

## Natural insulation fibres for the absorption of indoor volatile organic compounds

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# Natural insulation fibres for the absorption of indoor volatile organic compounds

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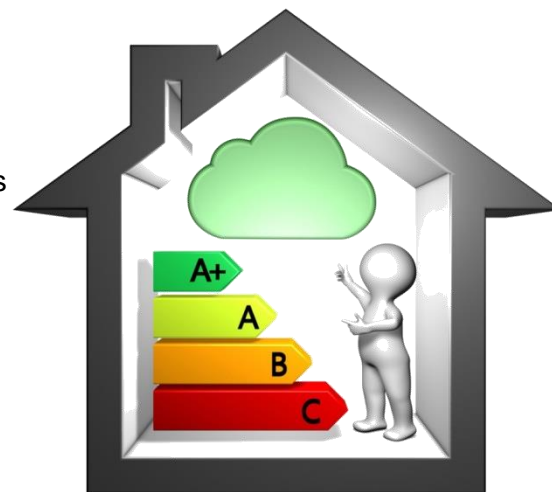
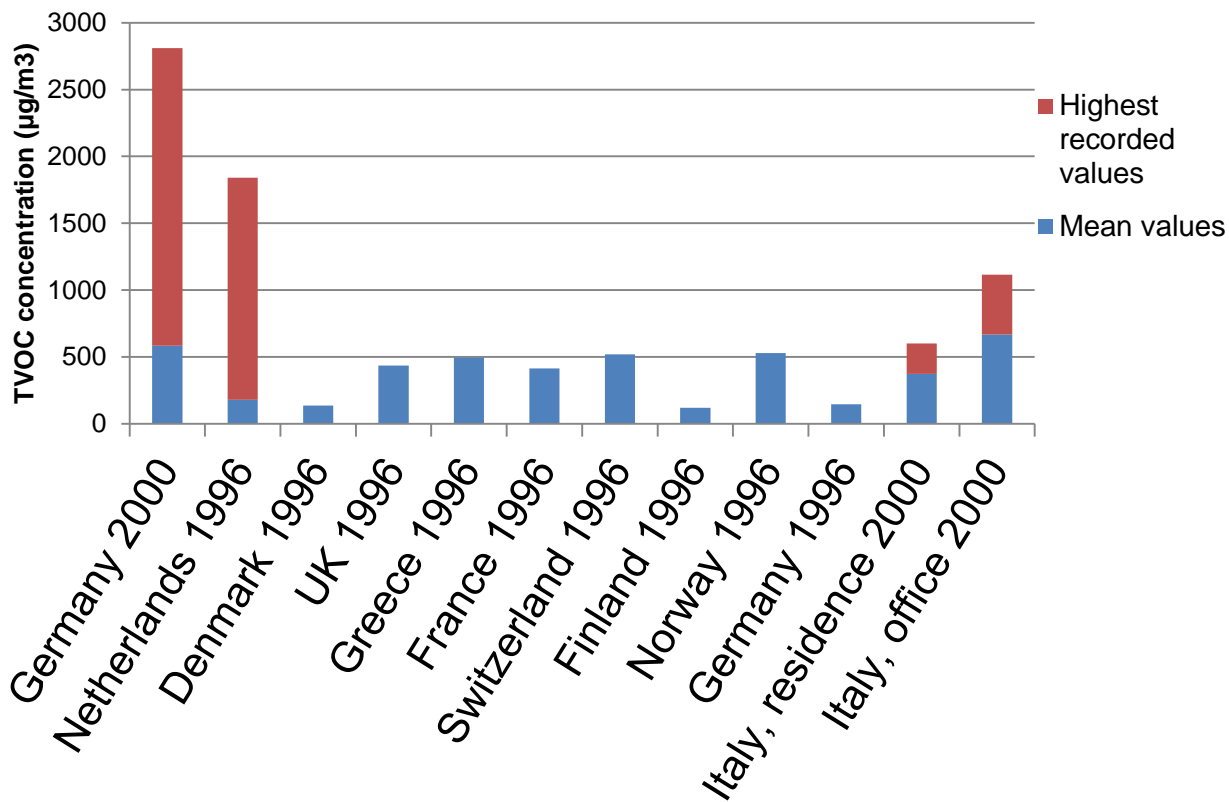


## Sick building syndrome

- First noticeable case: 1970s, Sweden, in preschools; casein that was emitted from self-levelling cement.
- Several similar cases were thereafter reported:
  - 10,000 Canadian buildings in the mid-1990s
  - Cost of ≈\$1 million at EPA U.S. headquarters due to decreased productivity



