

## **acpd-10-8415-2010 (He et al.)**

We thank the reviewer for the constructive comments on the manuscript. We are giving below our point-by-point response to each of the comments in the same order as raised by the reviewer.

### **General comments**

#### **Response:**

- 1) We have addressed the reviewer's concerns as part of our response to the specific comments.
- 2) We thank the reviewer for the advice to examine the levoglucosan data carefully. We have reanalyzed the aerosol samples for levoglucosan using an improved analytical method (details below). The results are much better now and are consistent with the trend seen for the TSP samples and other reports in the literature.
- 3) In accordance the reviewer's advice, the supplementary document has been updated and uploaded to the ACPD website.

### **Specific comments**

#### 1) Abstract

As suggested, the statement "Among the POCs investigated, phthalic acid and cis-pinonic acid showed a strong linear relationship with maximum daily ozone concentration, indicating secondary organic aerosols (SOA) to be an important contributor to ambient atmospheric organics over Singapore" has been revised as "Among the POCs investigated, phthalic acid and cis-pinonic acid were abundant during October 2006 and showed strong linear relationships with maximum daily ozone concentrations throughout the entire sampling period. This correlation with ozone suggested that the secondary aerosol constituents such as phthalic and cis-pinonic acids were formed at least partially through O<sub>3</sub>-induced photochemical transformation."

#### 2) Sample collection

As suggested, more details on aerosol sampling are added as in the Table below.

(1) During this sampling period from August to early November 2006, altogether 20 pairs of filter/PUF samples were collected and this information will be clearly stated in the experimental section of the revised manuscript.

(2) The original Figure 6 correctly presented the actual number of samples collected from Aug to early Nov 2006. As such, this figure needs no revision.

(3) We missed out one sampling point in the original Figure 7 and will add it in the revised version.

(4) Both TSP and PSI data have been reflected in the added table clearly.

Table Summary of meteorological parameters, TSP and PSI data during the sampling period in 2006

Sampling Date	Air Temperature °C	Humidity %	Wind Speed m s <sup>-1</sup>	TSP µg m <sup>-3</sup>	PSI
10-11 Aug	26	84	1.7	46	42
16-17 Aug	27	83	3.1	43.7	45
04-05 Sep	29	78	1.9	39.3	47
20-21 Sep	29	74	3.3	39.4	44
02-03 Oct	28	76	1.1	80.5	68
04-05 Oct	28	77	2.5	57.9	53
07-08 Oct	28	79	1.6	217.9	130
10 Oct-D	30	70	1.8	127.5	59
10-11 Oct-N	26	81	0.4	108.8	71
12 Oct-D	29	73	1.5	63.1	54
13-14 Oct-N	25	78	1.2	57.7	85
14-15 Oct	28	78	1.4	134	116
16-17 Oct	28	80	0.8	143.4	118
18-19 Oct	29	76	0.8	123.7	97
21-22 Oct	29	79	0.7	128	81
23-24 Oct	28	88	0.3	64	69
26-27 Oct	28	89	0.6	43.9	38
2-3 Nov	27	86	0.8	32.6	37
5-6 Nov	28	84	0.6	49.8	58
9-10 Nov	28	85	0.8	37.0	35

Note: 24 h sampling started from 8am to 8am next day;

D: daytime sampling started from 8am to 8pm on the same day for 12h;

N: nighttime sampling started from 8pm to 8am next day for 12 h.

3) Page 8428, line 15: As pointed out, “alkanedioic acid” has been replaced by “dicarboxylic acid”. In addition, on Page 8428, line 6: “(saturated dicarboxylic acids)” have been added after “alkanedioic acids”. We would make other necessary revisions as point out by the reviewer.

4) W reanalyzed all the aerosol samples in our collaborator’s lab at DRI (USA) by using a new internal standard, levoglucosan-d7 that has recently become available from Cambridge Isotope Laboratories and also an improved gas chromatographic conditions. We obtained a new batch of analytical results for levoglucosan. Figure 7 is re-plotted with a new set of analytical data for levoglucosan. Data for all samples are shown in the supplemental material available on-line.

