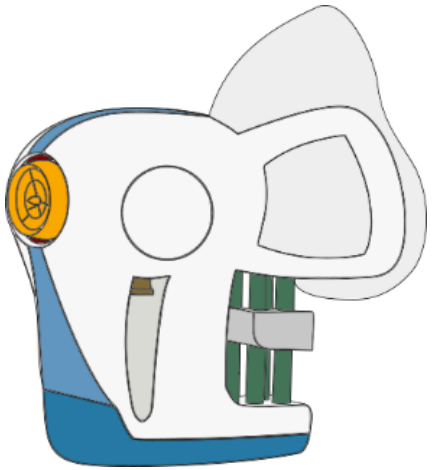
Effects of high relative humidity and dry purging on VOCs obtained during breath sampling on common sorbent tubes

Maxim Wilkinson, Iain R. White, Royston Goodacre, Tamara Nijsen, Stephen J. Fowler

Introduction

- Shorter pathway between mouth and sorbent tube
- Less condensation, potentially improved reproducibility but higher humidity during loading
- We aimed to determine:
  - If loading VOCs in wet gas affected their recovery
  - How much water was loaded onto sorbent tubes during sampling
  - What dry purge times were required to remove the water
  - How three sorbents compared when used to sample breath



Study design

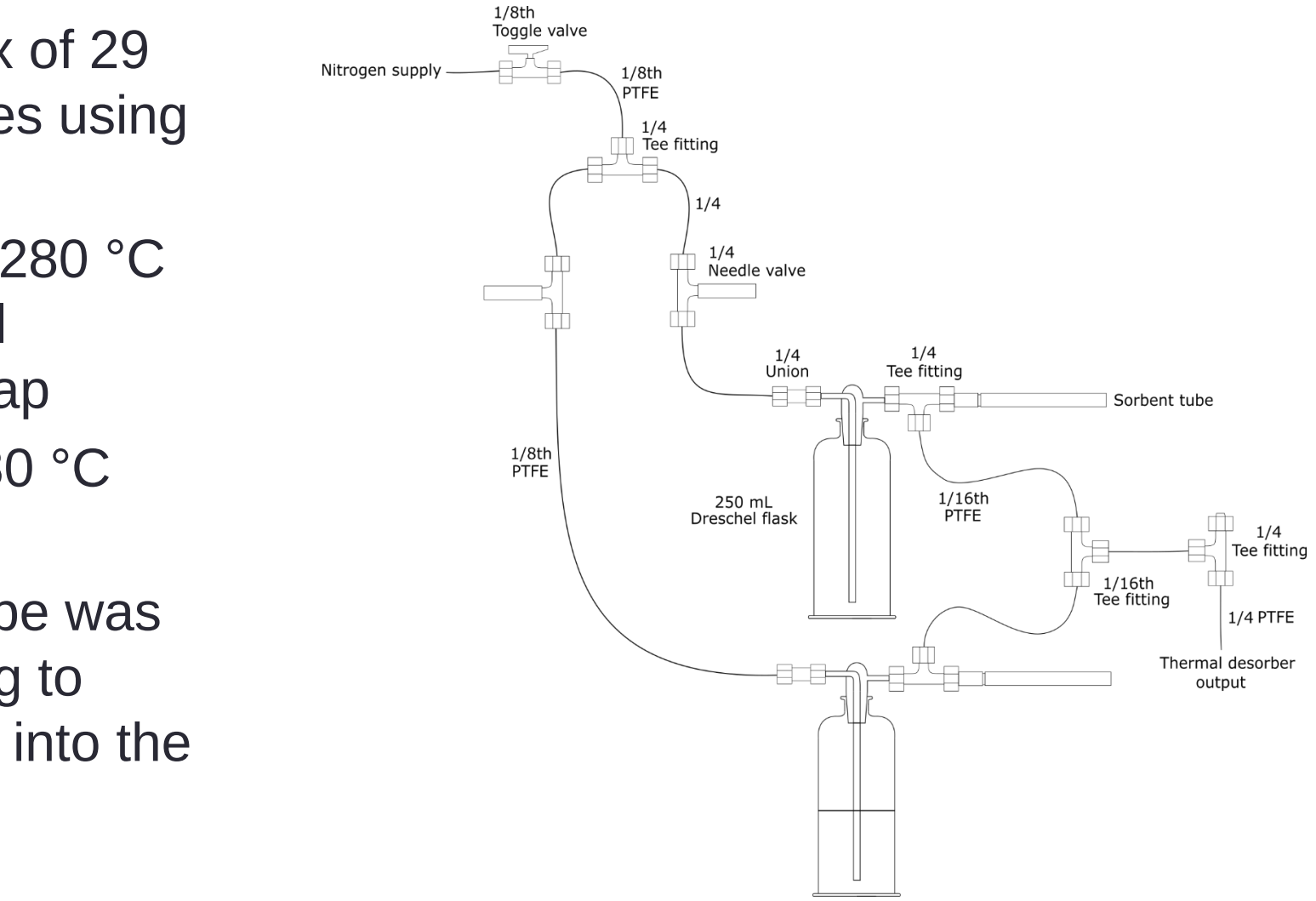