# What's the problem?



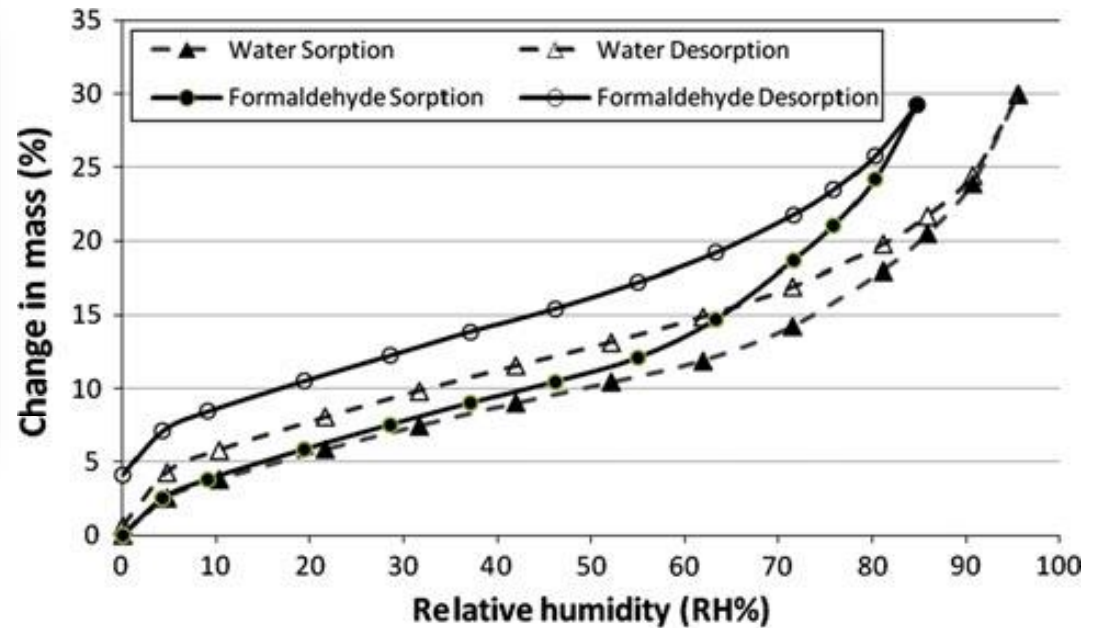
## European regulations and schemes

Limit concentrations	Germany (Ausschuss zur gesundheitlichen Bewertung von Bauprodukten (AgBB), 2012)	Belgium (Federal Public Service Of Health, Food Chain Safety And Environment, 2012)	France (Ministère De L'écologie, Du Développement Durable, Des Transports Et Du Logement, 2011)	Finland (Finnish Society of Indoor Air Quality and Climate, 2010)
<b>TVOC</b>	1,000 µg/m <sup>3</sup> µg/m <sup>3</sup> after 28 days of storing in test chamber	1,000 µg/m <sup>3</sup> after 28 days of storing in test chamber	2,000 µg/m <sup>3</sup> for class B 1,500 µg/m <sup>3</sup> for class A 1,000 µg/m <sup>3</sup> for class A <sup>+</sup>	200 µg/m <sup>2</sup> h for class M1 and 400 µg/m <sup>2</sup> h for class M2
<b>Formaldehyde</b>	100 µg/m <sup>3</sup> after 28 days of storing in test chamber	100 µg/m <sup>3</sup> after 28 days of storing in test chamber	120 µg/m <sup>3</sup> for class B 60 µg/m <sup>3</sup> for class A 10 µg/m <sup>3</sup> for class A <sup>+</sup>	50 µg/m <sup>2</sup> h and 125 µg/m <sup>2</sup> h for class M2
<b>Acetaldehyde</b>	1,200 µg/m <sup>3</sup> after 28 days of storing in test chamber	200 µg/m <sup>3</sup> after 28 days of storing in test chamber	400 µg/m <sup>3</sup> for class B 300 µg/m <sup>3</sup> for class A 200 µg/m <sup>3</sup> for class A <sup>+</sup>	-

## Why wool?



- 4.9% by weight absorbed
- 2/3 permanently bound



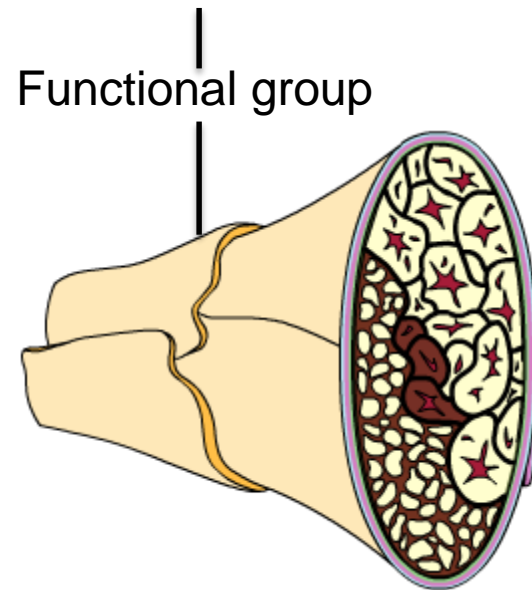
CURLING, S.F., LOXTON, C., ORMONDROYD, G.A. (2012): A rapid method for investigating the absorption of formaldehyde from air by wool. *J. Mater. Sci.* 47: 3248–3251

