Volatile organic compounds (VOCs) observed at a site in the central Pearl River Delta (PRD) region in autumn of 2007 and 2008: Influence of the financial crisis?

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Outline

- Background
- Field and Lab Works
- Results and Discussion
- Summaries
Background

Facts:

- Improved overall air quality in 2008 in PRD according to GDEPB & HKEPD
- Significant drop of haze days since the second half of 2008
- Haze days occurred mostly in winter and autumn before [>70%; Liu AJ et al. (2004)]
- Haze days in Guangzhou
  - 2007, 1-6: 84 days; 7-12: 47 days
  - 2008, 1-6: 96 days; 7-12: 14 days
  - 2009, 1-6: 49 days; 7-12: 25 days
- Wanqingsha, PM10: Nov. 2007: 0.141;
  - Nov. 2008: 0.094 (GDEPB & HKEPD)

Why?

- Meteorological conditions
- Reduction in emission due to:
  - Effective emission control
  - Financial crisis
Background

- About 1,500 factories shut down in Dongguan in 2008.

- Aug-Dec, 2008: Export decreased 9.1% when compared with the same period in 2007.

---Guangdong Statistical Yearbook, 2008
Purpose

From comparison of VOC at Wanqingsha in November of 2007 and 2008, to explore

- Changes of levels and patterns of VOCs
- Changes of OFP of VOCs
- Changes of sources of VOCs
- Implication of VOC emission control
Wang qingsha:
- a sub-urban site in the central of Pearl River Delta region
- 40 km NE of Dongguan city
- station on the rooftop of a Middle school (15 m AGL, 22°43’N, 113°33’E)

Sampling time:
- 23th, OCT, 1st, DEC, 2007
- 25th, NOV, 2nd, DEC, 2008
Air Sampling and Analysis

2-L canisters from UCI
cleaned with pure nitrogen
Leakage checked
Evacuated before use (< 0.05 mmHg)

Liquid Nitrogen Trap
PreConcentration-
GC/MSD/FID/ECD
Results Changes of concentrations

Increased $C_3$-$C_5$ alkanes and decreased aromatics in 2008 when compared with that in 2007.

Top 31 species accounted for over 95% of total NMHCs.
Results

Changes of proportion

- **Aromatics** made the greatest contribution to total NMHCs in 2007.
- Proportion of aromatics in 2007 was about 2 times of that in 2008.
- **Alkanes** was the most abundant NMHCs in 2008.
The percentage of each species in total NMHCs in 2007 and 2008
Aromatics accounted for **77%** of the Top 31 species in 2007, and **39%** in 2008
Air mass mainly across Northeast China and South China Sea before reaching WQS in 2007.
All the air masses reaching WQS were from Northeast China and across Dongguan
Results _23^{th}\ NOV,\ 2007\ vs\ 30^{th}\ NOV,\ 2008_

The contribution of aromatics to total NMHCs in 23\th\ NOV,\ 2007 was about 6 times of that in 30\th\ NOV,\ 2008.
The contribution of aromatics to total NMHCs in 23th NOV, 2007 was about 4 times of that in 30th NOV, 2008.
The contribution of aromatics to total NMHCs in 23th NOV, 2007 was about 5 times of that in 30th NOV, 2008.
Results

Ratios

T/B ratios of 2007-11-23 and 2008-11-30

T/B > 5, mainly affected by industry activities.

T/B~1.16-2.23, suggesting the main source of toluene was vehicle exhaust.

---Wang et al., 2002; Chan et al., 2006; Barletta et al., 2008;
Results_Ratios

Concentrations of typical industrial tracers, TrCE and TeCE, were much higher in 2007 than in 2008.

The halogenated hydrocarbons to CO ratios in 2007 were significantly higher than in 2008.
Results  PMF source apportionment

Decreased:
- Industry sources

Increased:
- LPG/LNG
- Evaporative emissions
- Biomass burning

Anthropogenic Source contributions to total NMHCs in 2007 and 2008
Summary

Comparison of November VOC data between 2007 and 2008 at Wanqingsha:

◆ Significant drop of aromatic hydrocarbons and OFP probably influenced by the Financial crisis

◆ Increase share of C3-C5 hydrocarbons from LPG/LNG and oil evaporation

◆ Enhancing control of aromatic hydrocarbons from coating and painting using solvent-based paints would benefit
Acknowledgment

NSFC

GD-NSF

Thanks for your attention!
Results

PMF factor profiles

Diesel exhaust

Evaporative emissions

Gasoline exhaust

Industrial Processes Losses

Biomass burning

LPG/LNG

Ethane
eThene
Ethylene
Propene
1-Butene
2-Butene
3-Butene
1-Pentene
2-Pentene
3-Pentene
n-Hexene
n-Heptane
n-Decane
Toluene
Ethylbenzene
m,p-Xylene
o-Xylene
1,3,5-TMB
1,2,4-TMB
1,2,3-TMB
CB8C10

% of species