- Selected three sorbents to compare

- Based on commonly used mixes in the literature

Sorbent material	Type of tube	Volatility range	Hydrophobicity
TenaxTA/5TD	Dual Bed	C5 – C20	Most hydrophilic
TenaxTA/1TD	Dual Bed	C6 – C20	↕
TenaxGR	Single Bed	C6 – C20	Least hydrophilic

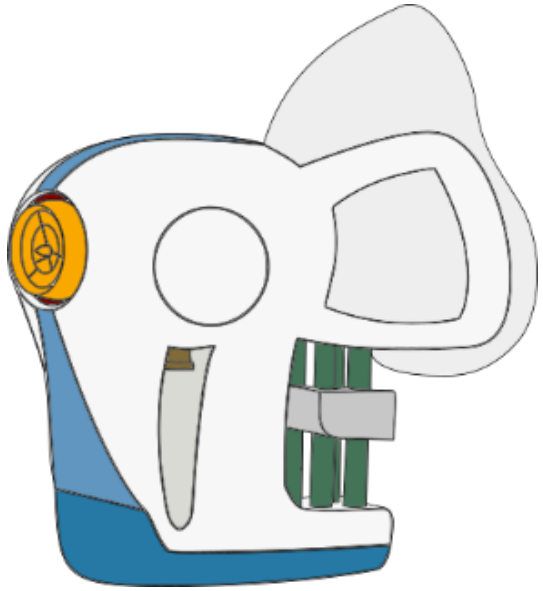
Methods – Loading in humid gas

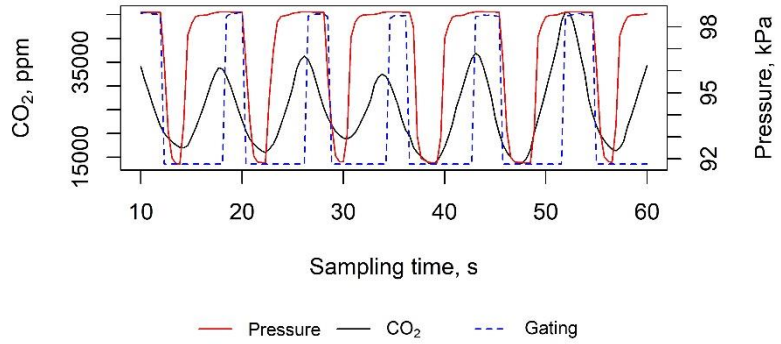
- Loaded a standards mix of 29 VOCs onto sorbent tubes using a CSLR
- Desorbed each tube at 280 °C for 5 min onto a general purpose hydrophobic trap
- Desorbed the trap at 280 °C with the split on
- The split recollection tube was replaced with ptfe tubing to allow the VOCs to pass into the sampling rig



