

# Sulphur Diagnostics Needs and Challenges

Partners:

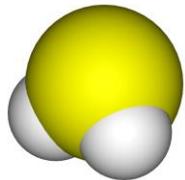


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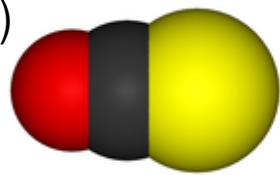
[www.briskeu.com](http://www.briskeu.com)

# Expected sulphur compounds in raw gases

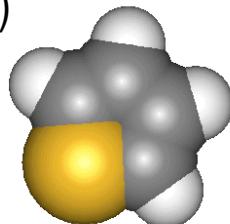
Hydrogen sulphide  
(H<sub>2</sub>S)



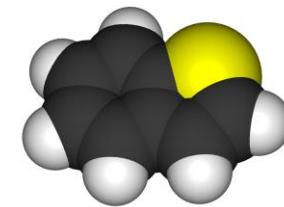
Carbonyl Sulphide  
(COS)



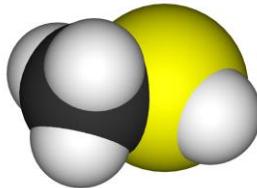
Thiophene [T]  
(C<sub>4</sub>H<sub>4</sub>S)



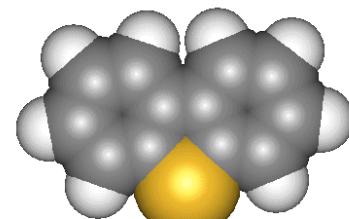
Benzothiophene  
[BT] (C<sub>8</sub>H<sub>6</sub>S)



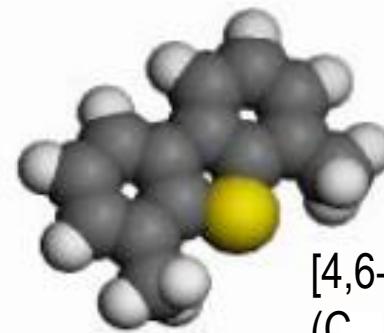
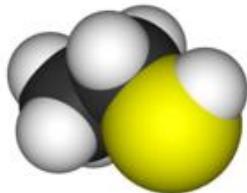
Methanethiol  
(CH<sub>4</sub>S)



Dibenzothiophene [DBT]  
(C<sub>12</sub>H<sub>8</sub>S)



Ethanethiol  
(C<sub>2</sub>H<sub>6</sub>S)



[4,6-DMDBT]  
(C<sub>14</sub>H<sub>12</sub>S)

