



Moisture sorption of wool insulation materials: Comparison of material and product testing approaches.

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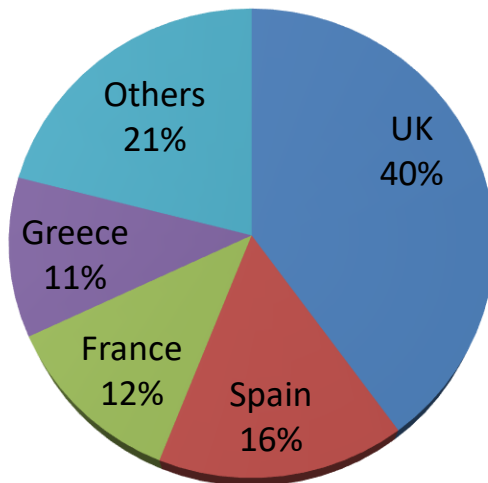




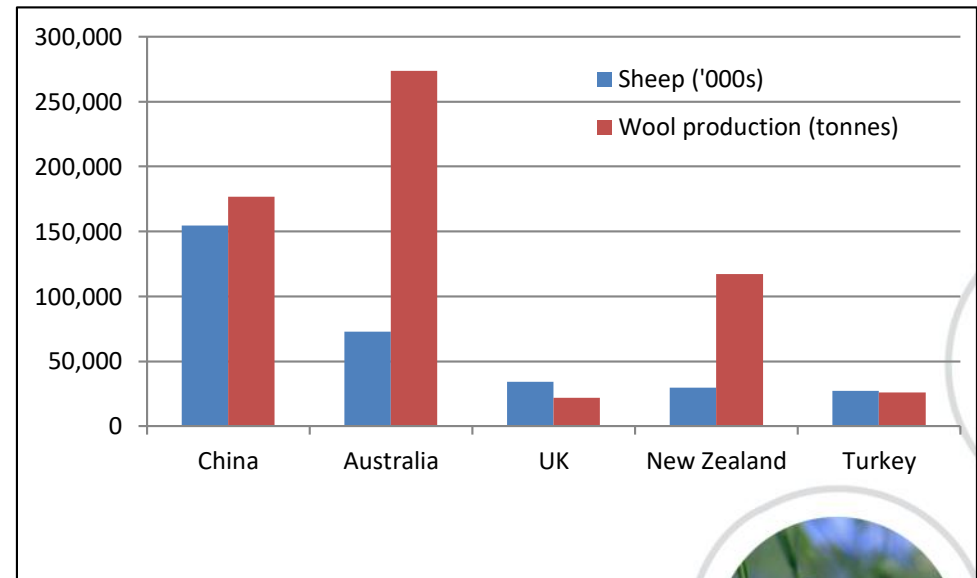
INNOVATION IN BIO-MATERIALS FOR INDUSTRY



UK sheep and wool industry



Sheep meat production in EU 2014 (source Eurostat)



Sheep population and wool production 2015 (Source IWTO)



Why wool?

- Wool is an fibre that has a wide range of uses from clothing to household textiles and to insulation
- Wool is still somewhat of a niche market compared to synthetic or non –organic products
- Other beneficial characteristic's of wool may increase use e.g. improvement of air quality