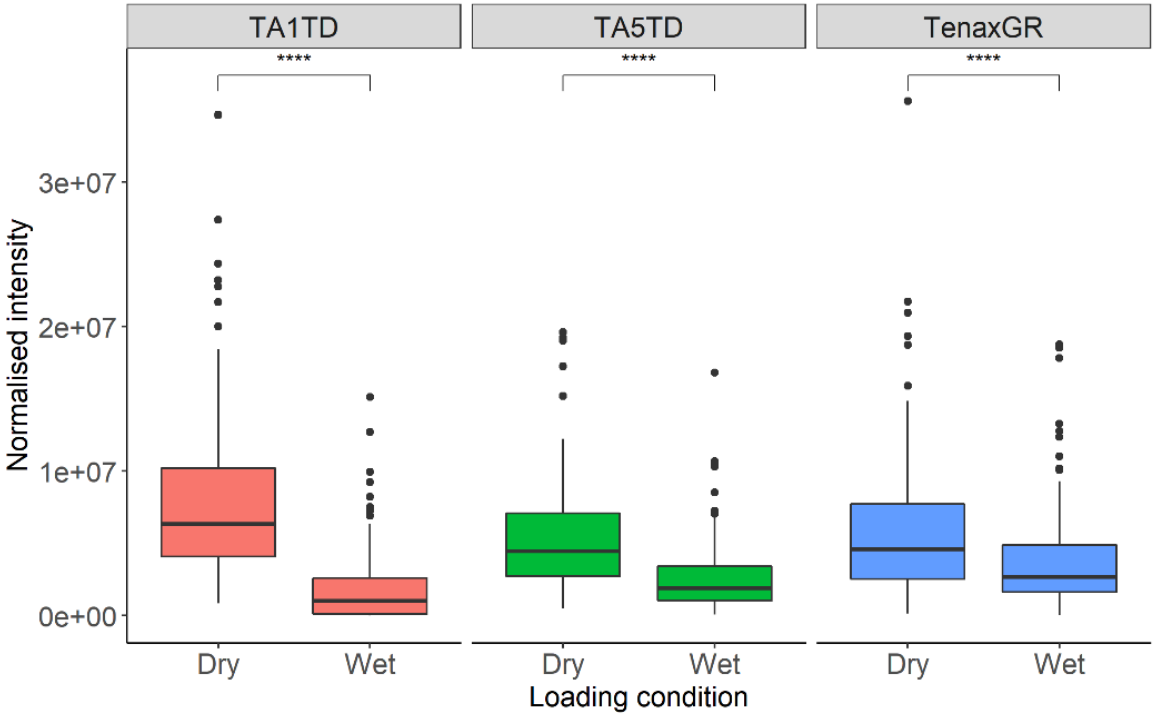
Methods – loading breath samples

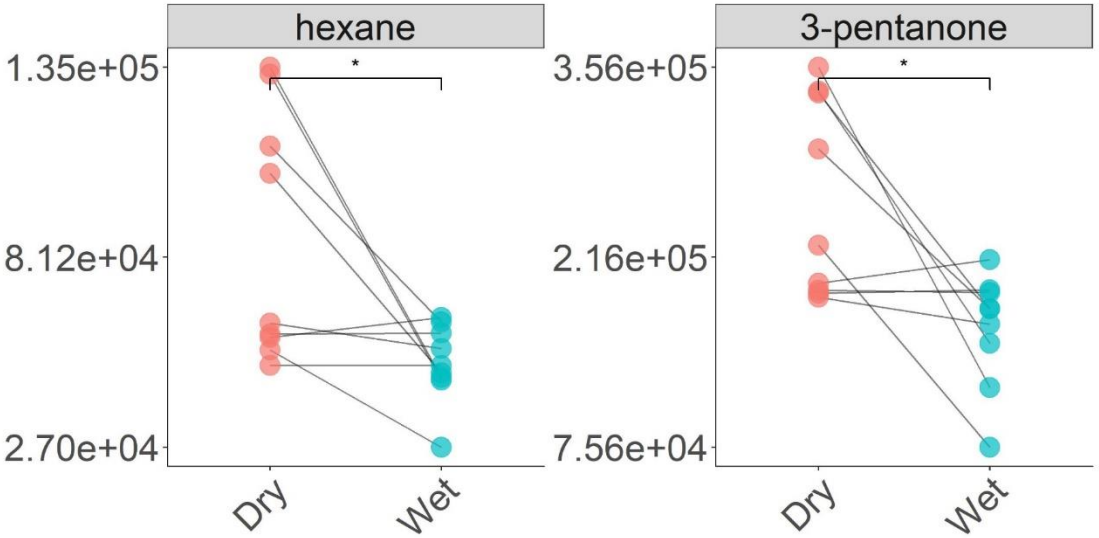
- Breath was collected using the ReCIVA
- End tidal collection at 200 mL/min
- Six individual collections were made with all four ports filled each time
- At least one tube of each sorbent material was included for each exhalation
- Two sampling volumes were used, 500 and 1000 mL
- Tubes were weighed before and after sampling to assess the amount of water loaded



