

# Emission factors and species profile of vehicular evaporative loss: China vs. US

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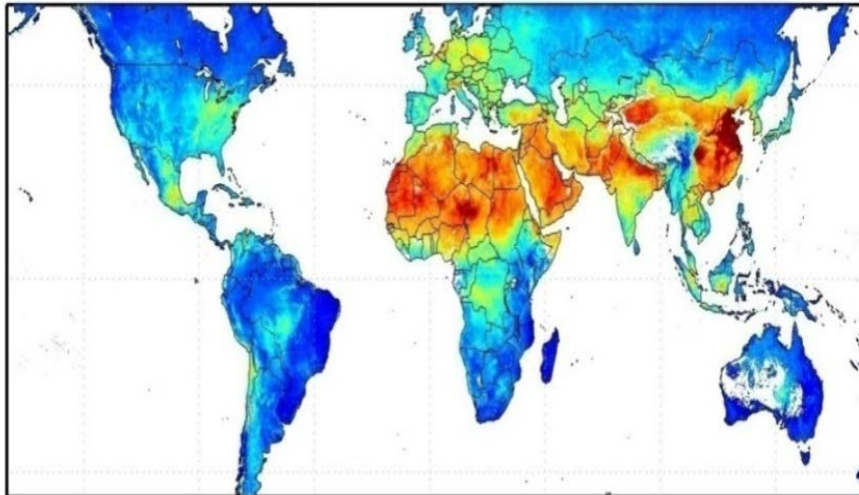
2015.04.16

# Overview

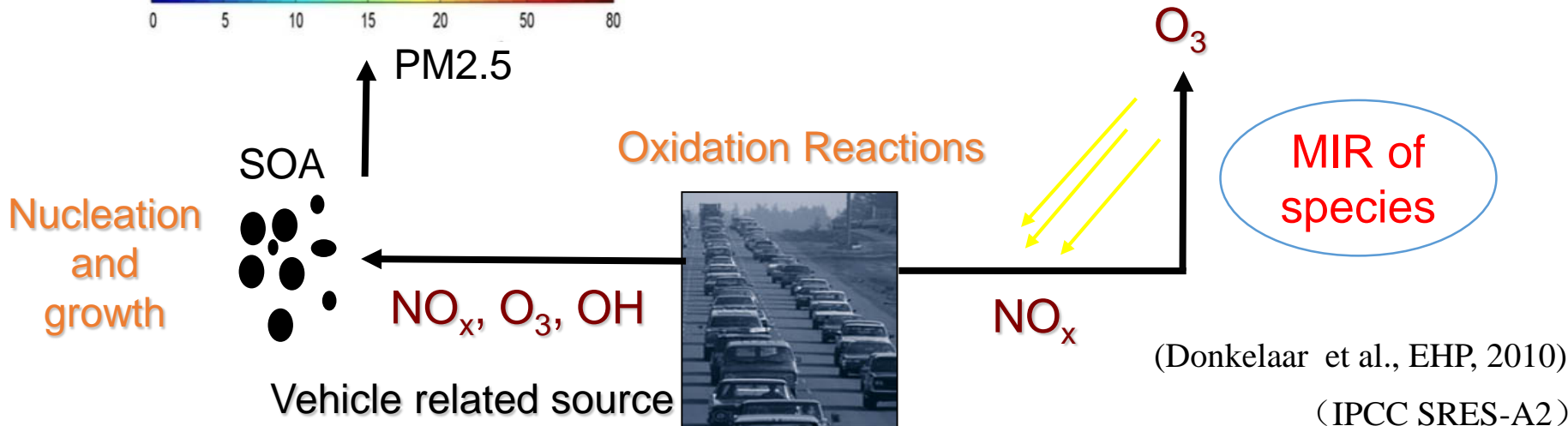
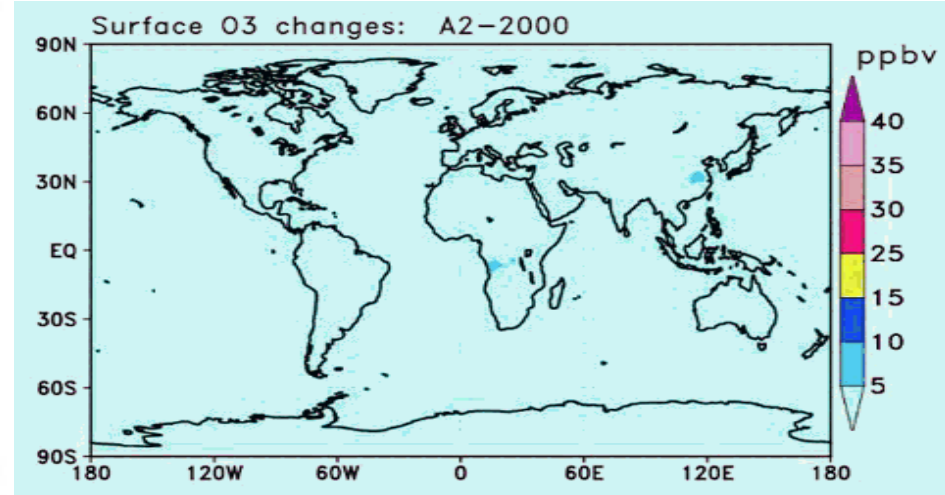
- Introduction
- Research framework
- Experiment data and analysis
- Conclusion

# Sever PM2.5 and O<sub>3</sub> pollution in China

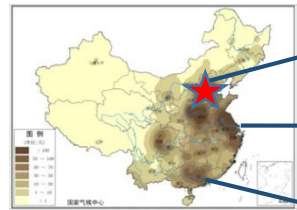
Global satellite-derived PM<sub>2.5</sub> averaged over 2001-2006



Predicted Ozone level in the surface of the earth



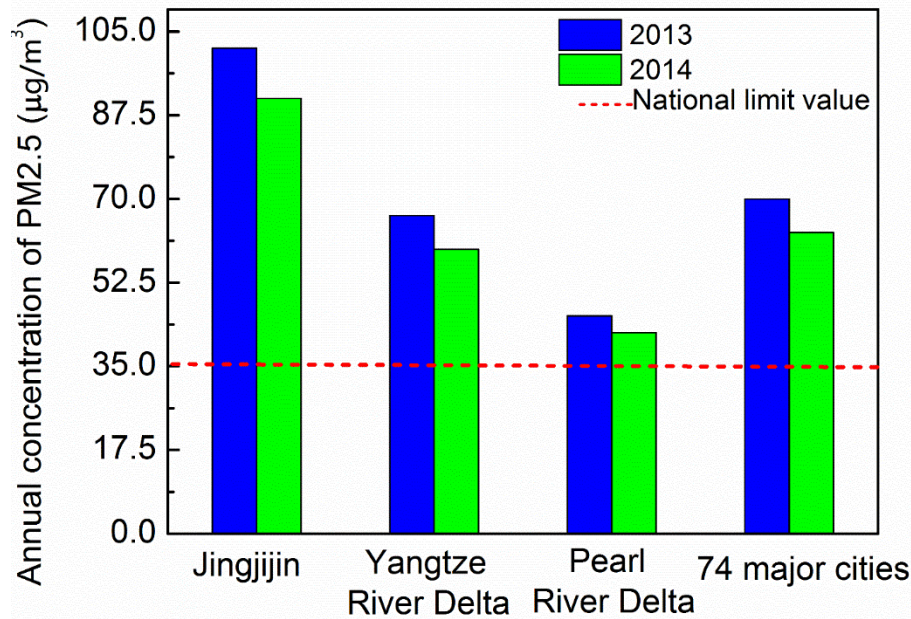
# China has been controlling exhaust VOCs to reduce PM2.5