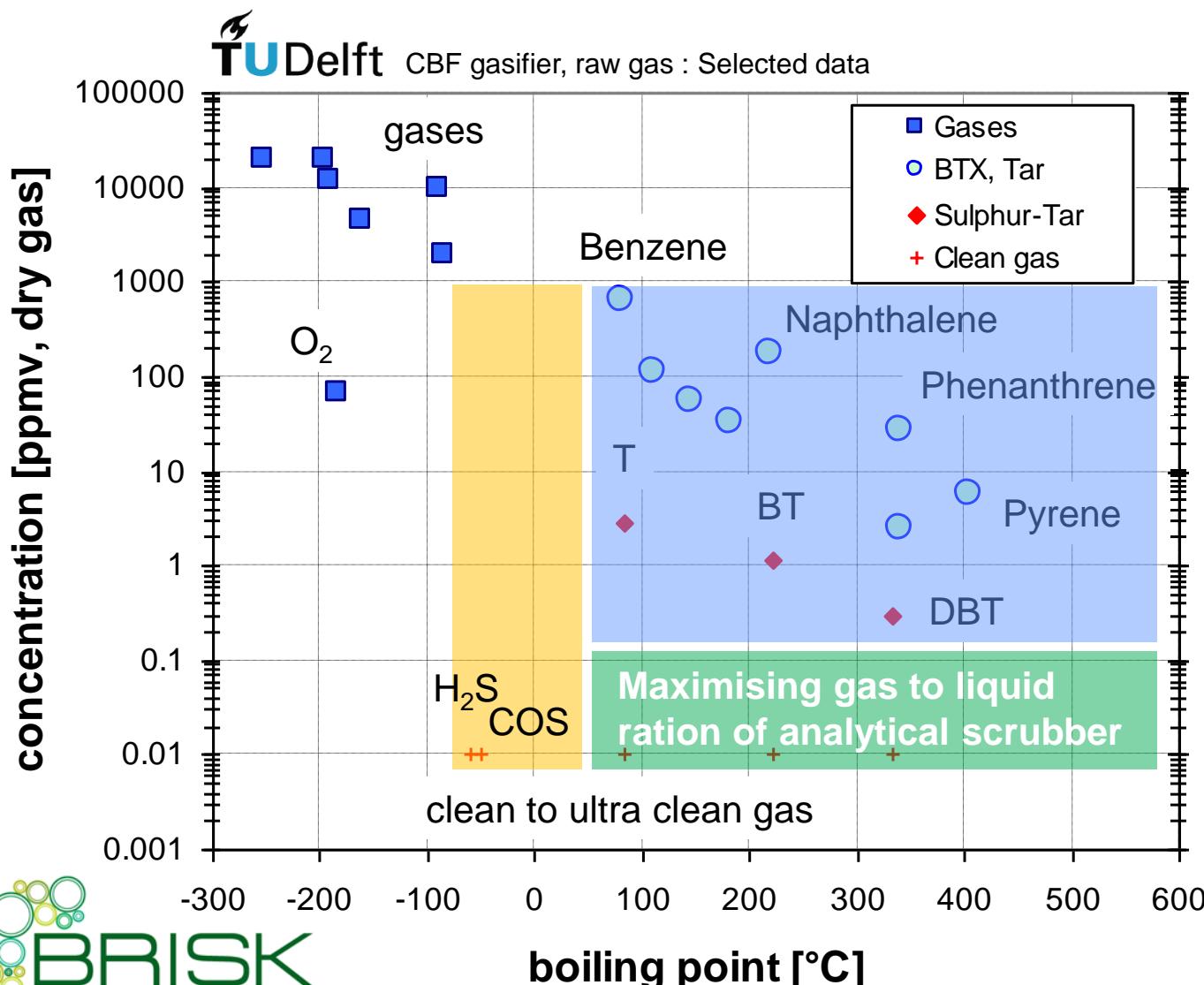
PASH: Polycyclic Aromatic Sulphur Heterocycle = sulphur PAH