Not all sheep are the same



Oxford Down



Cambridge

There are over 60 breeds of sheep in the UK

- Mountain, Upland, lowland sheep

Different wool types

- sorted on wool diameter
- Medullation of the wool
- Colour



Cheviot



Welsh Mountain



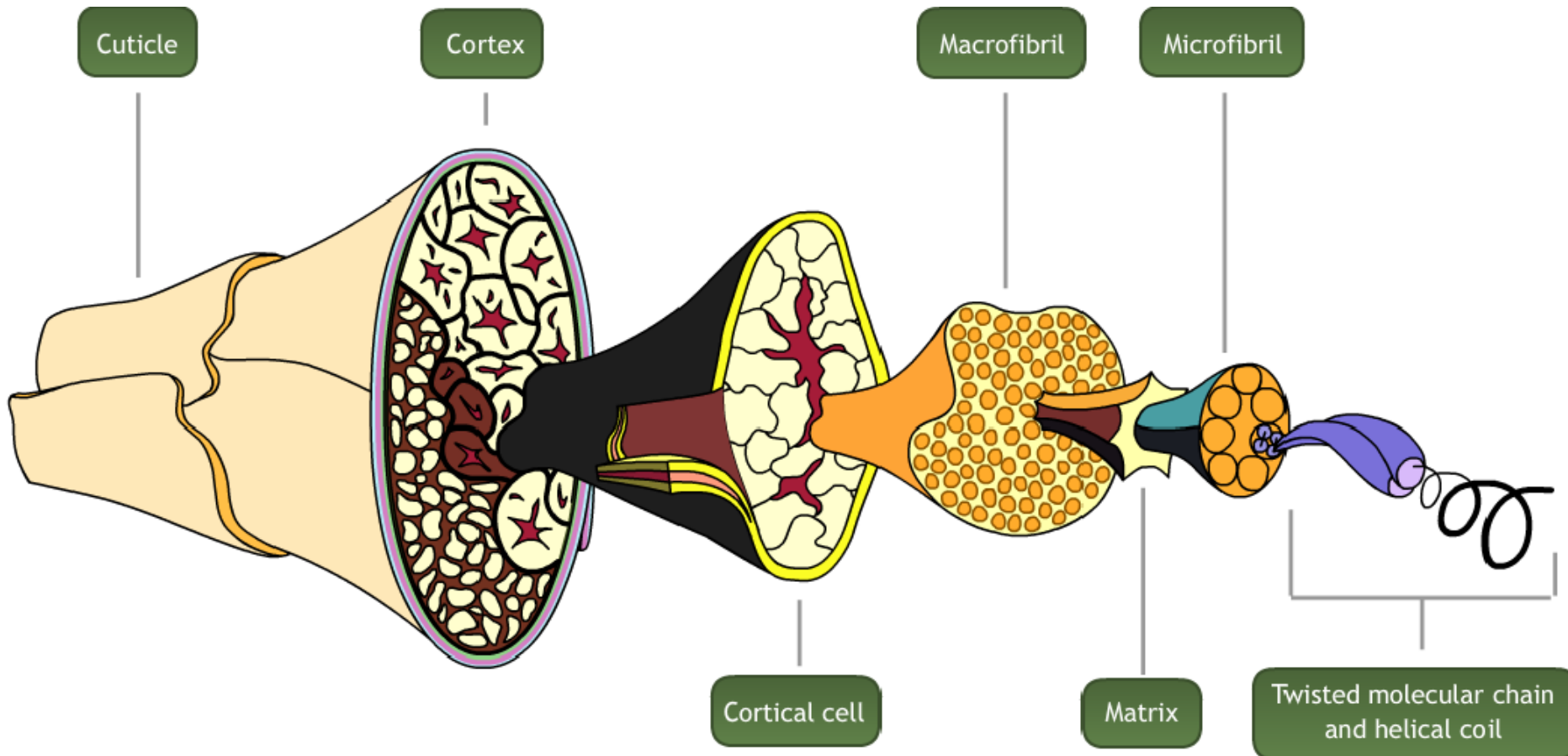
Herdwick



Swaledale



What is wool?



Wool has..

- Complex structure
- Low thermal conductivity = good insulator
- Thermal properties can be affected by moisture content
- Good sorptive potential

