these studies?
- 3) H/C ratio: On page 17387, beginning on line 22, the authors state: "But the measured medium H/C ratio of 1 is too low for atmospheric HULIS. The reported values are between 1.6 and 1.7." As stated above, the authors must reference the reported H/C range. The H/C range of approximately 1 is similar to those reported for Suwannee River fulvic acid (e.g. see Table 3 in Dinar et al. [Dinar et al., 2006]), which is not discussed or noted in the report and should be included because it is often used as a proxy to atmospheric HULIS in many recent studies (e.g. [Baduel et al., 2009; Dinar et al., 2006; Hatch et al., 2009]). The authors need to establish through a meaningful discussion that SOA derived from catechol and guaiacol is a better proxy to atmospheric HULIS than commercially available Suwannee River fulvic acid and humic acid.
- 4) Molecular weight: In the abstract the authors state: "Ultrahigh resolved mass spectroscopy (ICRFT/MS) determined O/C-ratios between 0.3 and 1 and main molecular weights between 200 and 500 Da." However, in the conclusion (Page 17387, beginning on line 28) the authors state: "The medium mass of organic molecules in the particles of 300-450 Da is close to natural HULIS samples." The authors should clarify what the term "main molecular weight" means. I think the term "medium mass" is vague and the appropriate terminology should be employed. As noted above, this statement needs to be referenced. The authors also need to develop the discussion that compares their results for the molecular mass of compounds in catechol and guaiacol derived SOA with the molecular mass of compounds in atmospheric HULIS samples. This includes addressing problems with HULIS associated with the water soluble organic compound fraction of atmospheric aerosols that may be either high molecular weight macromolecules or a complex mixture of poorly separable compounds (see the review on HULIS by Graber and Rudich [Graber and Rudich, 2006] for further discussion). In summary, the authors have presented a vague description of the molecular weight of compounds in catechol and guaiacol derived SOA particles and also have not formulated a convincing argument that this class of SOA is a good representation of atmospheric HULIS.
- 5) The authors provide no meaningful discussion that compares the optical properties of catechol and guaiacol derived SOA particles to atmospheric HULIS or other laboratory generated materials that have been suggested to be a model for atmospheric HULIS. For example, Gelencsér et al. [*Gelencsér et al.*, 2003] formed a brownish material by reacting 3,5-dihydroxy-benzoic acid with OH radicals, which was subsequently shown to have properties similar to naturally occurring HULIS[*Hoffer et al.*, 2004]. The optical properties of the products derived from 3,5-dihydroxy-benzoic acid and any other aromatic precursors that have been proposed to be models or proxies for atmospheric HULIS should be compared to those properties for catechol and guaiacol derived SOA.

Conclusion: While the topic of the submission of Ofner et al. is in accord with the theme of ACP, this work has extensive technical concerns that must be corrected prior to resubmission. More importantly, this work also lacks a meaningful discussion of how the results obtained by Ofner et al. compare to other important studies. After reading this paper I was not convinced by the authors that catechol and guaiacol derived SOA is an appropriate model for atmospheric HULIS.

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