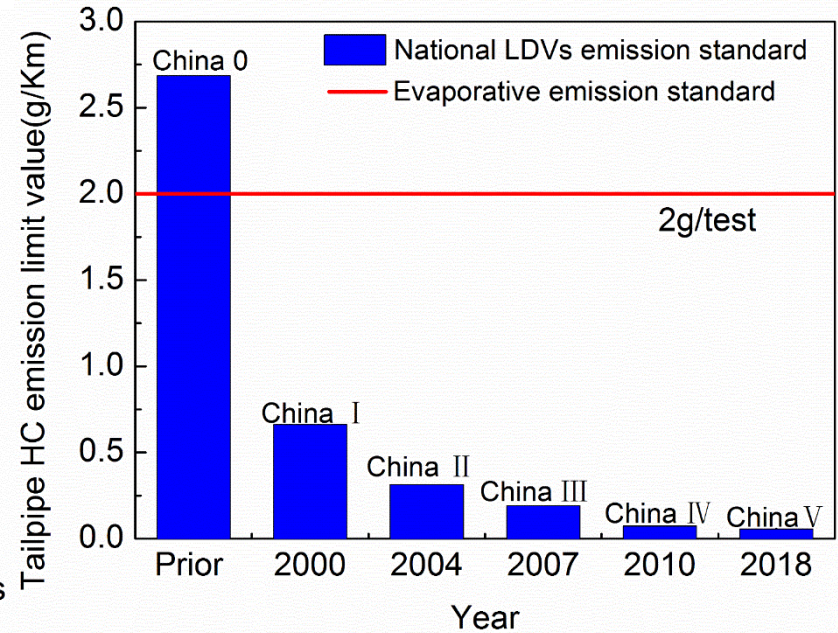
Jingjinji

YRD

PRD

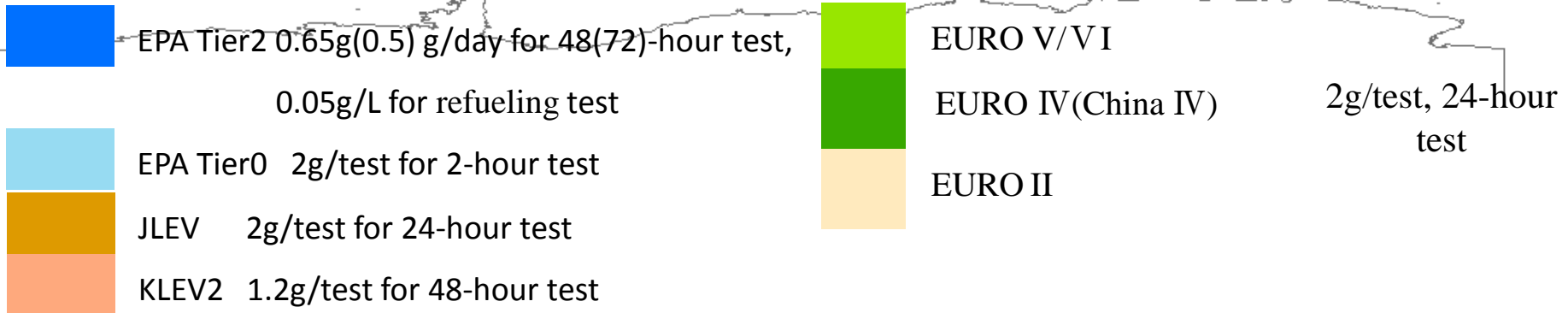
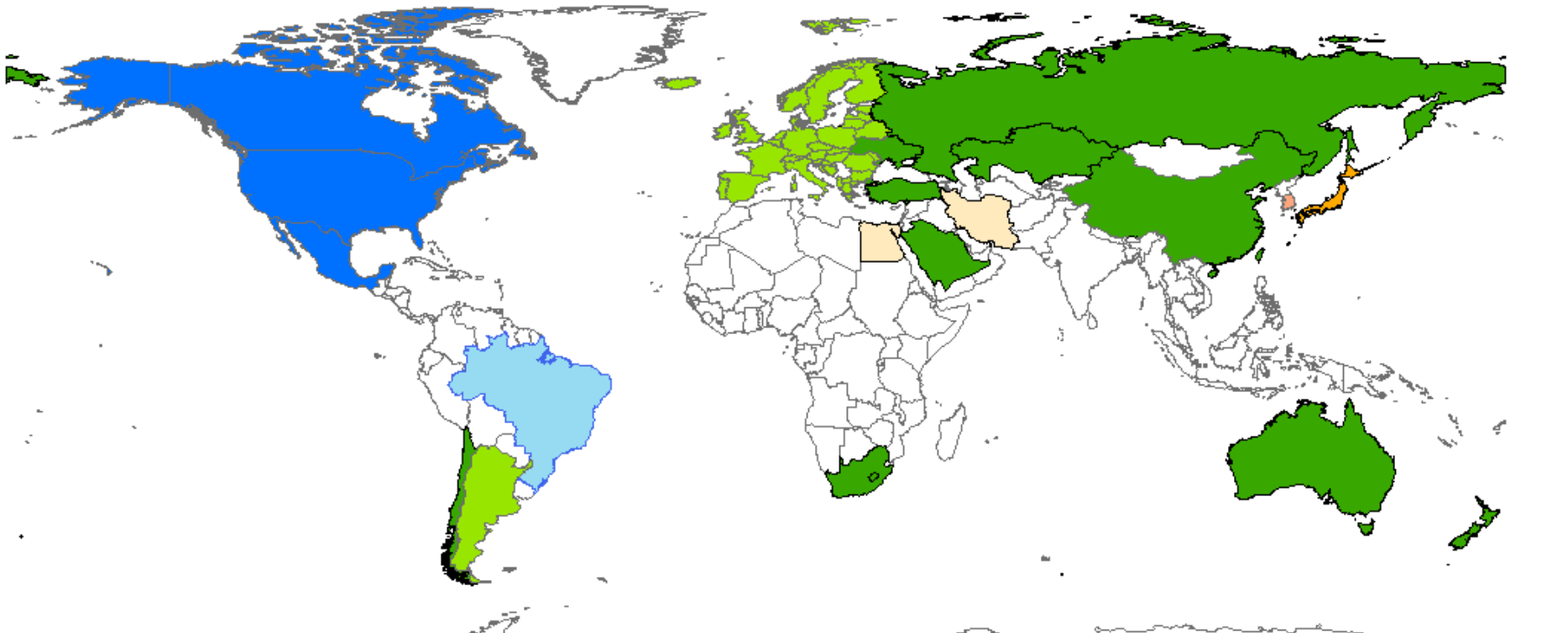