VSC: Volatile Sulphur Compounds = sulphur VOC



# Tar - & sulphur sampling protocol

Common basis for PAH & PASH

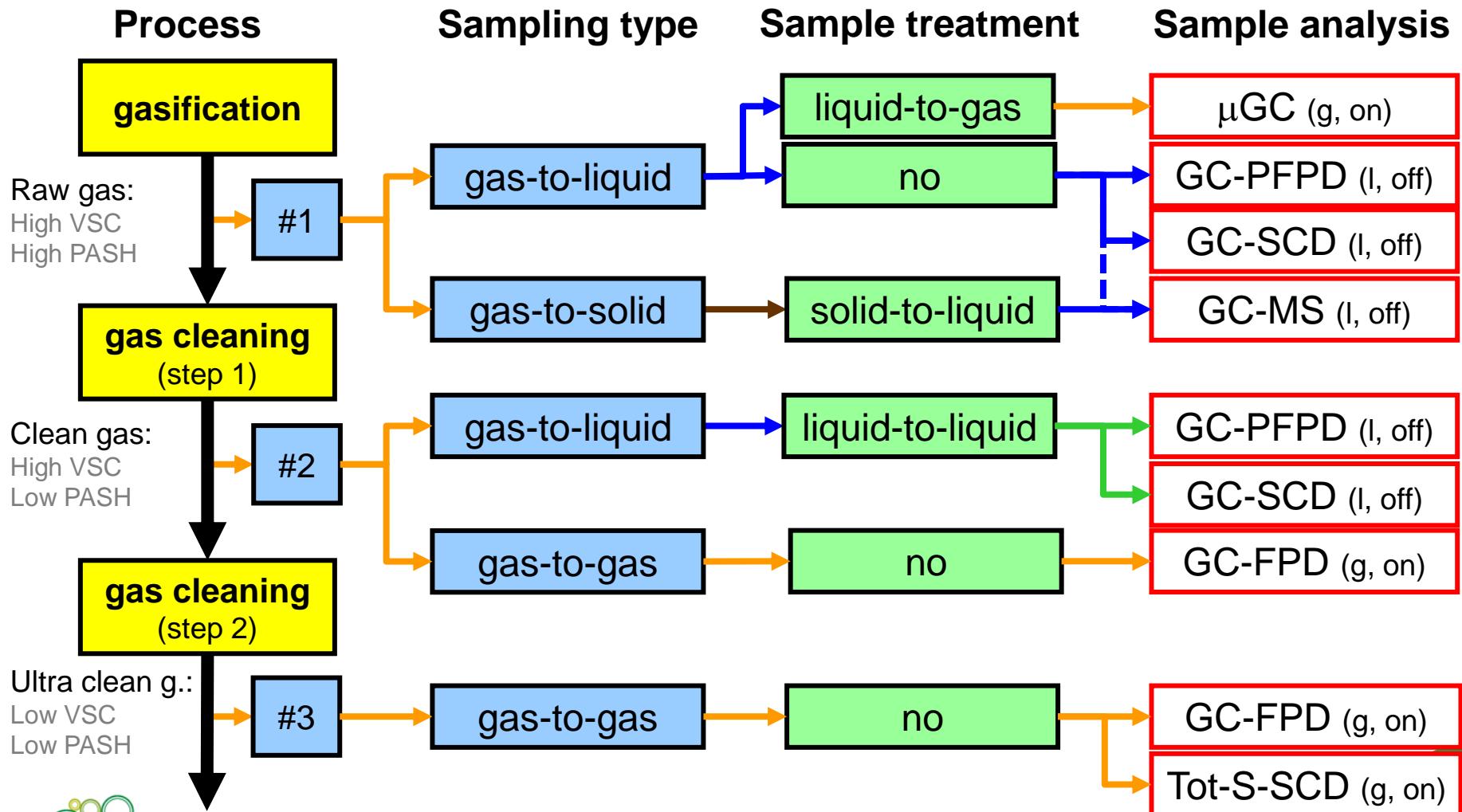


**Sampling protocols:**

- ~ tar protocol (light blue box)
- ~ tar protocol (medium blue box)
- tar protocol not applicable (orange box)



# Recommendations for sampling and analyses



# Comparison of sampling systems

## Gas, liquid & solid phase



Operation of CFB  
gasifier and hot gas  
filter (800°C)