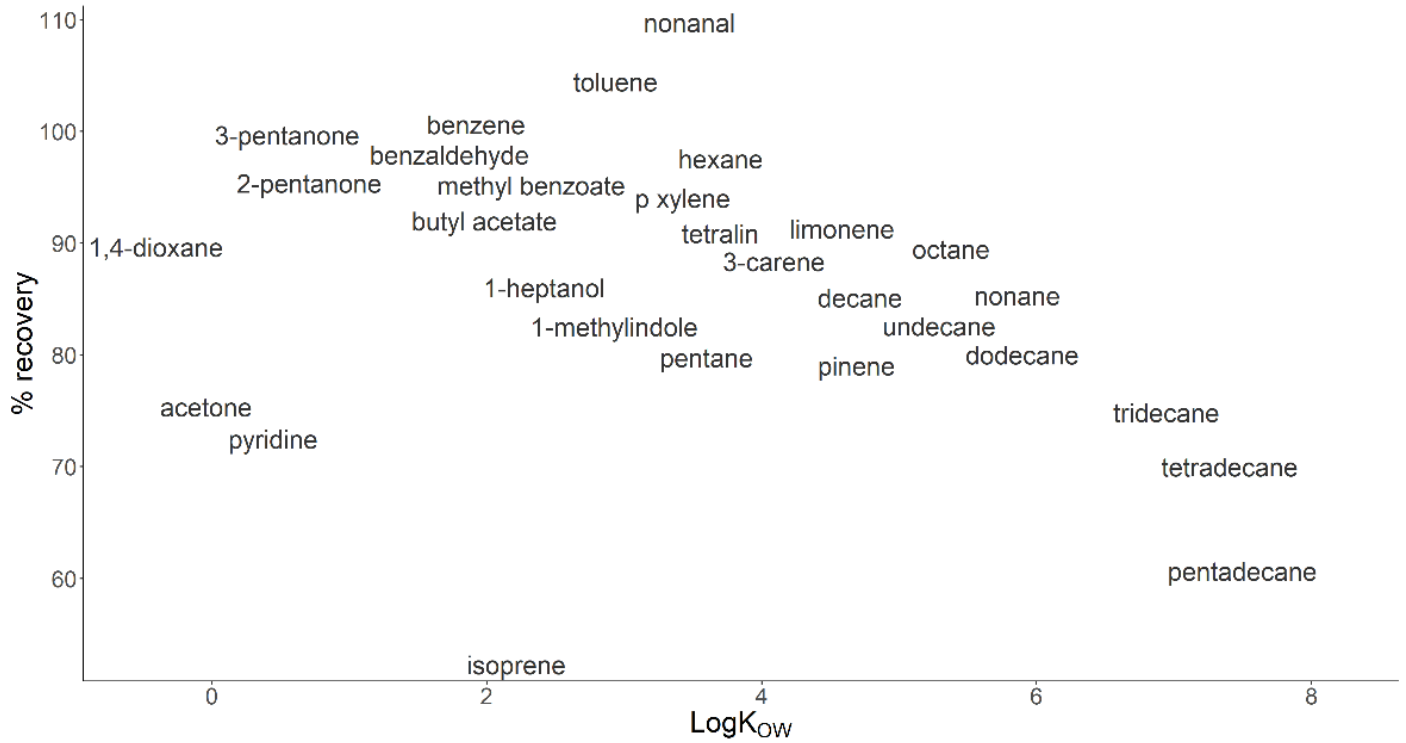


Loading VOCs in humid gas





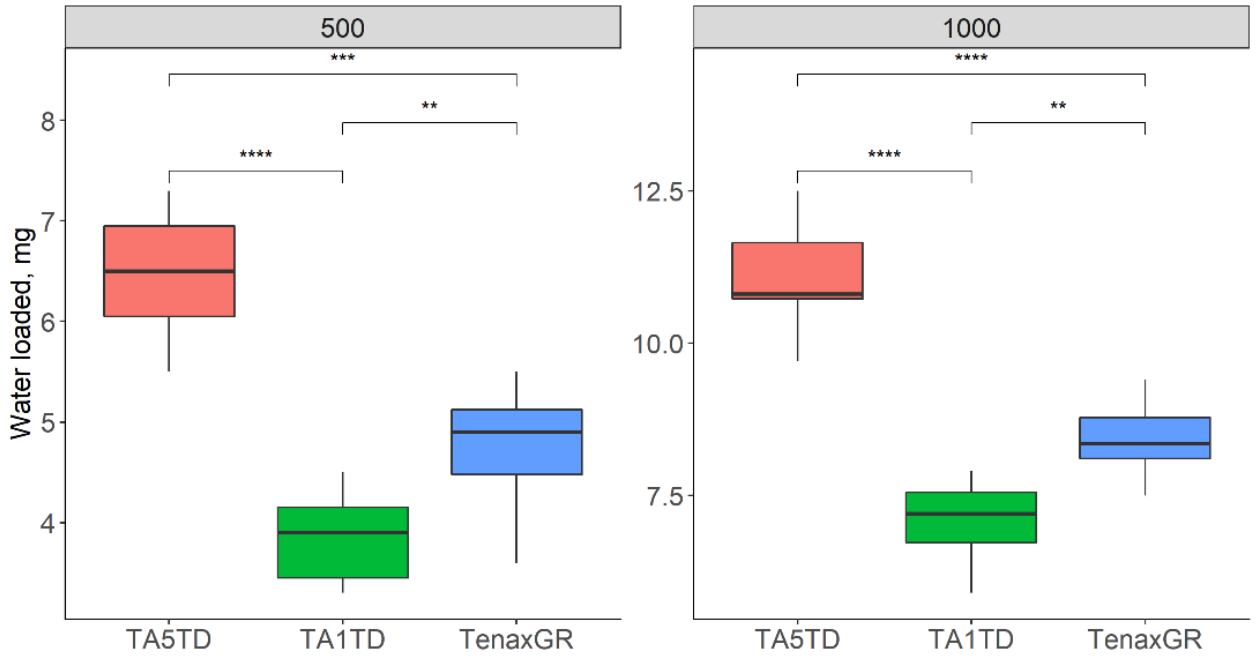
Chemical properties and compound recovery



- Compared the recovery of each VOC in the standards mix in the dry and wet gas samples