Annual concentration of PM2.5 in China



Tailpipe and evaporative emission standards in China

# Control strategies of vehicular evaporative emissions worldwide



# More research is necessary to understand evaporative emission

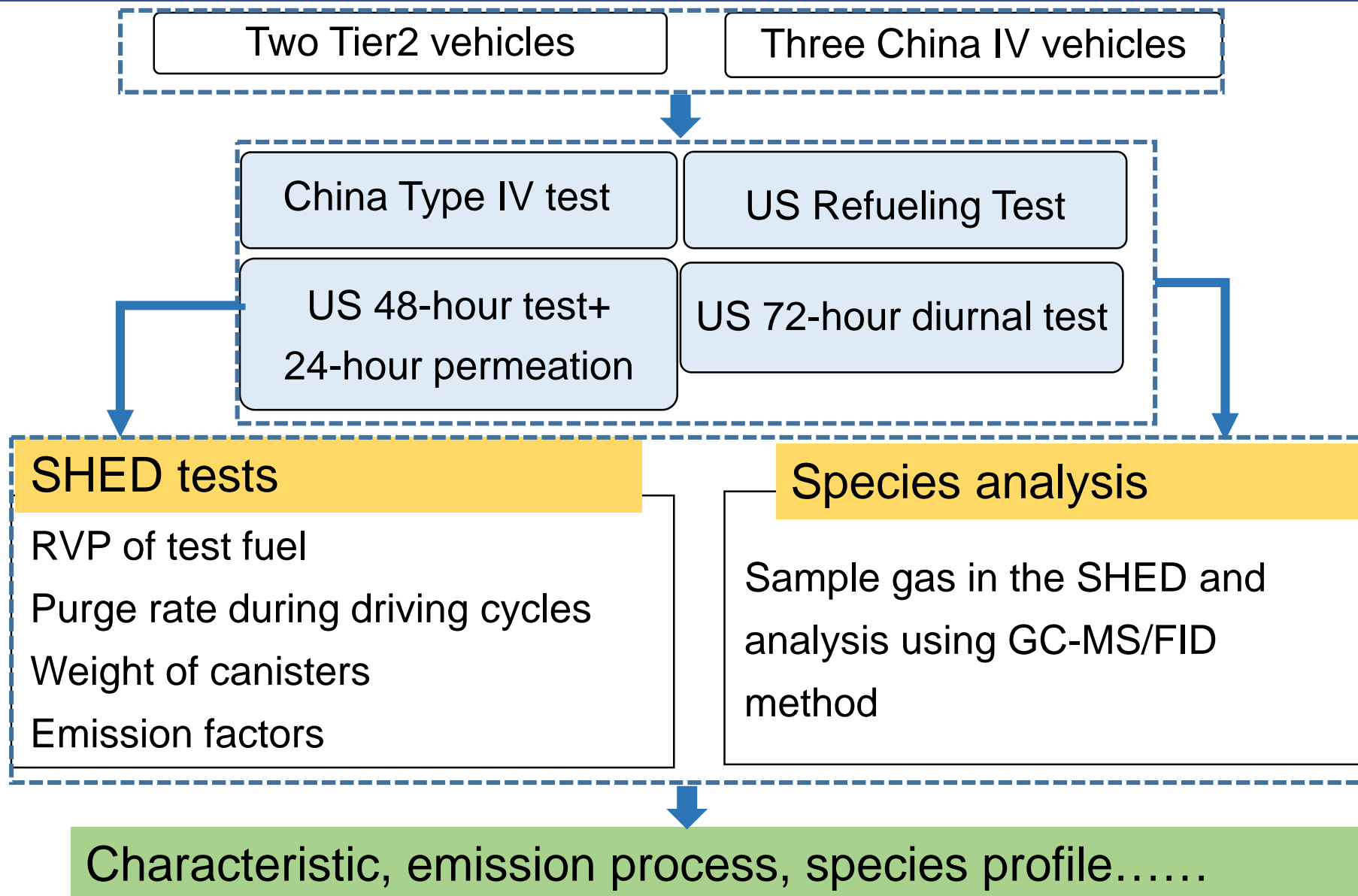
We need to know :

What are evaporative emission characteristics and factors in China ?

How much do emissions vary between US and EURO regulations ?

What is the difference of species among different type emissions ?

# Research Framework



Two Tier2 vehicles

Three China IV vehicles

China Type IV test

US Refueling Test

US 48-hour test+  
24-hour permeation

US 72-hour diurnal test

**SHED tests**

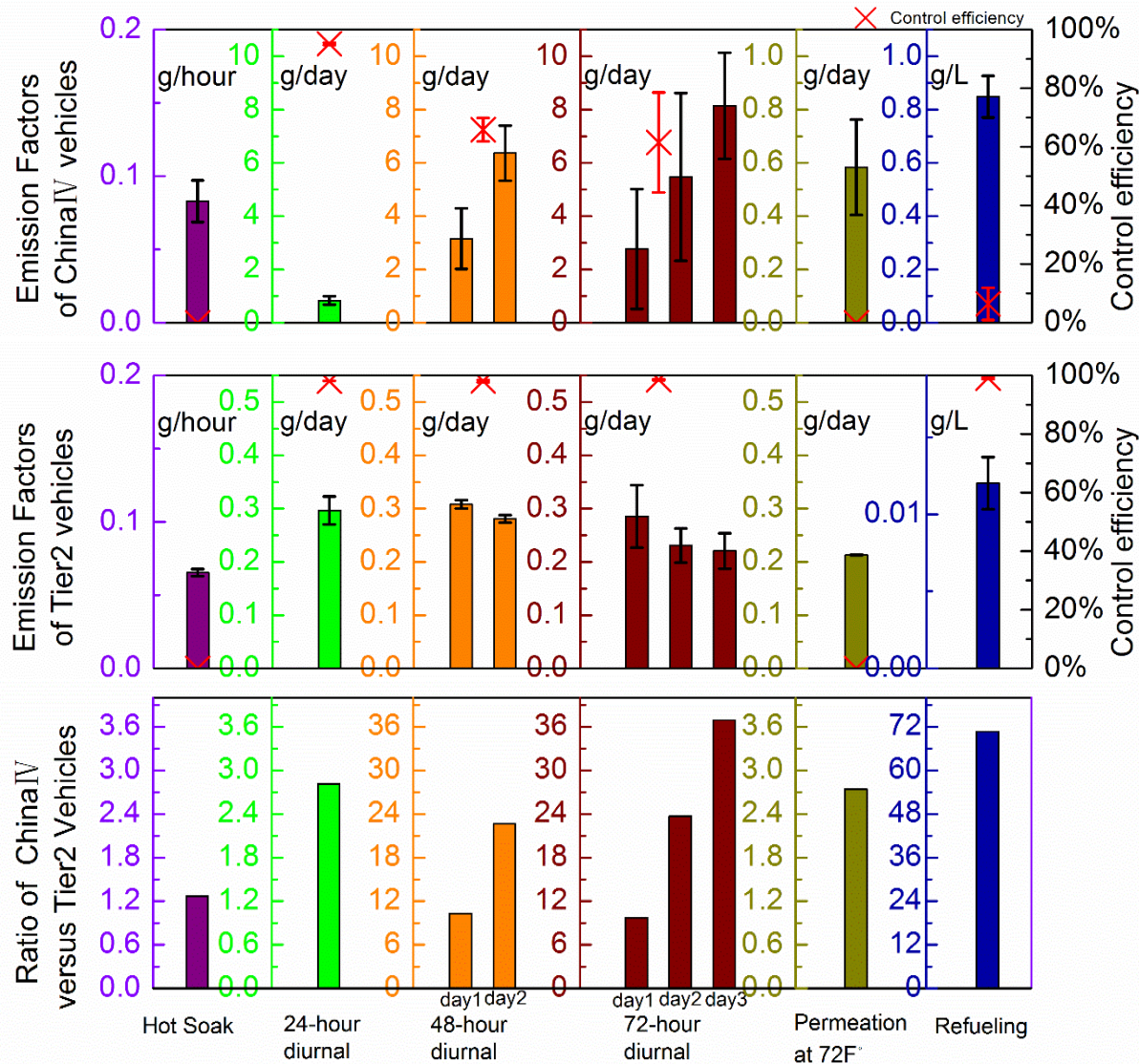
RVP of test fuel  
Purge rate during driving cycles  
Weight of canisters  
Emission factors