# What is wool?



# Absorption

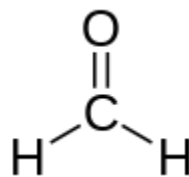
VOC



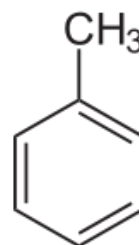


## Which VOCs?

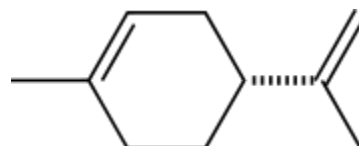
- Formaldehyde



- Toluene



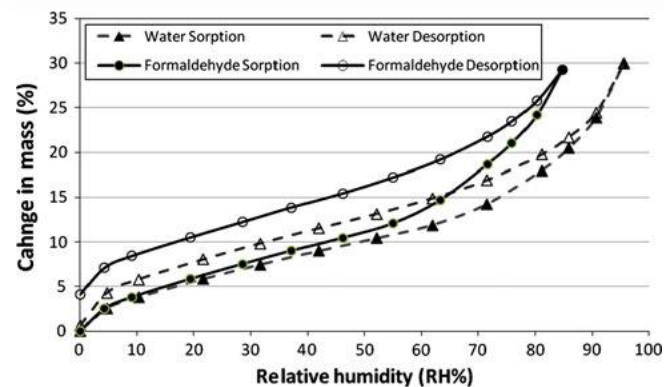
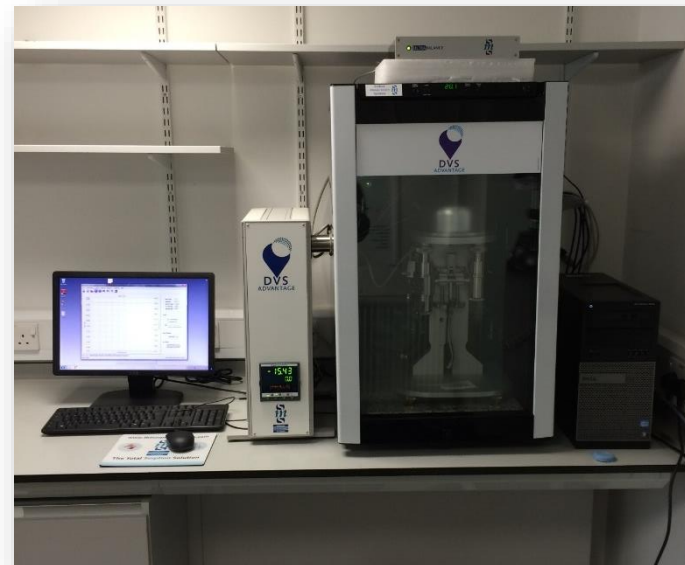
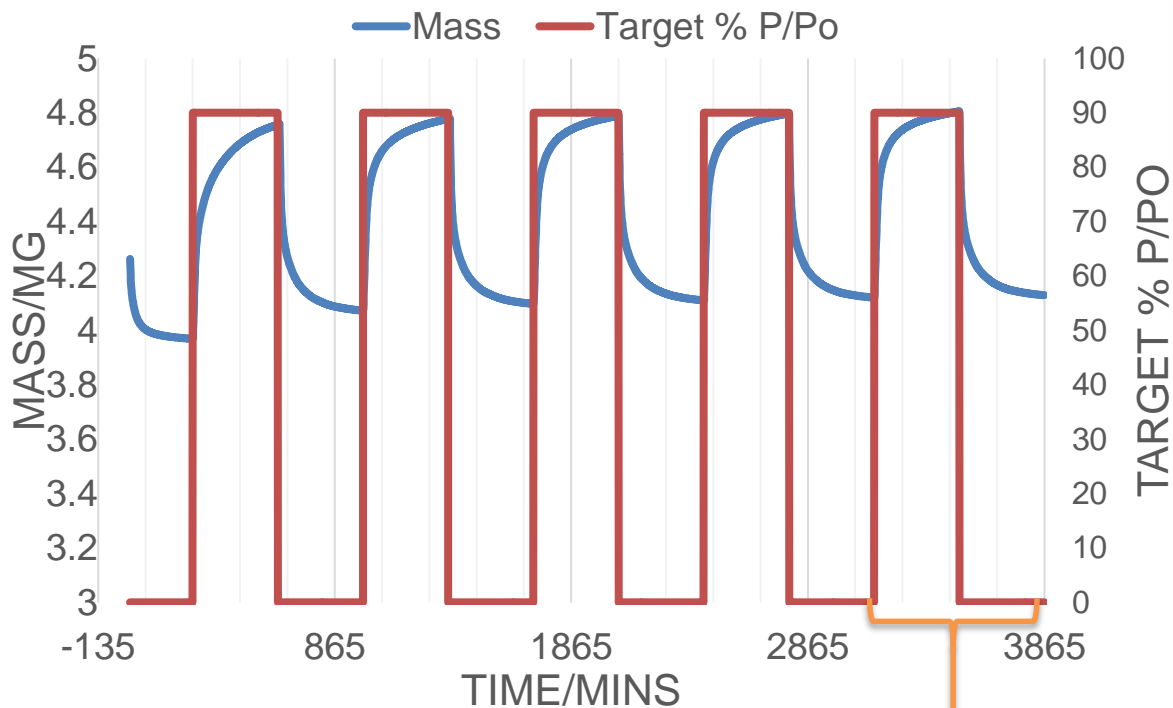
- Limonene