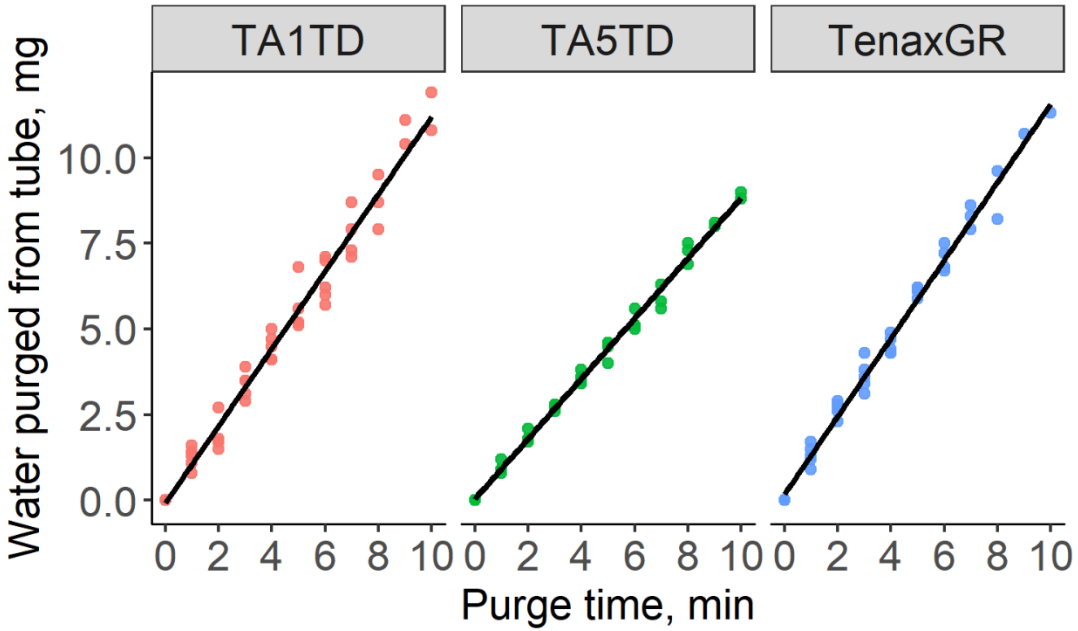
Water loaded during breath sampling

- As expected the most water was retained on the strongest sorbent
- TA1TD retained less water than expected