**Species analysis**

Sample gas in the SHED and  
analysis using GC-MS/FID  
method

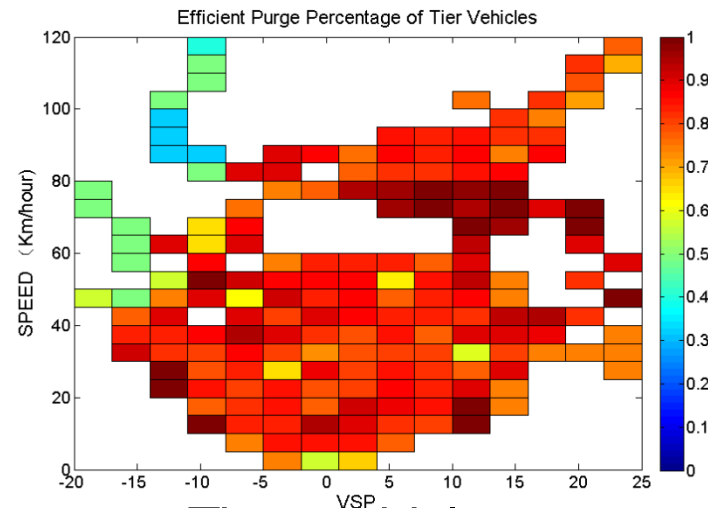
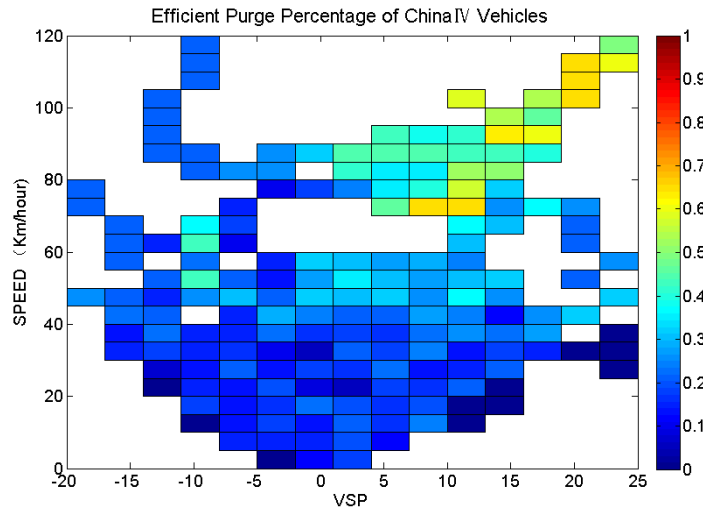
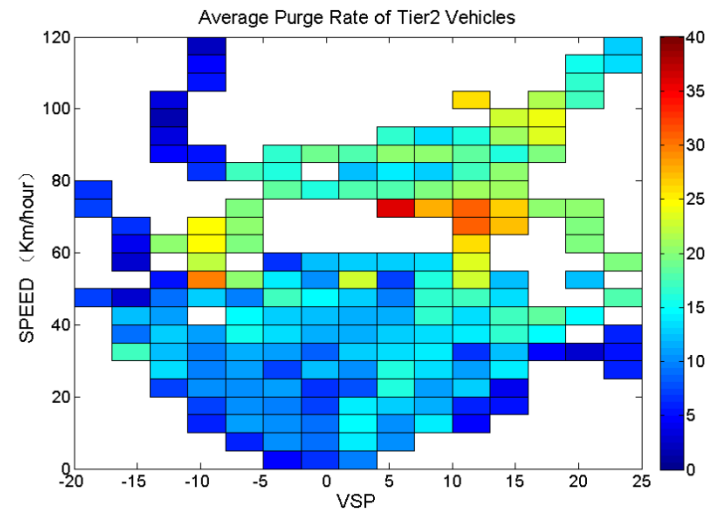
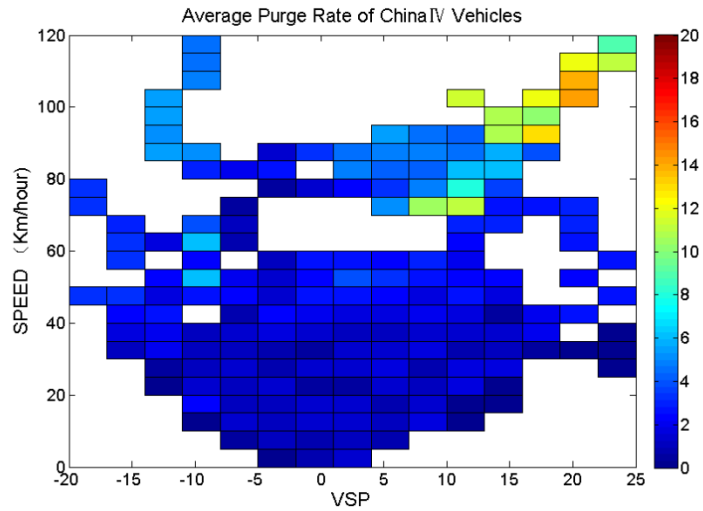
Characteristic, emission process, species profile.....

