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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Vehicular fuel composition and atmospheric emissions in South China: Hong Kong, Macau, Guangzhou, and Zhuhai" *by* W. Y. Tsai et al.

Anonymous Referee #2

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General comments

This manuscript presents organic speciation of gasoline, diesel fuel, and liquefied petroleum gas and of ambient roadside and tunnel samples in the Pearl River Delta region of South China. Given the importance of this rapidly developing area of the world with respect to atmospheric emissions, this study presents important new data that will aid the study of regional and global air quality. The results are presented in a well-organized, if terse, fashion; and the discussion would be considerably strengthened by comparison of these speciation results against others found elsewhere in the world. Because of the way fuel was analyzed, the authors should emphasize that their

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results for fuel speciation represent evaporative conditions. The authors need to justify some of their claims in greater detail, often with more references. Additionally, a proof-reader is needed to edit the grammar for errors such as subject-verb disagreement.

Specific comments

1. In the abstract, the “maximum benzene levels for Mainland China unleaded gasoline” should probably be the “maximum recommended benzene level...” or “the benzene limits....”

2. Additional details should be provided on fuel sampling methodology. How were the samples collected and stored? What volume was injected into the canisters? As the authors acknowledge in Section 2.1, their sampling approach–injecting a drop of fuel into an evacuated canister and basing measurements on evaporation of the fuel–“depends on vapor pressure of each fuel component and thus it tends to underestimate the heavier, less volatile hydrocarbons.” To obtain the true speciation of the fuel, they could inject the fuel directly into a GC. Elsewhere in the text, i.e. the abstract, results and discussion, and tables and figures, they need to emphasize that their measurements reflect not the actual fuel composition, as presently implied, but the evaporative composition.

3. The authors discuss toluene-to-benzene ratios extensively but do not compare their values to others reported in the literature. Here and in subsequent discussions, their work would be greatly strengthened by comparison of their results to others found elsewhere in the world.

4. There are several claims in the manuscript that should probably have references: in the introduction, “Fuel composition significantly affects vehicular performance and the emissions in part because they [sic] affect the combustion efficiency and evaporative emissions from the fuel system”; in Section 3.3, “In Hong Kong, pollutants emitted from motor vehicles are often trapped between the very tall buildings along the streets”; in Section 3.4, “Ethene and ethyne are typical tracers for combustion...”; and in Section

ACPD
6, S912–S914, 2006

EGU

3.4, “These gases are tracers of gasoline evaporation and their enhanced concentrations indicated the importance of running evaporative loss from gasoline-fueled vehicles in the targeted cities.”

5. Standard deviations should be provided for ethyne/ethane ratios reported in Section 3.4, as they were given for toluene/benzene ratios.

6. Additional evidence is needed to substantiate the claim in Section 3.4, “We contend that this indicates a higher degree of gasoline evaporation to the roadside atmospheres [sic] from vehicles in Guangzhou and Zhuhai, likely the result of less effective fuel system maintenance.” How might the proportion of diesel vehicles on the road at each site affect the variability in the ratios? What other sources of i-pentane may confound these results? What is the likelihood that vehicles might have purchased their fuel elsewhere? Given the variance in gasoline composition from a single city (standard deviations of up to 35% in Table 2), how confident are the authors in their conclusion? The authors might want to consider weighting the gasoline results by sales. What evidence can the authors provide for less effective maintenance in Guangzhou and Zhuhai? Error propagation should be conducted for the ratios.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 3687, 2006.