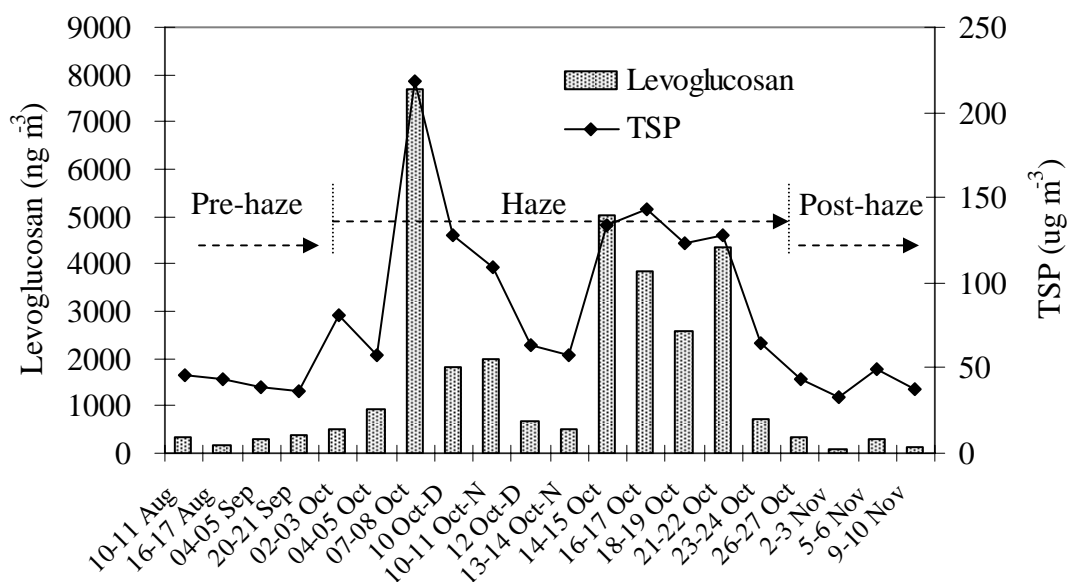


Fig. 7. Temporal trends of levoglucosan and TSP from August to early November 2006

As shown in Fig. 7, levoglucosan concentrations were observed in the ranges of 170-380 ng m<sup>-3</sup>, 350- 7700 ng m<sup>-3</sup>, and 90-280 ng m<sup>-3</sup>, for August-September, October and early November in 2006, respectively. The correlations between levoglucosan and TSP were found to be high for both the entire sampling duration and the hazy period (October 2006) with  $r^2$  up to 0.79 and 0.87, respectively. As can be seen in Fig. 7, the temporal trends of levoglucosan and TSP are quite similar during the entire sampling period, both of which showed significant peaks in Oct 2006, indicating that the air quality in Singapore was affected by the smoke haze transported from biomass burning sites in Indonesia during the hazy period.

5) We thank the reviewer for the advice. We intend to keep this discussion as it is, as all biomass burning organic tracer compounds have been highlighted and discussed as part of different categories of organic compounds measured in this study. The concentration trends of levoglucosan and retene in individual samples are reflected clearly in Figure 7

and Figure 5, respectively. Vanillin, the most dominant species among the group of methoxylated phenols, has been discussed together with its spike in the concentration.

6) Page 8438, in Table 1 the title: “total concentration of both gaseous and particulate phases” has been added before “ $\text{ng m}^{-3}$ ”.

7) Page 8430, line 17-19: As stated in the manuscript, WNA was calculated based on the plant wax n-alkanes inputs, which may come from biomass burning as well as emissions of vegetative surfaces or detritus, etc. Hence, the term “biomass burning” here is not appropriate to cover these sources, as pointed out by the reviewer. In line 17, “biomass burning” has been replaced by “plant wax emissions”; in line 18, “biomass burning origin” has been changed to “plant wax inputs”.

8) Page 8424, lines 5-8: CPI 1: C12-C35; CPI 2: C12-C23; CPI 3: C24-C35

9) Page 8426: as suggested,  $C_0/C_0+C_1$  P/A and  $C_0/C_0+C_1$  F/P have been replaced by  $C_0/C_0+C_1$ \_MW178 and  $C_0/C_0+C_1$ \_MW202.

10) Page 8428, line 13: “unimodal GC chromatograph” has been removed.

11) Page 8429, lines 24-25: as per the reviewer’s advice, more appropriate references (Jang and Kamens, 1999 and Larsen et al., 2001) are used to replace the previous one (Park et al., 2006).

The following references will be added in the revised manuscript.

Jang, M., and Kamens, R.M.: Newly characterized products and composition of secondary aerosols from the reaction of alpha-pinene with ozone, *Atmos. Environ.*, 33, 459-474, 1999.

Larsen, B.R., Di Bella, D., Glasius, M., Winterhalter, R., Jensen, N.R., Hjorth, J.: Gas-phase OH oxidation of monoterpenes: gaseous and particulate products, *J. Atmos. Chem.*, 38, 231-276, 2001.

#### **Minor comments:**

1) Page 8426: (Yunker, 2002) have been replaced by (Yunker et al., 2002) in the revised manuscript.

2) Page 8428: the discussion on “levoglucosan” has been revised based on the new analytical data as stated above (response to Specific comment 4).

3) Page 8445, Fig. 7 caption: “October” will be changed to “November” and “ug” will be replaced by “ $\mu\text{g}$ ” in the y-axis in the revised manuscript.