# Emission factors, control efficiency and the ratio between China IV and Tier2 vehicles





# Purge properties of canisters

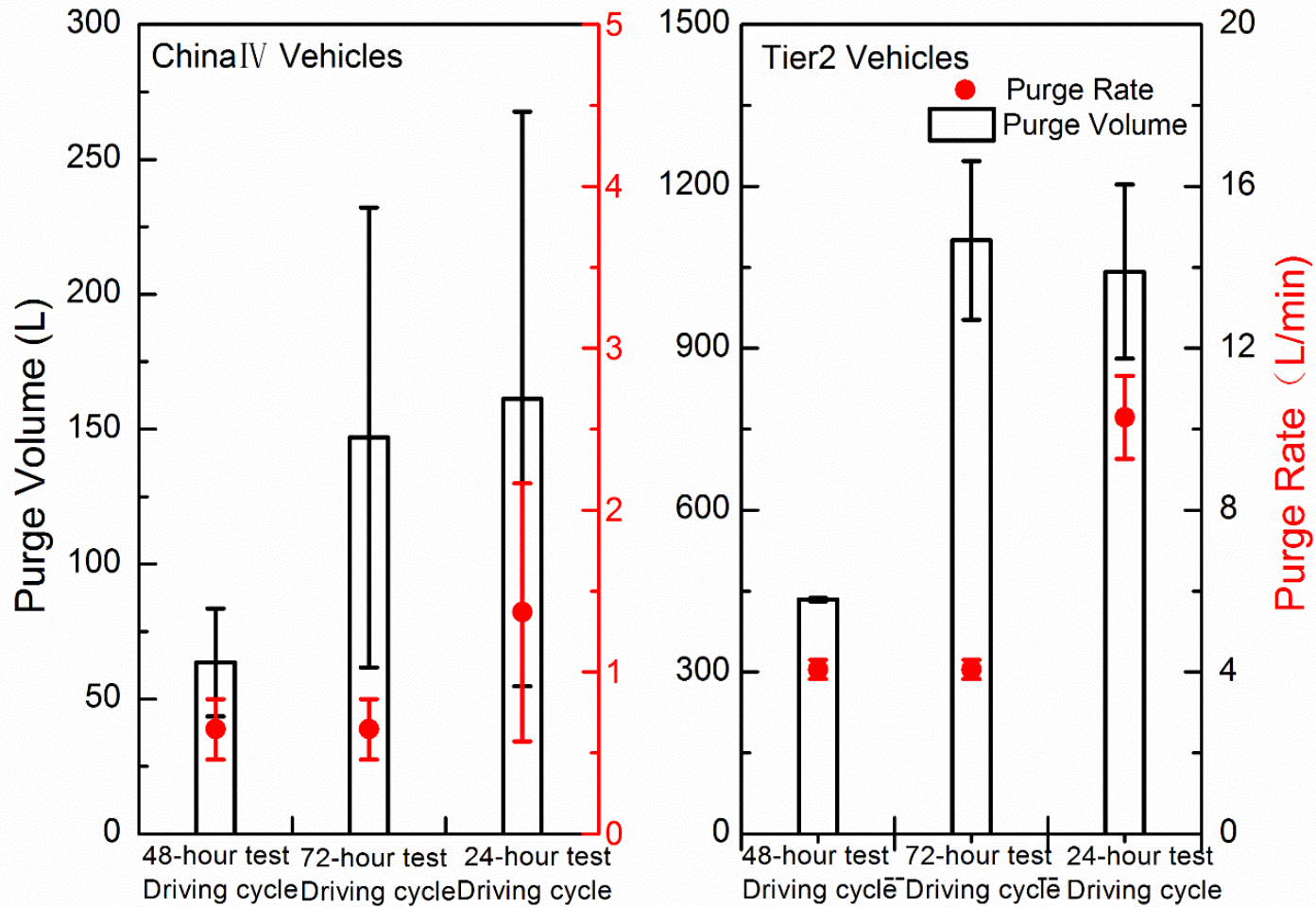


China IV vehicles

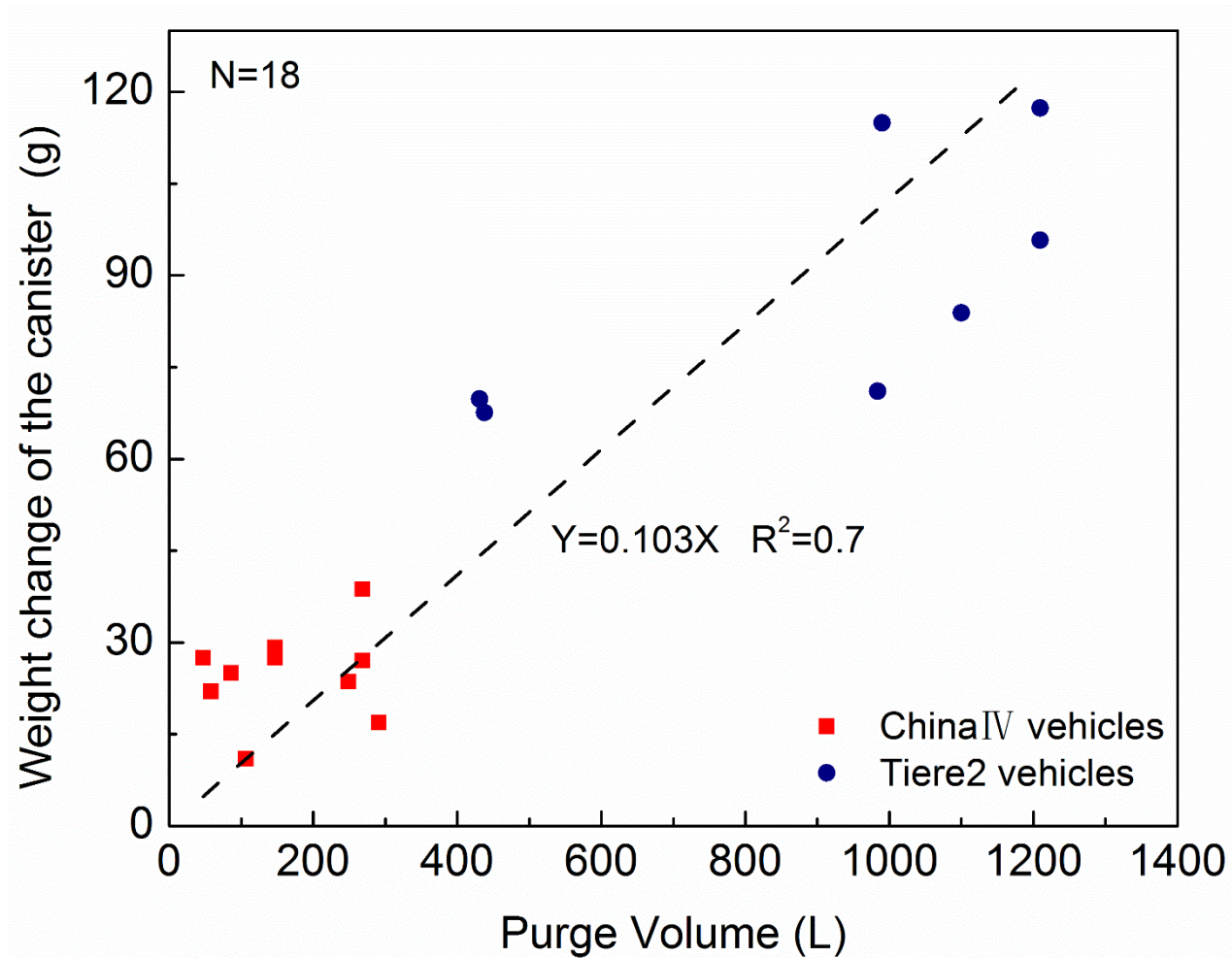
Tier2 vehicles

