

# Characteristics of Ambient Volatile Organic Compounds (VOCs) Measured in Shanghai, China

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## 1. Introduction

• Previous studies reported that O<sub>3</sub> production is limited by VOCs in Shanghai, and different VOC species have different contributions to the O<sub>3</sub> formation. The concentration of O<sub>3</sub> is increasing and could be another important atmospheric pollutant in YRD region. Thus, to better understand the characteristics of precursors of O<sub>3</sub> has become an important issue for studying ozone formation and for implementing effective O<sub>3</sub> control strategies in Shanghai.

## 2. Experimental Method

• In order to study the diurnal variations of VOC species, VOCs were intensively measured (8 samples per day) in different areas during 2009. VOC samples were also collected at the Xujiahui measurement site for 3 hours (from 6:00 to 9:00) from July 2006 to February 2010 using a 6 L silonite canister equipped with a valve;

• In order to gain insight into the influence of industrial factories on the three sampling site, the distribution of industrial sites in the surrounding area of Shanghai and the wind directions in different seasons are shown in Fig. 1;

• A propylene-equivalent concentration method and a maximum incremental reactivity (MIR) method are used to calculate the OH reactivity and maximum ozone-forming potential of VOCs.

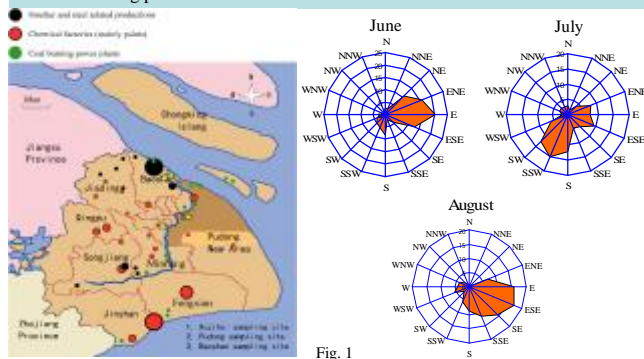


Fig. 1

## 3. Characteristics of ambient VOC concentrations in Shanghai

• Fig. 2 shows the comparison of ambient VOC concentrations measured at different sampling sites (Xujiahui and Pudong) during 2009, indicating that the total concentrations measured at the two sites are similar;

• Fig. 3 shows the comparison of ambient VOC concentrations measured at Baoshan (industrial area) and Pudong sampling sites during May 2009 indicating that the concentrations in the large steel industrial area were much higher than in the urban administrative area.