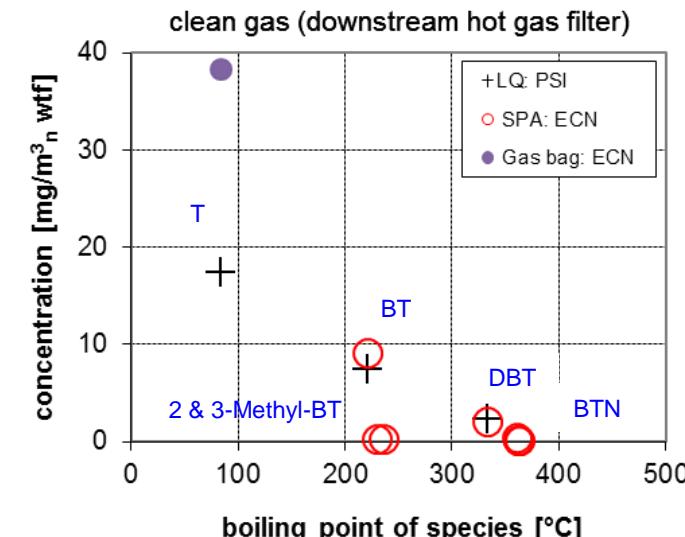
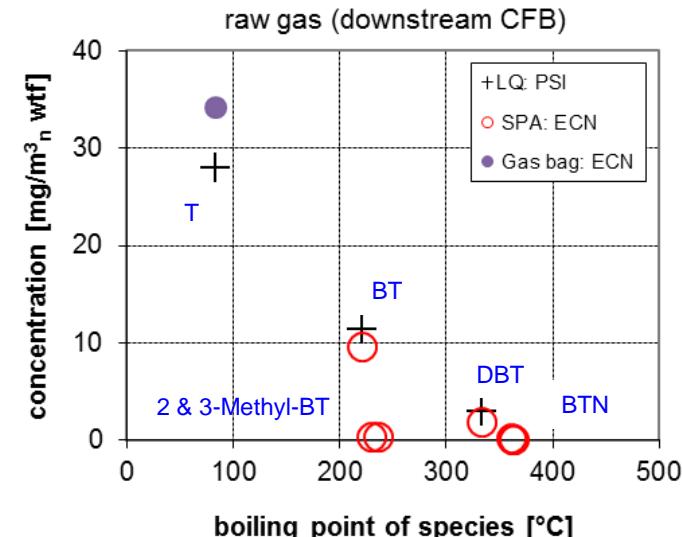
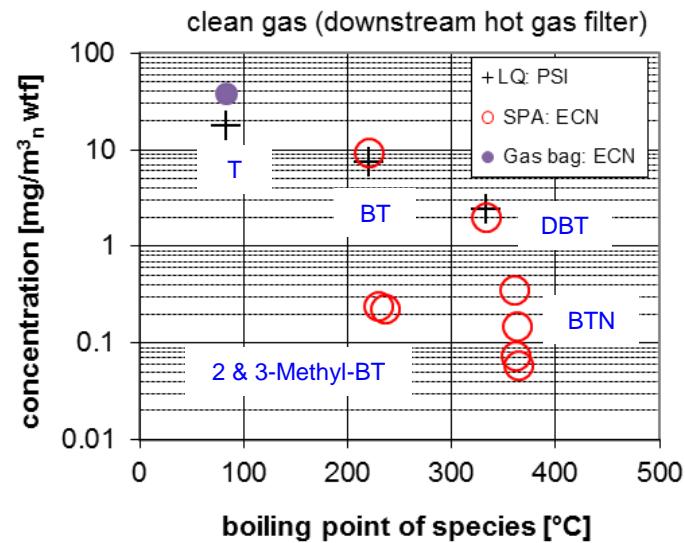
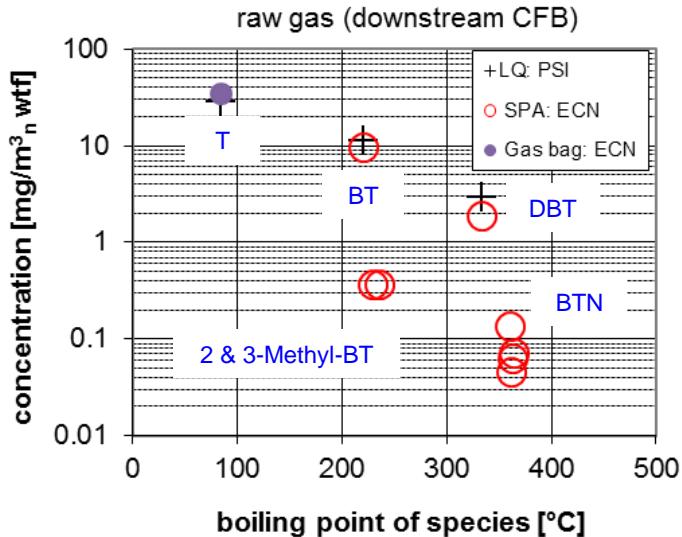