Note: Define purge rate larger than 3L/min as efficient

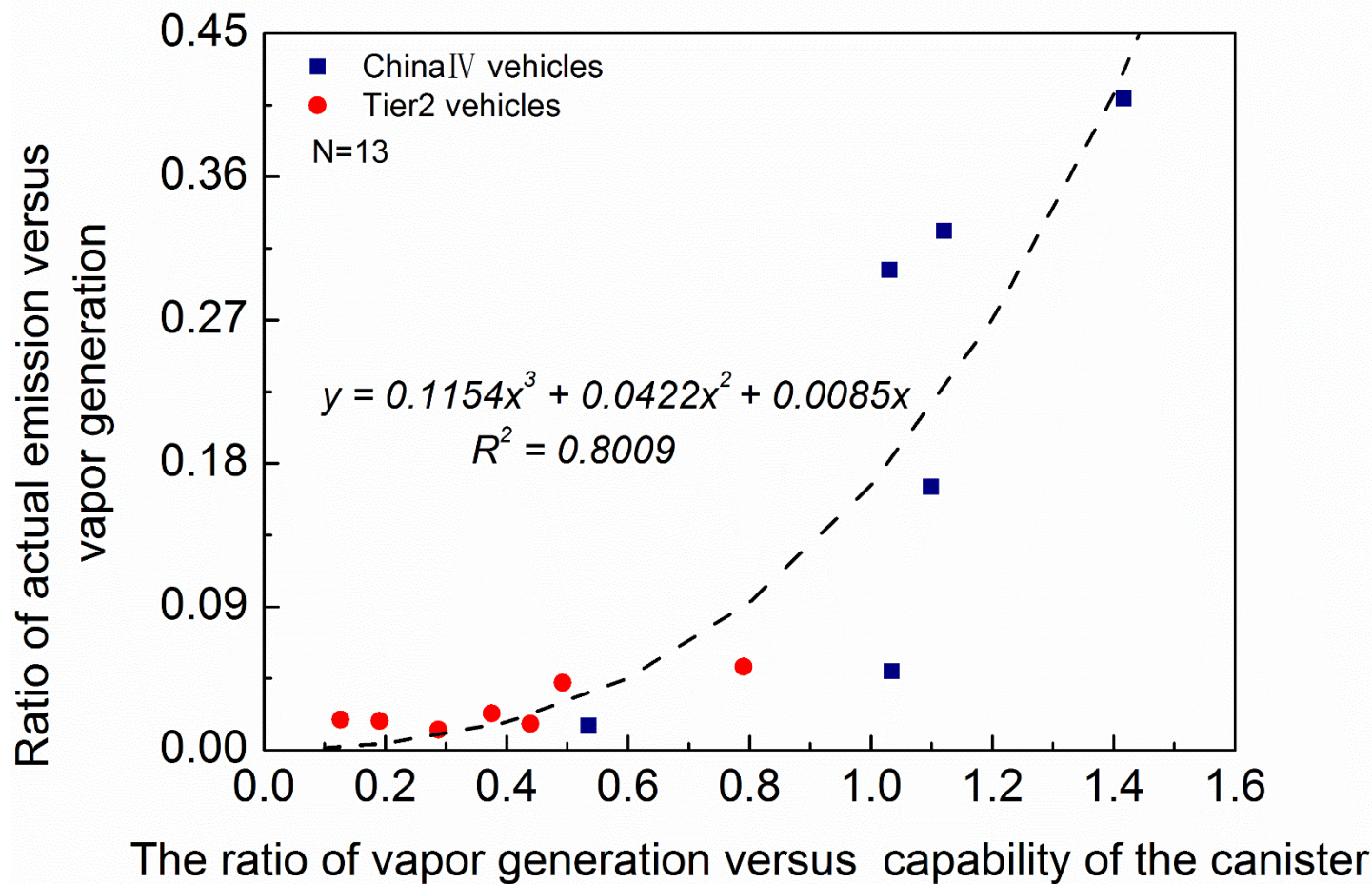
# Purge volume and purge rate during preconditioning driving cycles



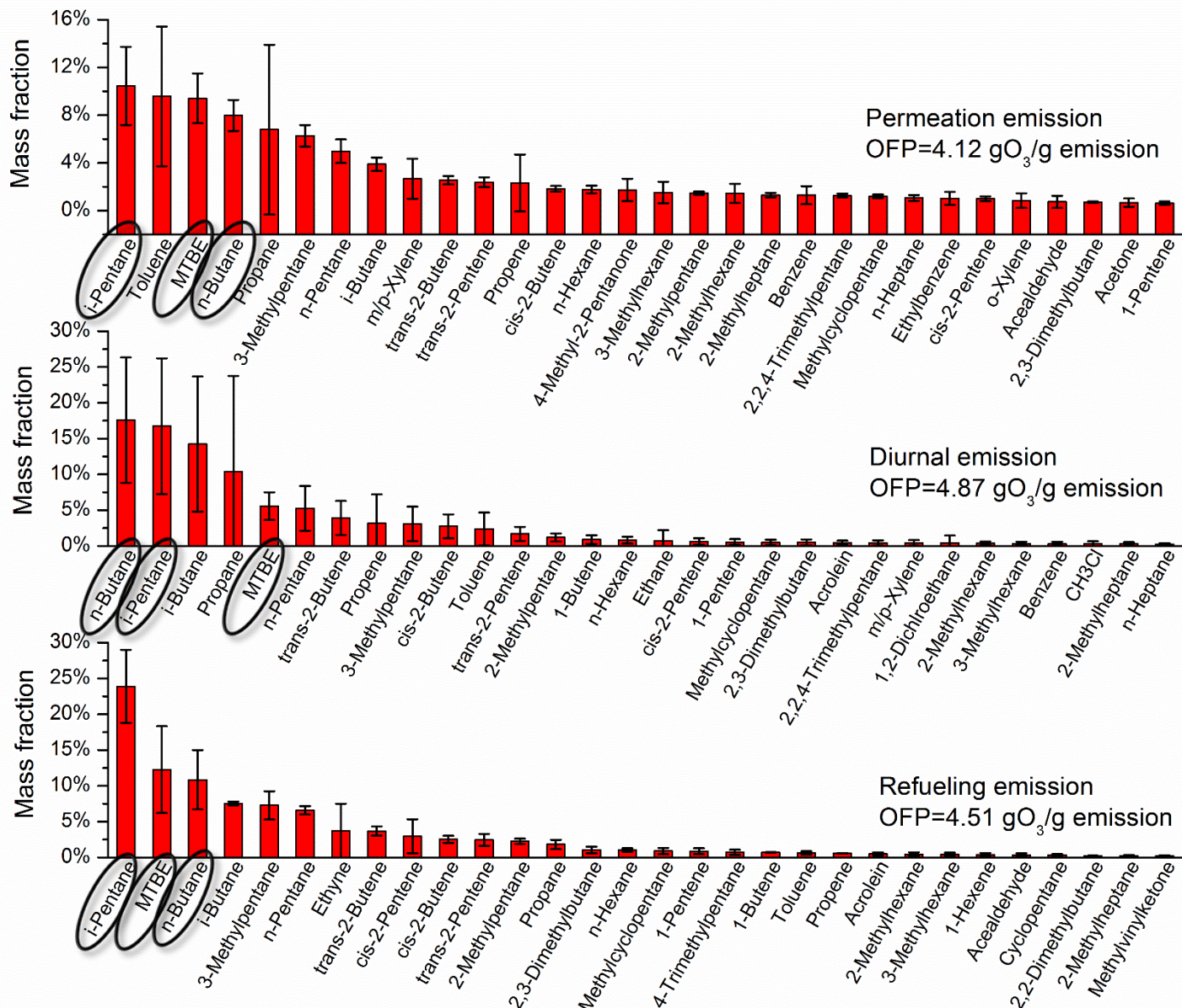
# The relationship between purge volume and the weight change of the canister