- Dodecane

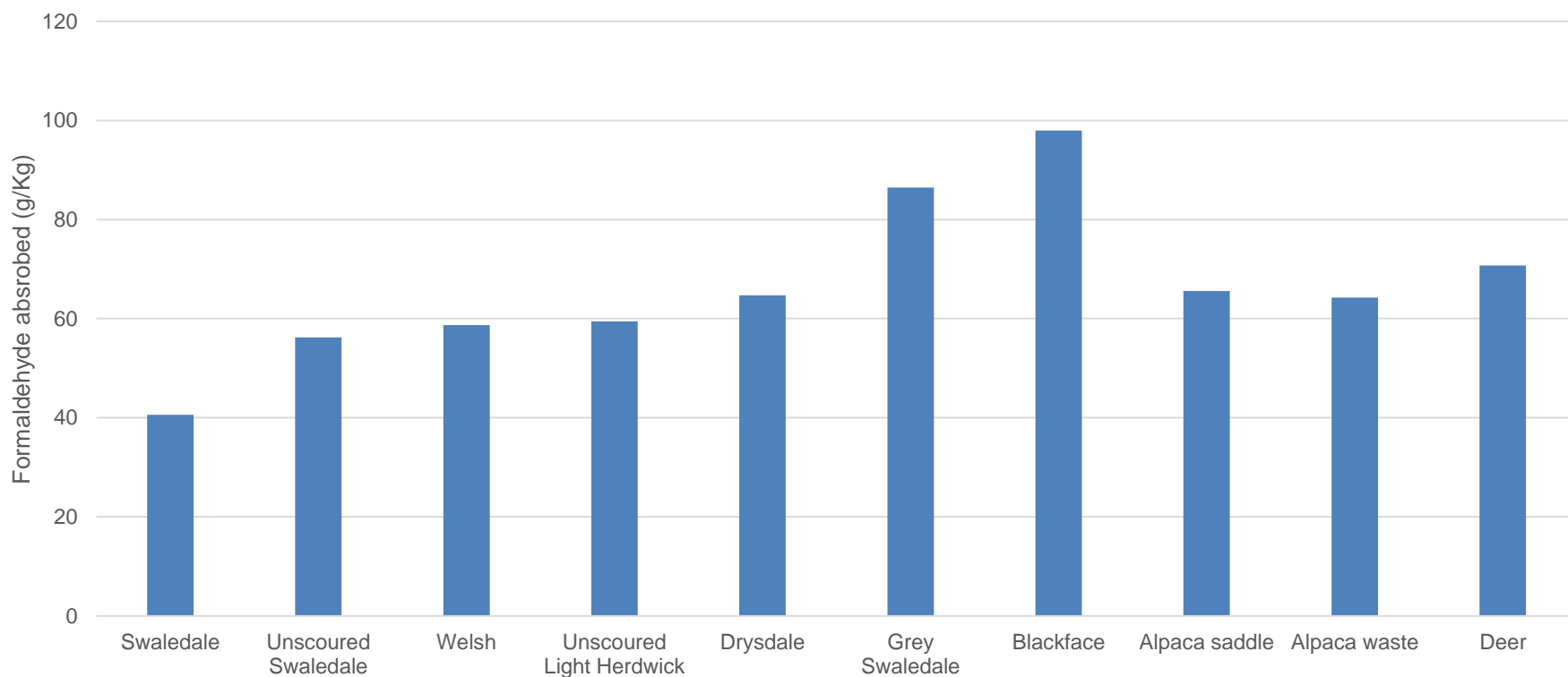


# Formaldehyde analysis