LQ + GC/SCD



Gas bag + GC-FPD  
SPA + GC/MS

Benzonaphtho-thiophene: BNT



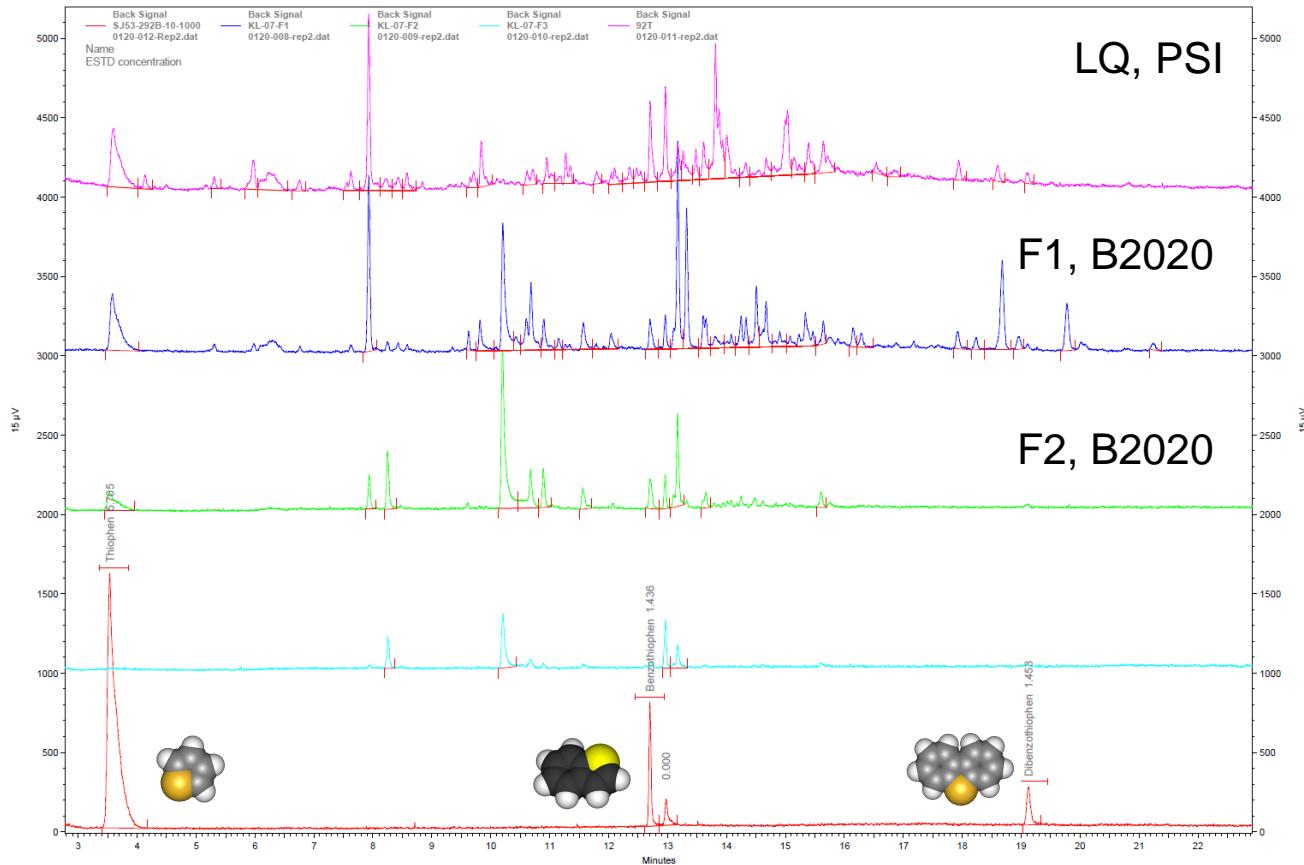
# Liquid phase analysis: Sampling system

## Influence of design and operation

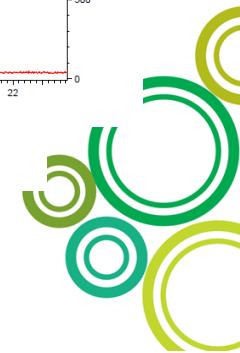
gas-to-liquid



## GC/SCD liquid phase analysis, isopropanol



Reference standard sample: T: 4.29 ng/ml, BT: 1.5 ng/ml, DBT: 1.56 ng/ml



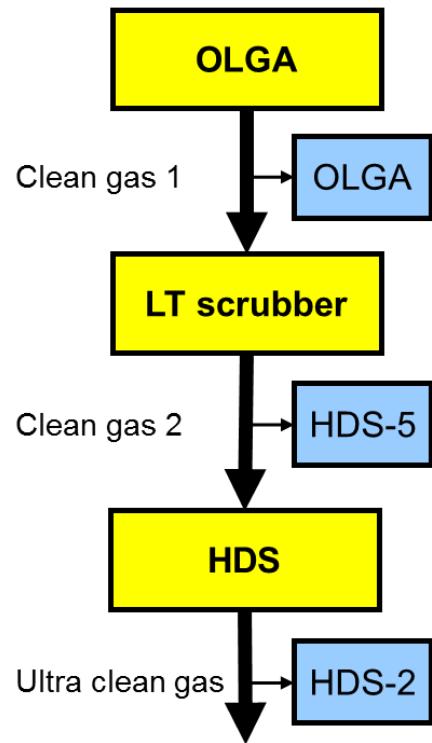
# Liquid phase analysis: Lab-round robin test