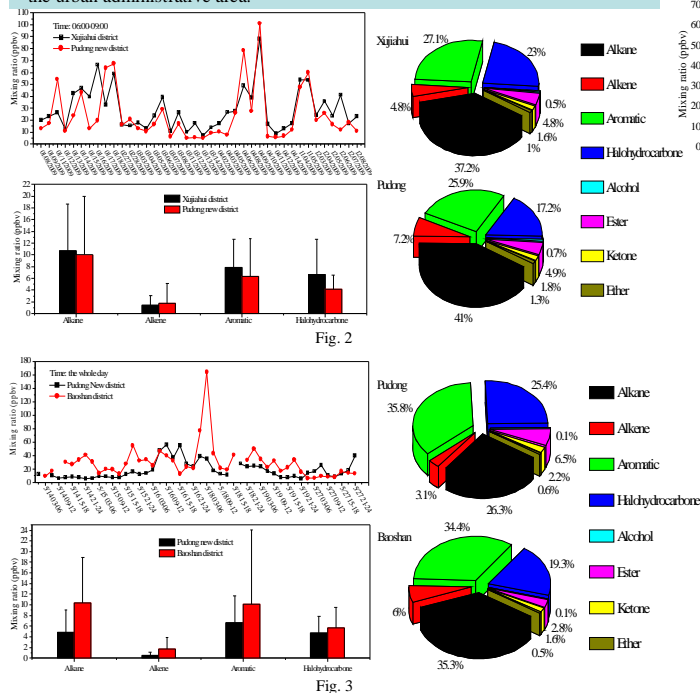


Fig. 3

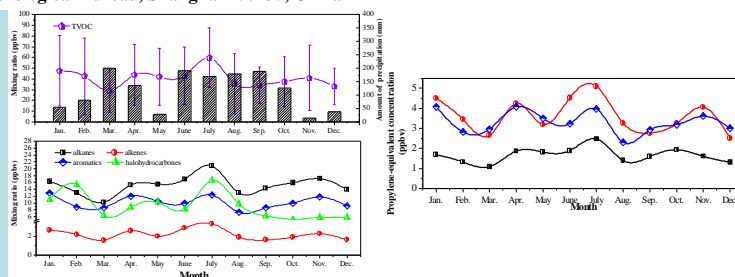


Fig. 4

## 4. Seasonal and diurnal variations

• The seasonal variations of VOC concentrations and monthly averaged precipitation at the Xujiahui site are shown in Fig. 4 (left). The result suggests that VOC concentrations were lower when the precipitation was higher, except in summer. In June and August, the prevailing wind directions were east and southeast. In this case, there were no major pollutant sources which have significant effect on the measured VOC concentration in the sampling sites. However, in July, the prevailing wind directions were south and southwest, and many major large industrial areas could have important effects. The fig. 4 (right) shows that aromatics play important roles in ozone formation, contributing to ozone formation by about 57%;

• The diurnal variations of ambient VOC concentrations are shown in fig. 5. The result suggests that the VOC concentrations are higher on weekdays than in weekends, indicating that human activities have significant impact on the VOC emissions at the urban site. The two peaks of VOC concentrations occurred around 09:00 and 15:00-18:00, and were correlated to the morning and afternoon rush hours. In addition, in weekends, no clear double-peak patterns were indicated, which might due to the change in traffic pattern.

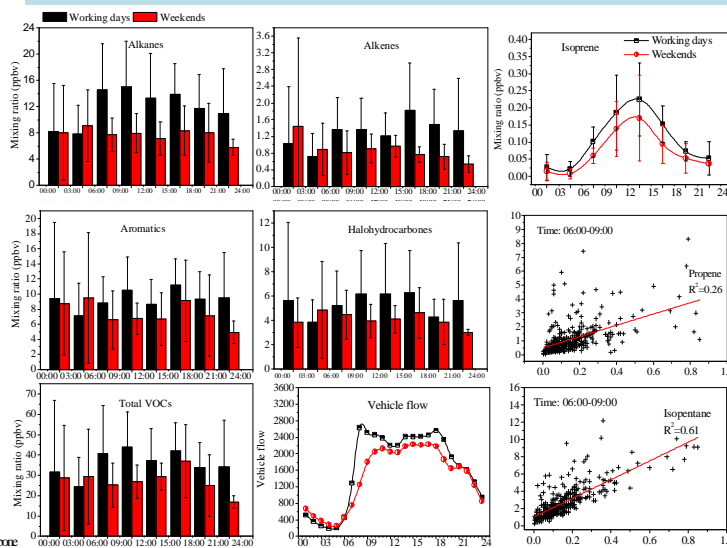


Fig. 5

## 5. Conclusions

• The comparison of ambient VOCs collected in different regions of Shanghai shows that the concentrations are slightly higher in the busy commercial area (28.9 ppbv at Xujiahui) than in the urban administrative area (24.3 ppbv at Pudong). However, during the intensive measurement period, the concentrations in the large steel industrial area (28.7 ppbv at Baoshan) were much higher than in the urban administrative area (18 ppbv at Pudong), especially for alkanes, alkenes and toluene;

• Seasonal variations of VOC concentrations are greatly influenced by meteorological conditions, including precipitation and wind direction. Aromatics play the most important role in ozone formation (account for about 57% of the total ozone formation potential), although the concentrations of alkanes are the highest;

• The weekend effect shows that VOC concentrations are much higher on weekdays than on weekends, and the diurnal variation pattern of traffic flow is similar with the pattern of VOC concentrations, indicating that human activities and traffic conditions greatly affect VOC emissions at the sampling sites;

• The evidence also shows that the major sources of isoprene are mainly resulted from anthropogenic sources at a particular time period (06:00-09:00) in the busy commercial area