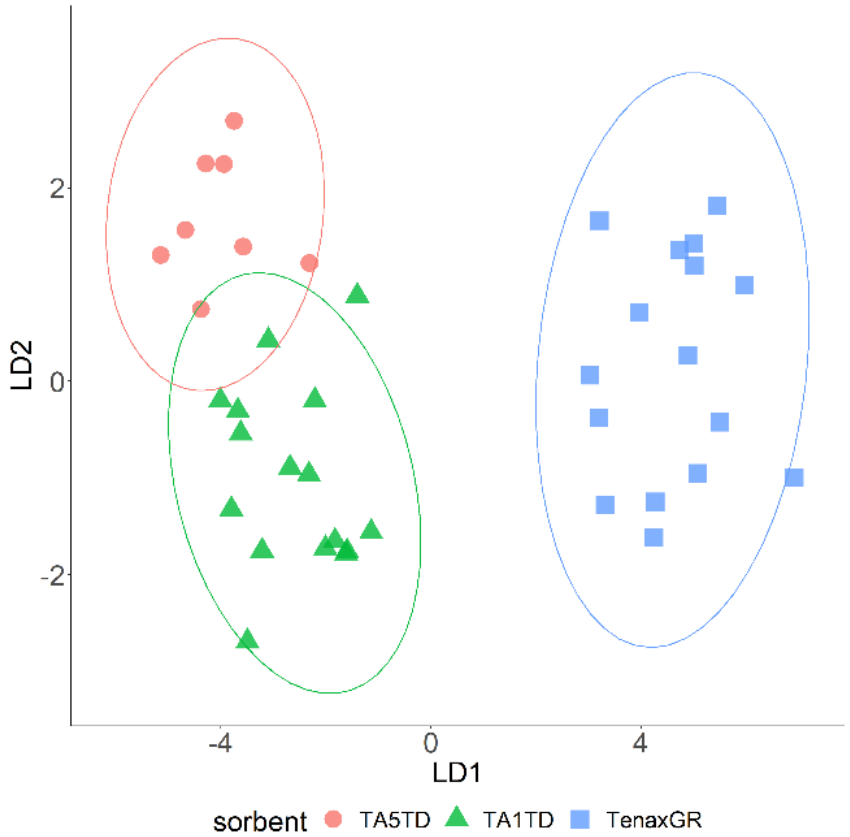


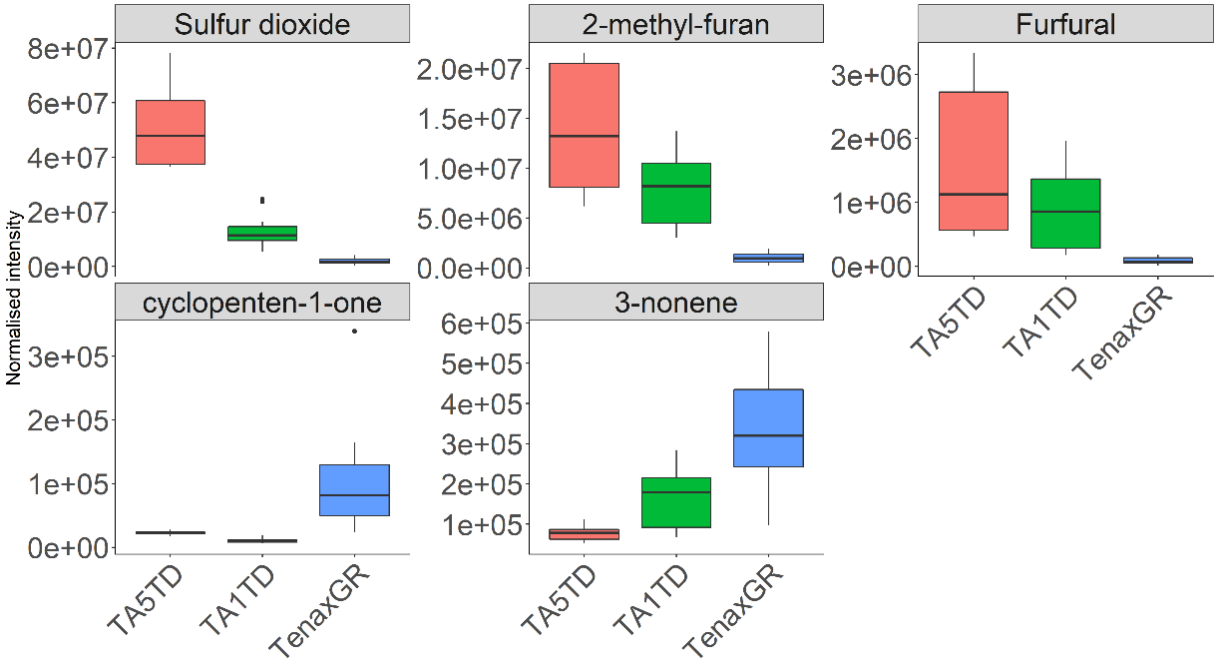
Water purging

- 50 mL/min N_2 used to flush the water from the tubes
- Purged in the same direction as sampling to reduce potential breakthrough
- Rate of water loss was the same for TA1TD and TenaxGR but was slower for TA5TD



Differences between the sorbents





Choosing a sorbent

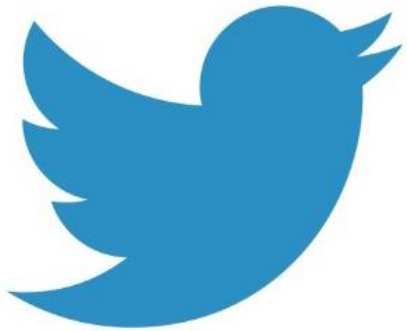
- Only limited differences were observed between the three sorbents
- TA5TD tubes are able to trap a wider range of compounds than either TA1TD or TenaxGR.
- TA1TD and TenaxGR retained significantly less water, therefore requiring less dry purging and potentially offering greater pre-purge storage stability.
- Friability of the sorbent should be considered if sampling occurs at distant locations

Conclusions

- High relative humidity effects the recovery of VOCs on sorbent materials
- The impact is largest on less water soluble compounds
- All sorbent materials were equally affected by the humidity
- Dry purging of samples is required to ensure accurate and sensitive GC-MS
- Few differences were observed between the sorbents when breath sampling was performed and the distinguishing compounds were mainly background artefacts

Keep up to date

- http://mancbreathgroup.net/
- Twitter bot that automatically posts recent publications
- @Breath_VOCs



Breathomics in Manchester

- Asthma
- COPD
- TB in Tanzania
- Pneumonia on the ICU
- Circadian rhythms in disease
- *In vitro* bacterial headspace sampling

MANCHESTER 1824

Breathomics Group