GC/MS, GC/FID, GC/PFPD, GC/SCD

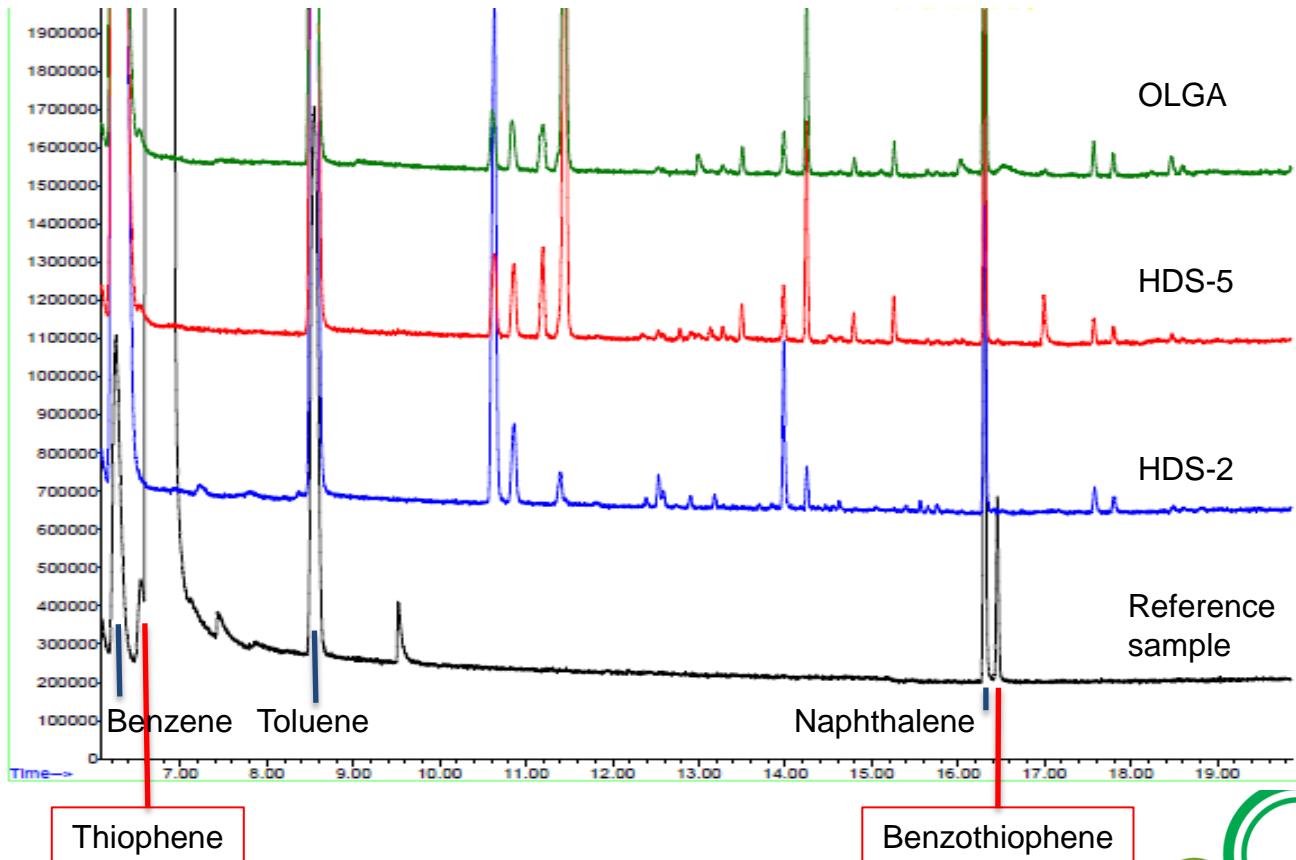
GC-MS (I)