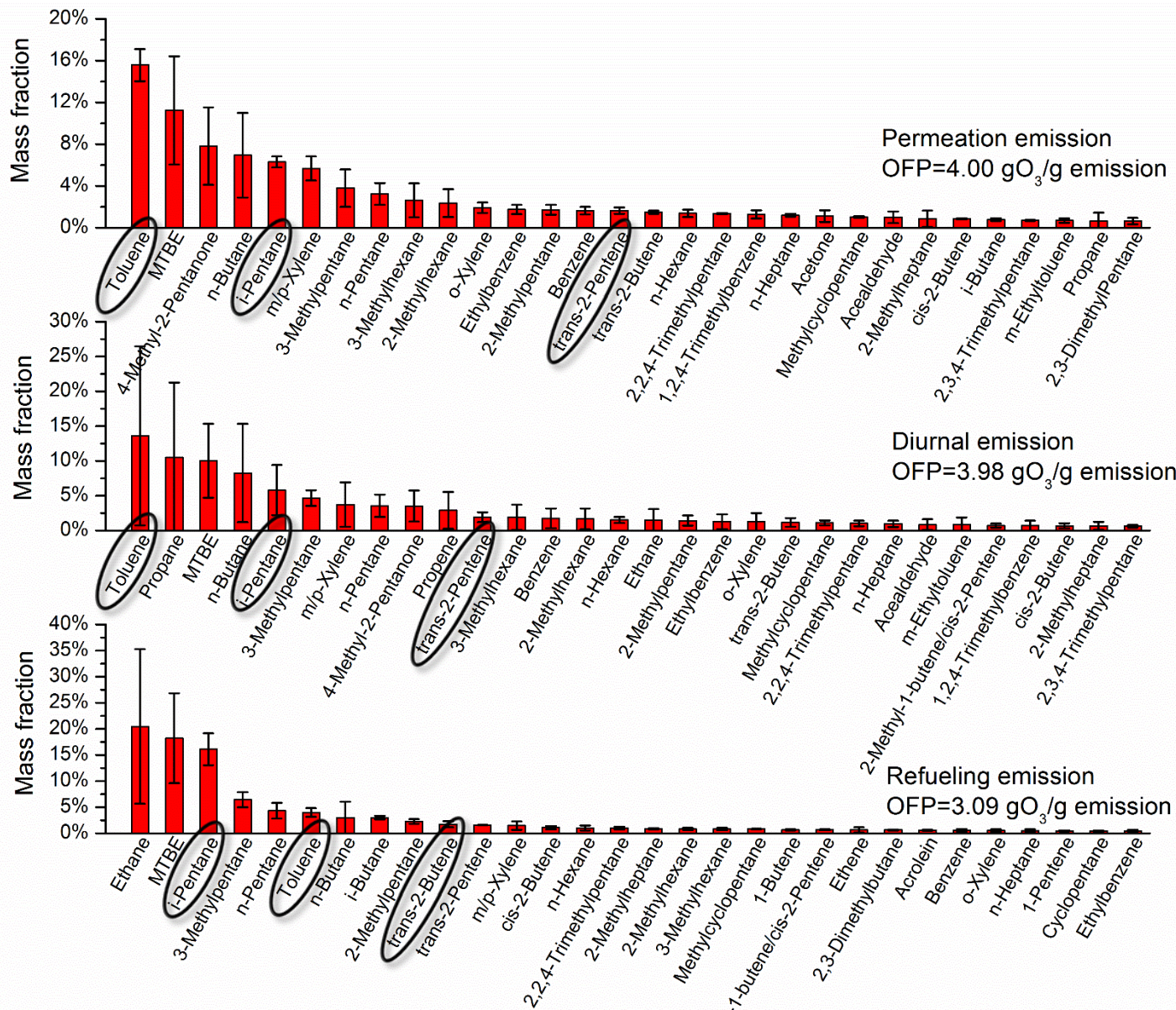
# The relationship between vapor emission, vapor generation and canister capacity



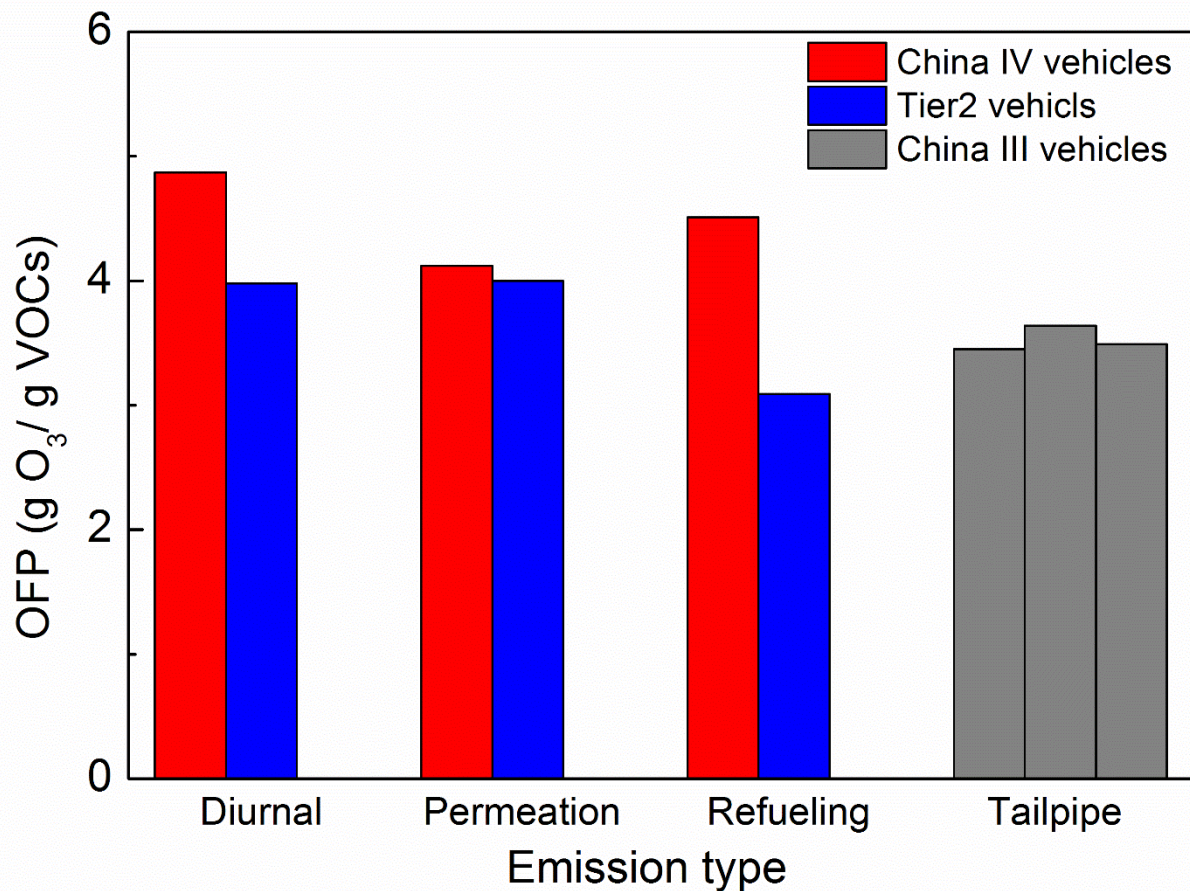
# VOCs profiles of China IV vehicular evaporative emissions