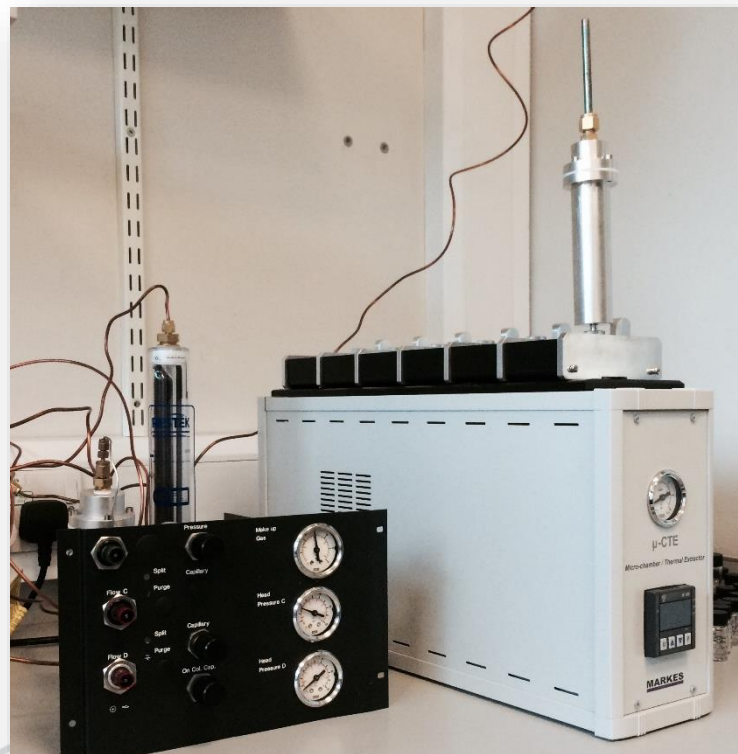
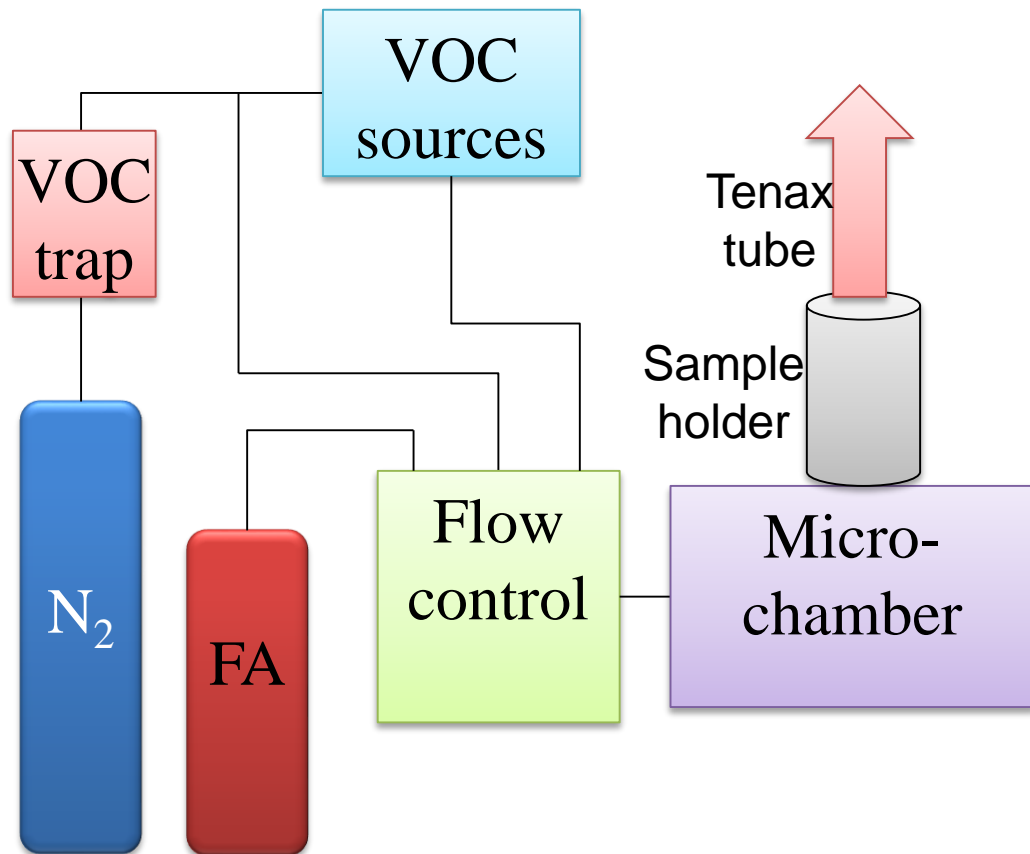