## Gas Cleaning Process



GC/MS liquid phase analysis, isopropanol



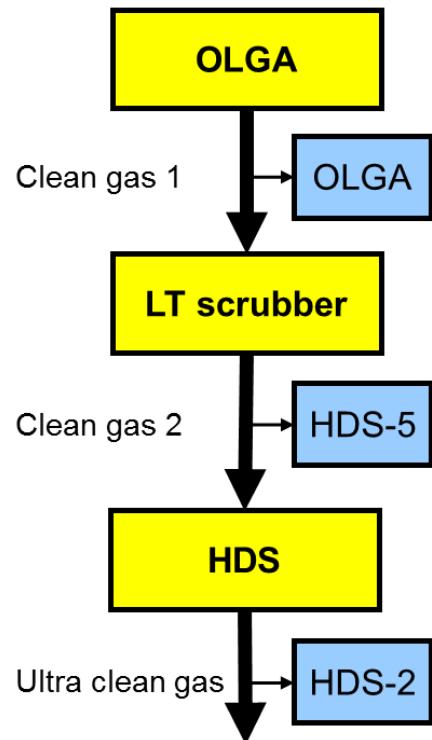
# Liquid phase analysis: Lab-round robin test

## GC/MS, GC/FID, GC/PFPD, GC/SCD

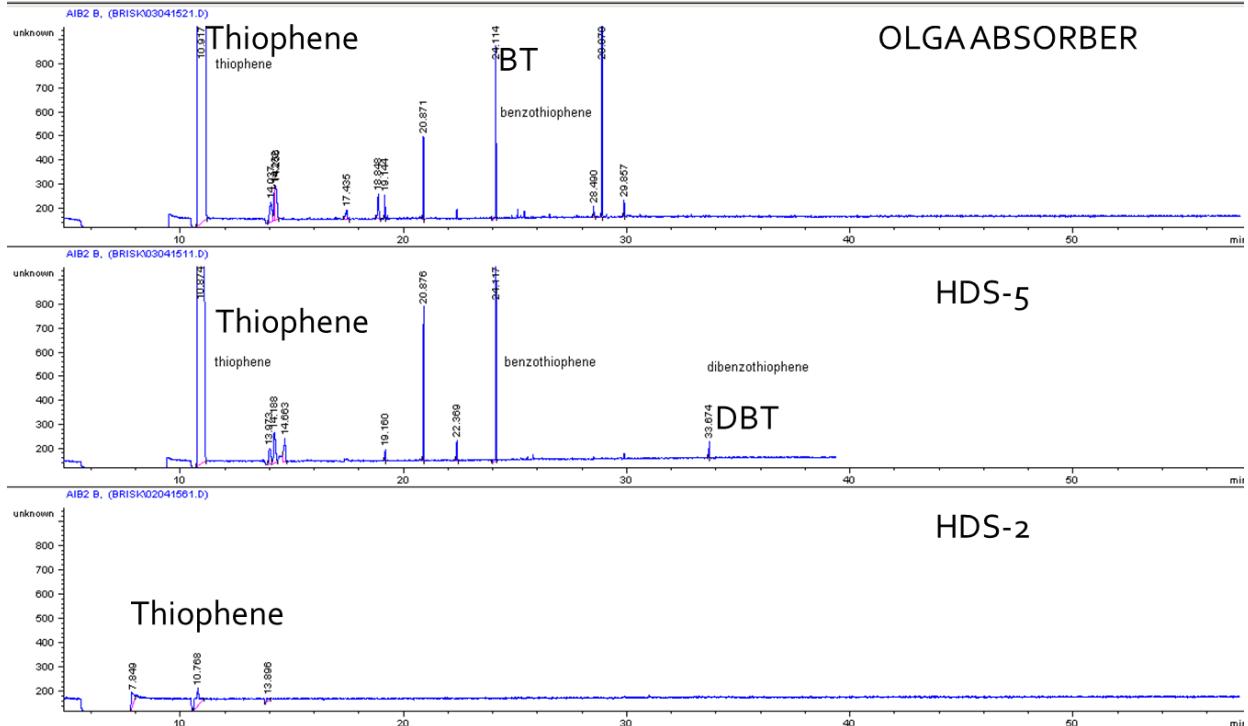
GC-PFPD (I)



### Gas Cleaning Process



GC/PFPD liquid phase analysis, isopropanol



# Summary

- Robust sulphur diagnostics (SD) is critical for the assessment of many catalytic processes
- SD is expensive for R&D and P&D activities
- Progress have been made for improved SD
- There is a need for a “sulphur protocol”.