# VOCs profiles of Tier2 vehicular evaporative emissions

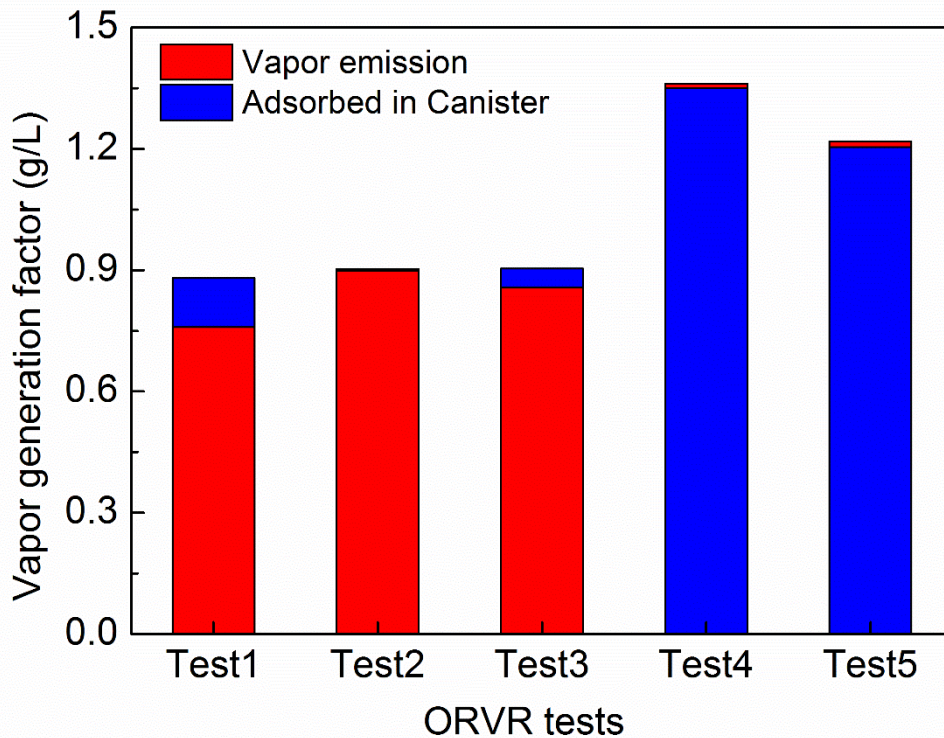


# Comparison of OFP between evaporative emissions and tailpipe emissions



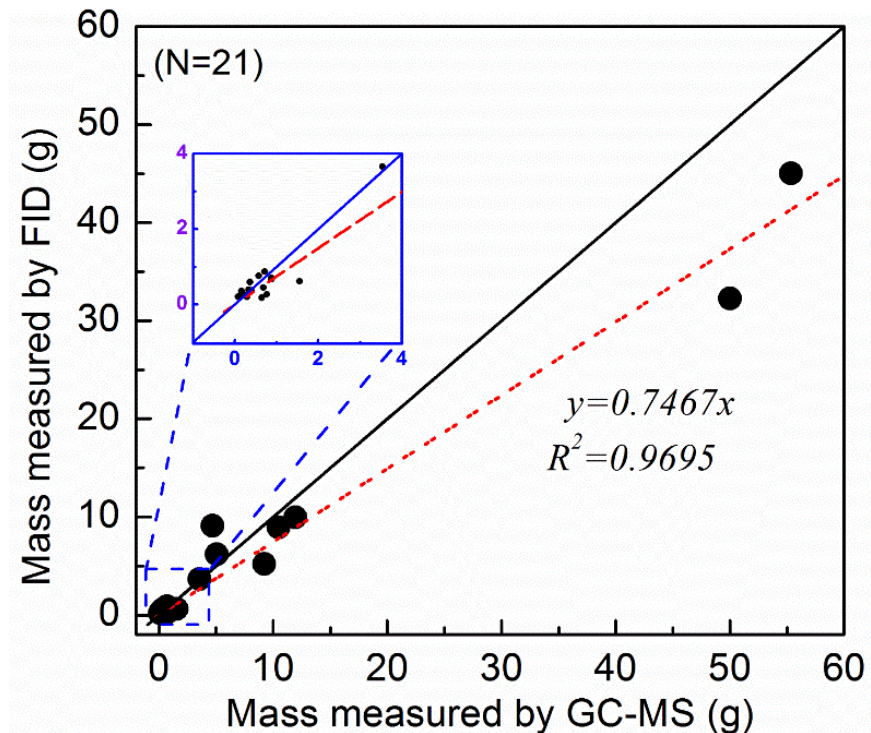
# An interesting results in ORVR tests

## Comparison of vapor generation for two type vehicles during ORVR tests



( Test1-3 is China IV vehicles Test4-5 is Tier2 vehicles )

## Relationship between emissions measured by GC-MS and FID





# Take home message

- The emission factors of China IV vehicles are **2-70 times higher** than those of Tier2 vehicles for reasons of **little capacity** of canister and **bad purge** performance.
- The Euro standards could **only** force vehicles **purge under high speed** (above 60 km/hour) and **high VSP**, which cannot meet the needs of urban driving conditions, while US standard is beneficial for vehicles to purge under almost all conditions.
- Although the amount of emission evaporations was comparable to that of tailpipe emissions for China and US vehicles under Chinese fuel condition, vehicles evaporative emissions control is essential because of its **higher OFP**.

Thanks!  
Your comment is highly appreciated.

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