## DVS results

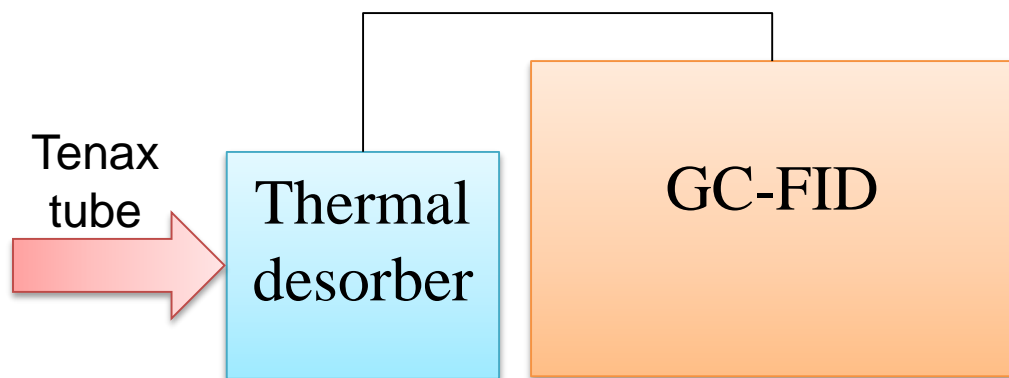
g formaldehyde / kg of material



# Toluene, limonene and dodecane analysis



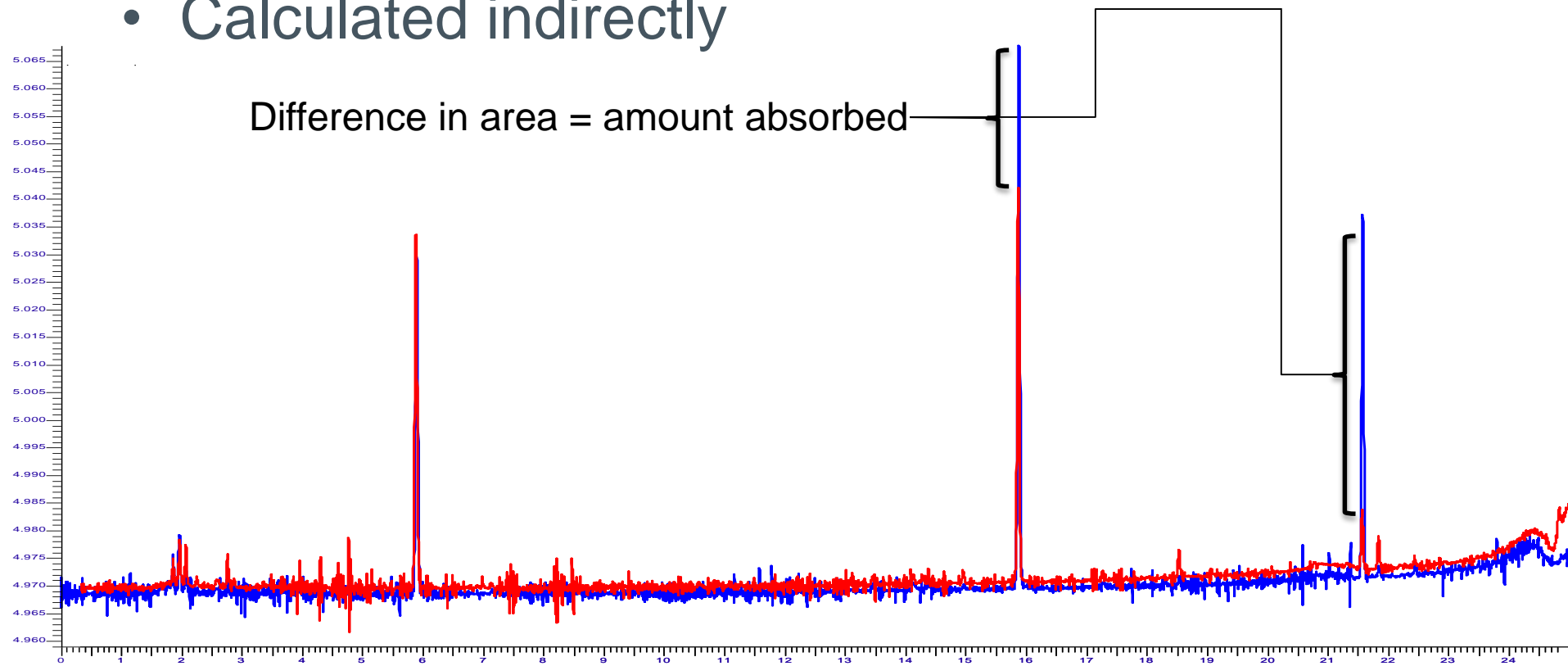
## Thermal desorber



## Chromatograms

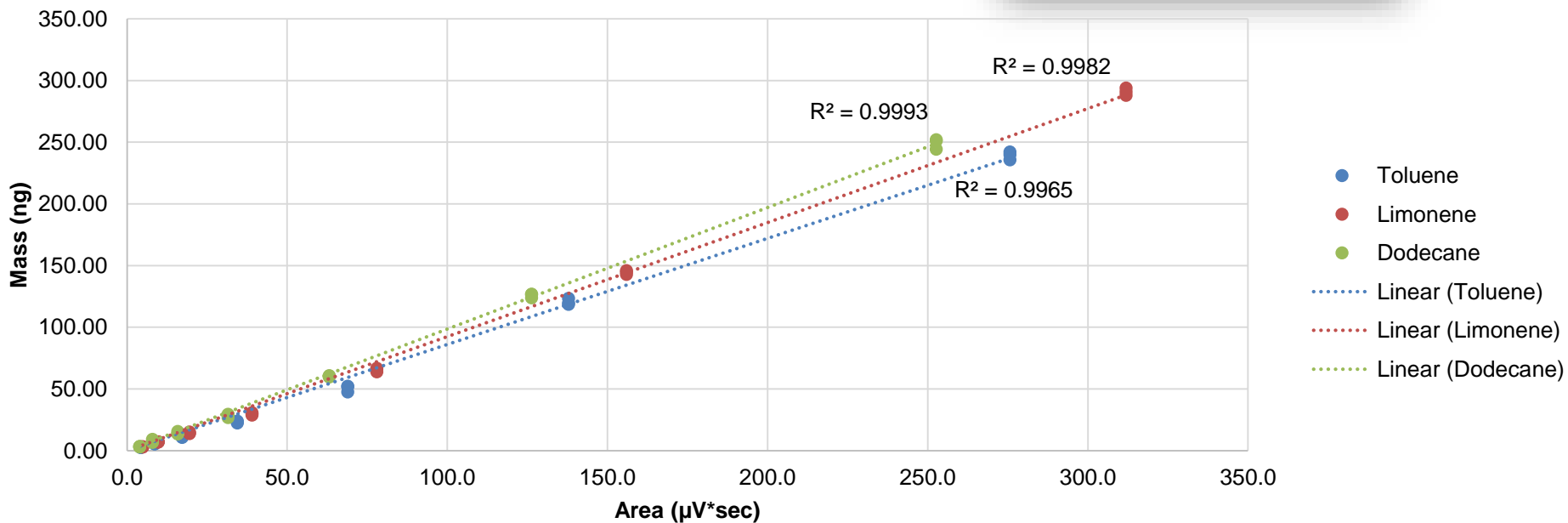
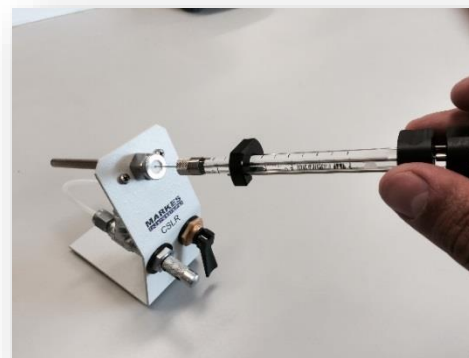
- Calculated indirectly

Difference in area = amount absorbed



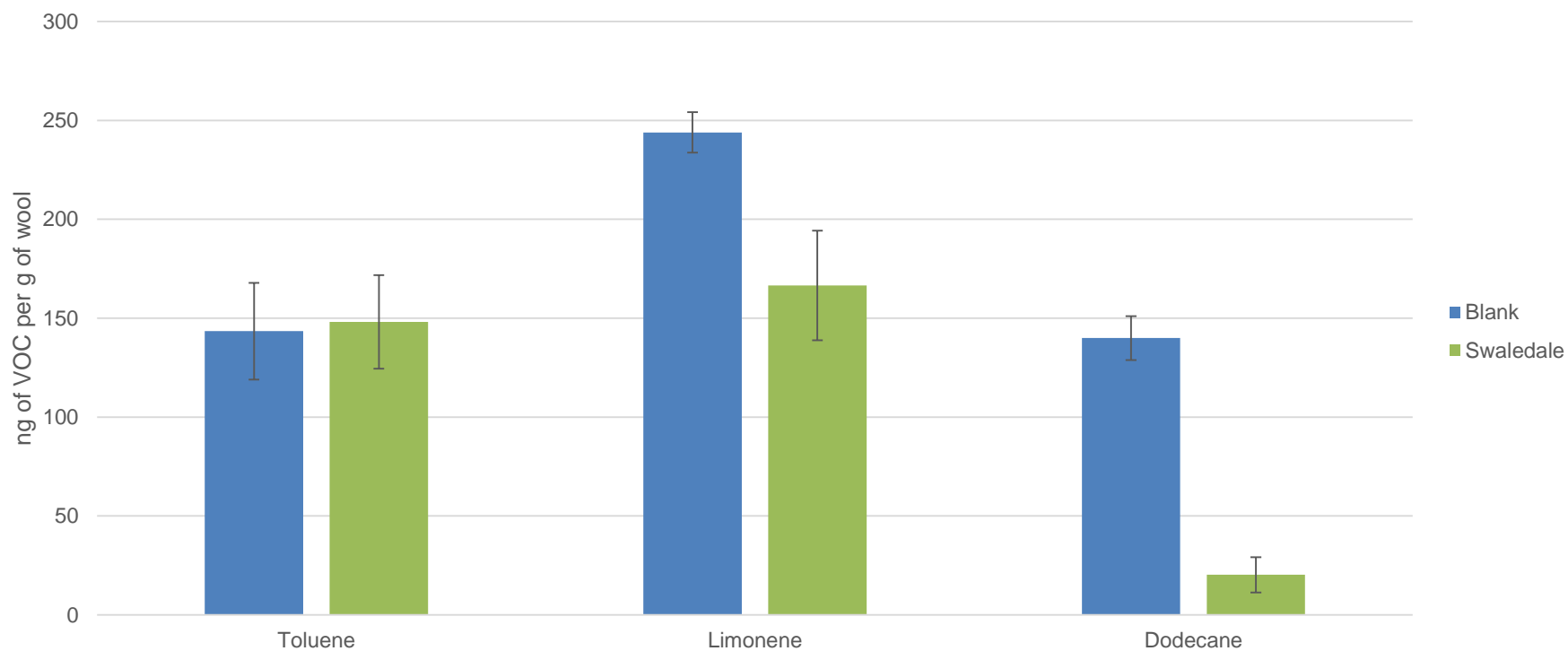
# Chromatograms

- Calibration



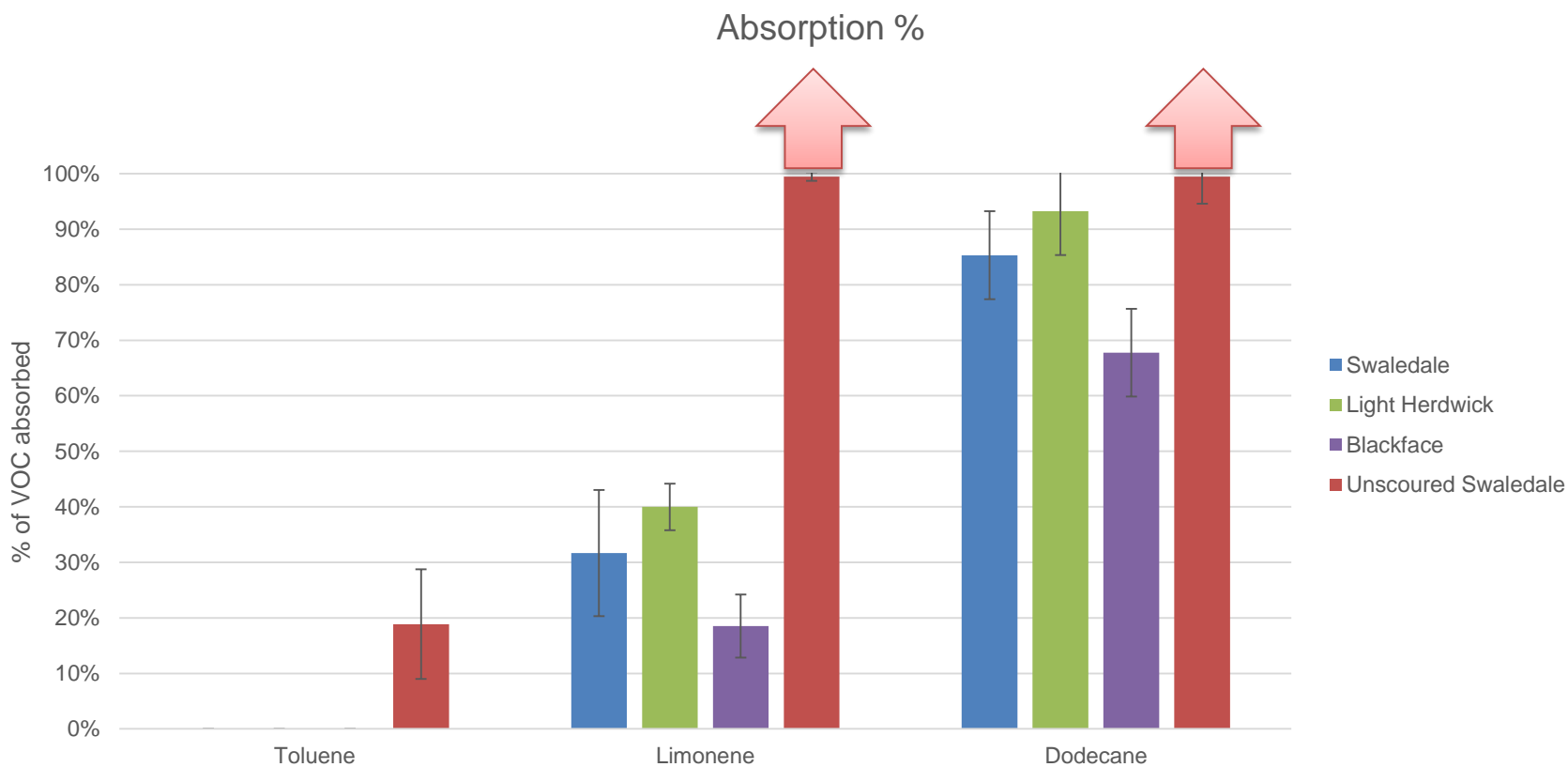
# Results

Detections - tube content

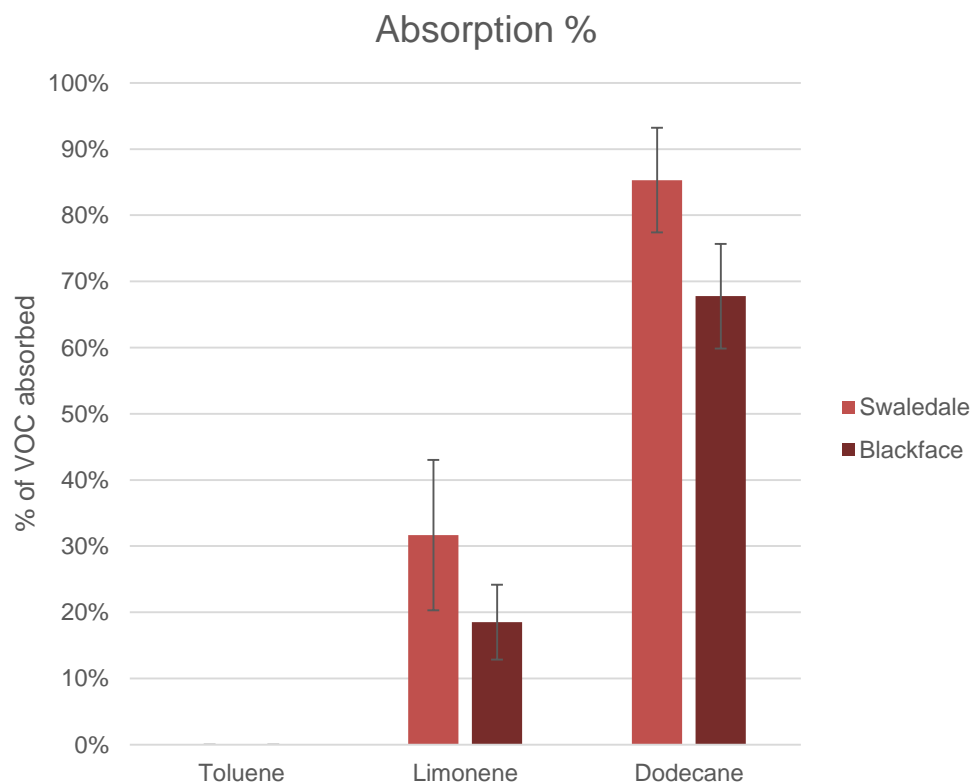
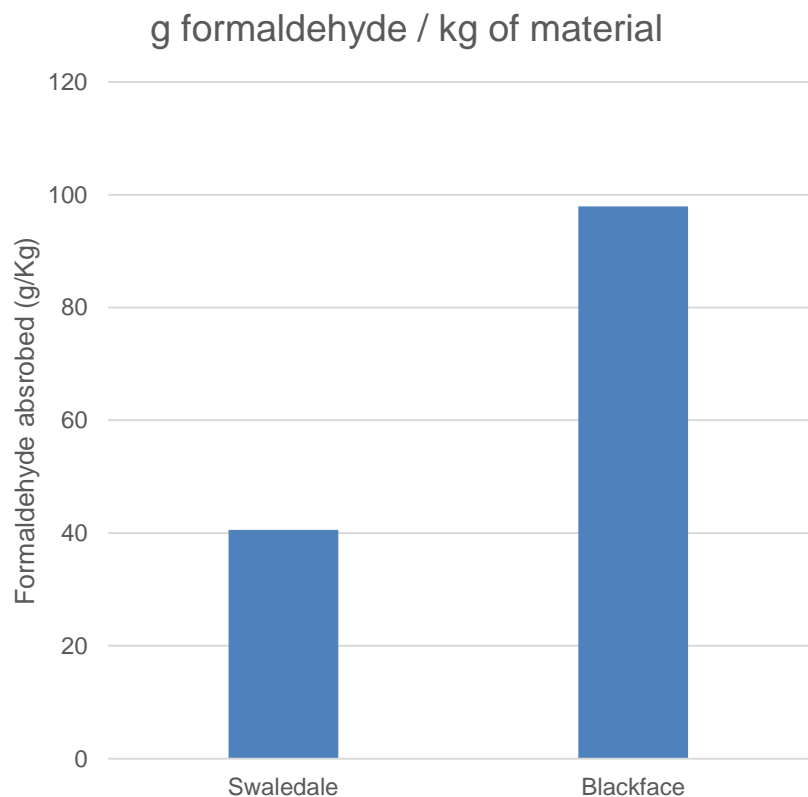




# Results



# Comparison of results



## Conclusions

- Wool types show different absorption characteristics
  - Wool type selection → tailored absorption
- Unscoured wool absorbs more
  - Scouring of wool seem to lessen absorption potential probably due to lack of lanolin/contaminant or modification
- Wool surface polarity linked to absorption properties



The research leading to these results has received funding from the European union's seventh framework programme (FP7/2007-2013) for research, technological development and demonstration under grant agreement no 609234.



Thanks for the wool!





Thank you