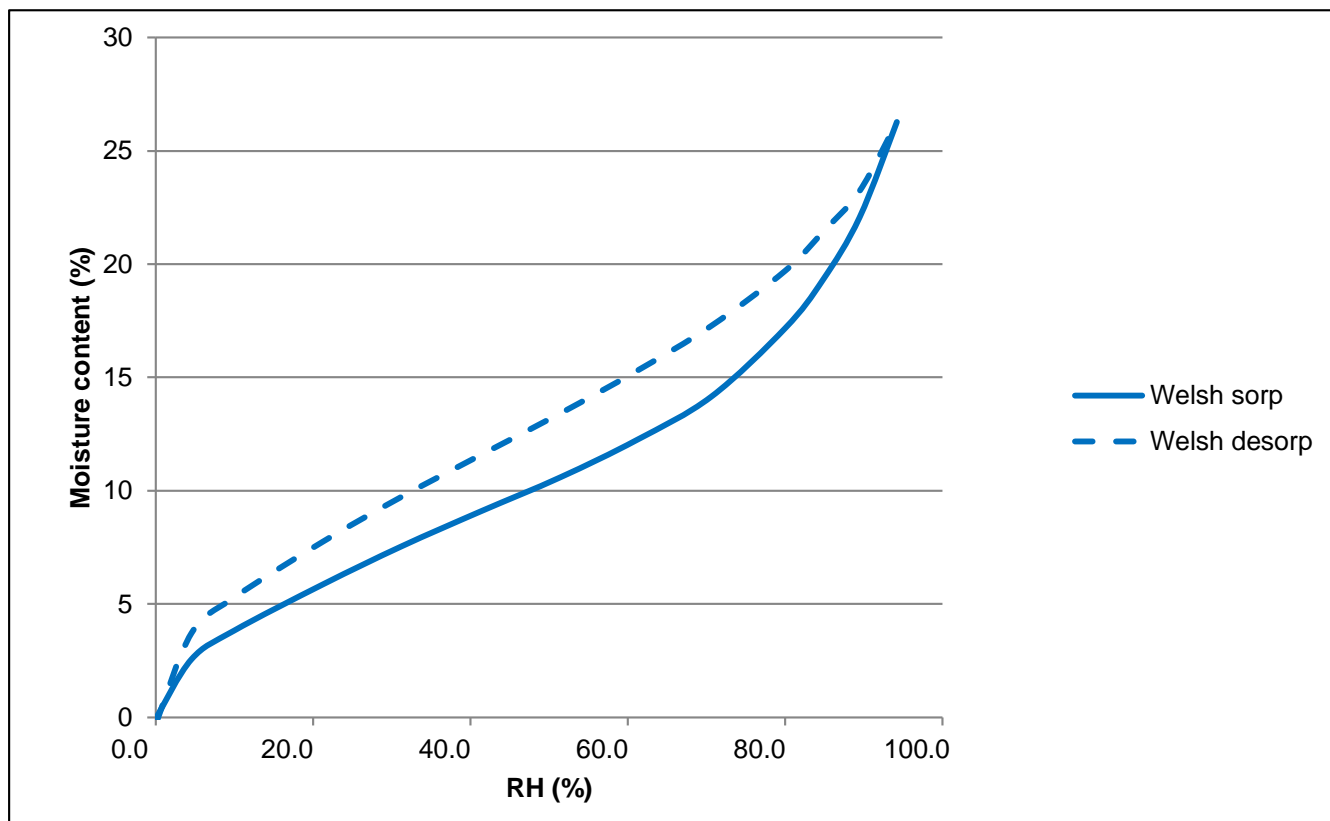


Moisture sorption properties of wool investigated

- Dynamic vapour sorption
 - RH values from 0-95%
 - Small sample size
 - Fast

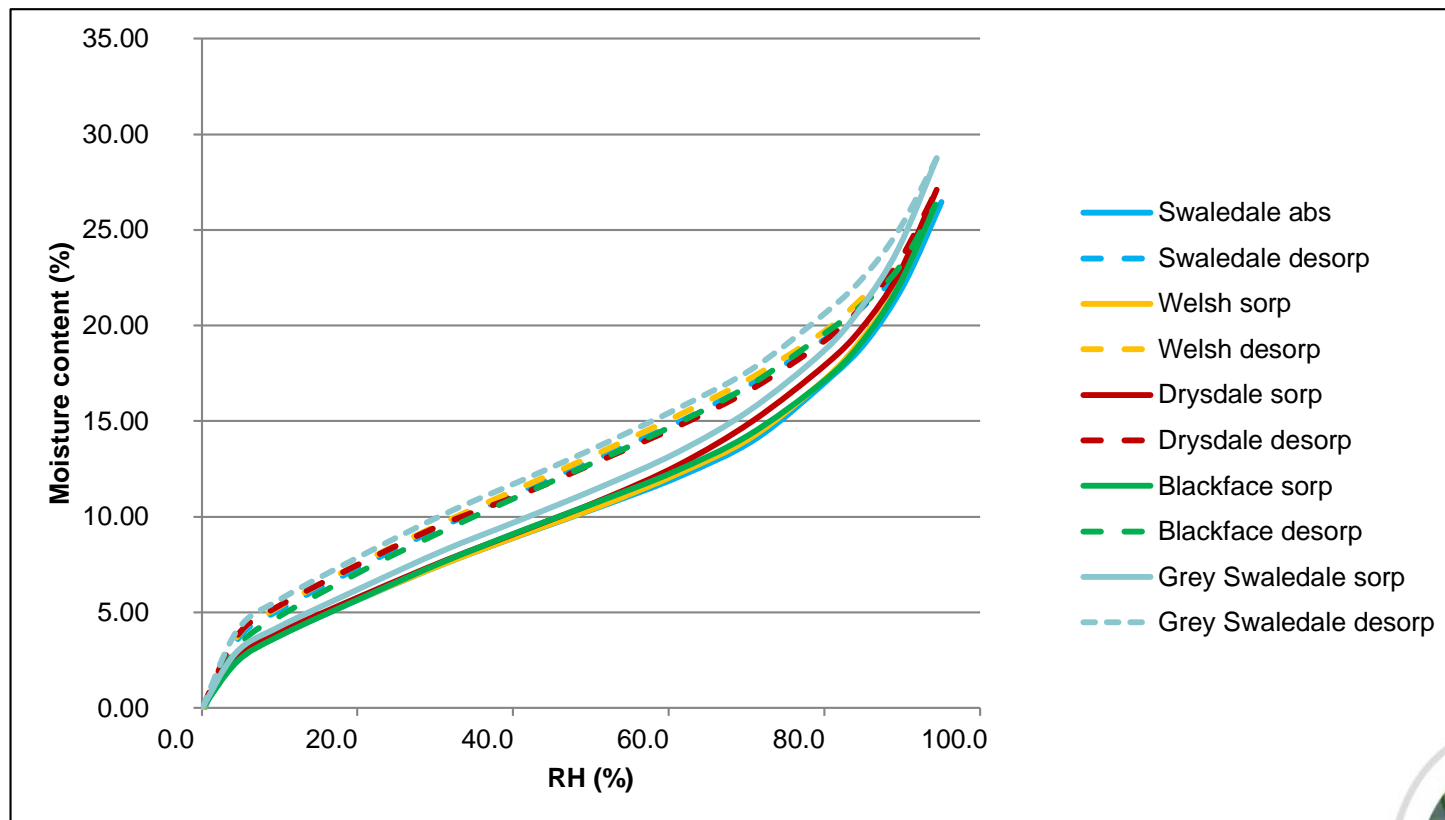


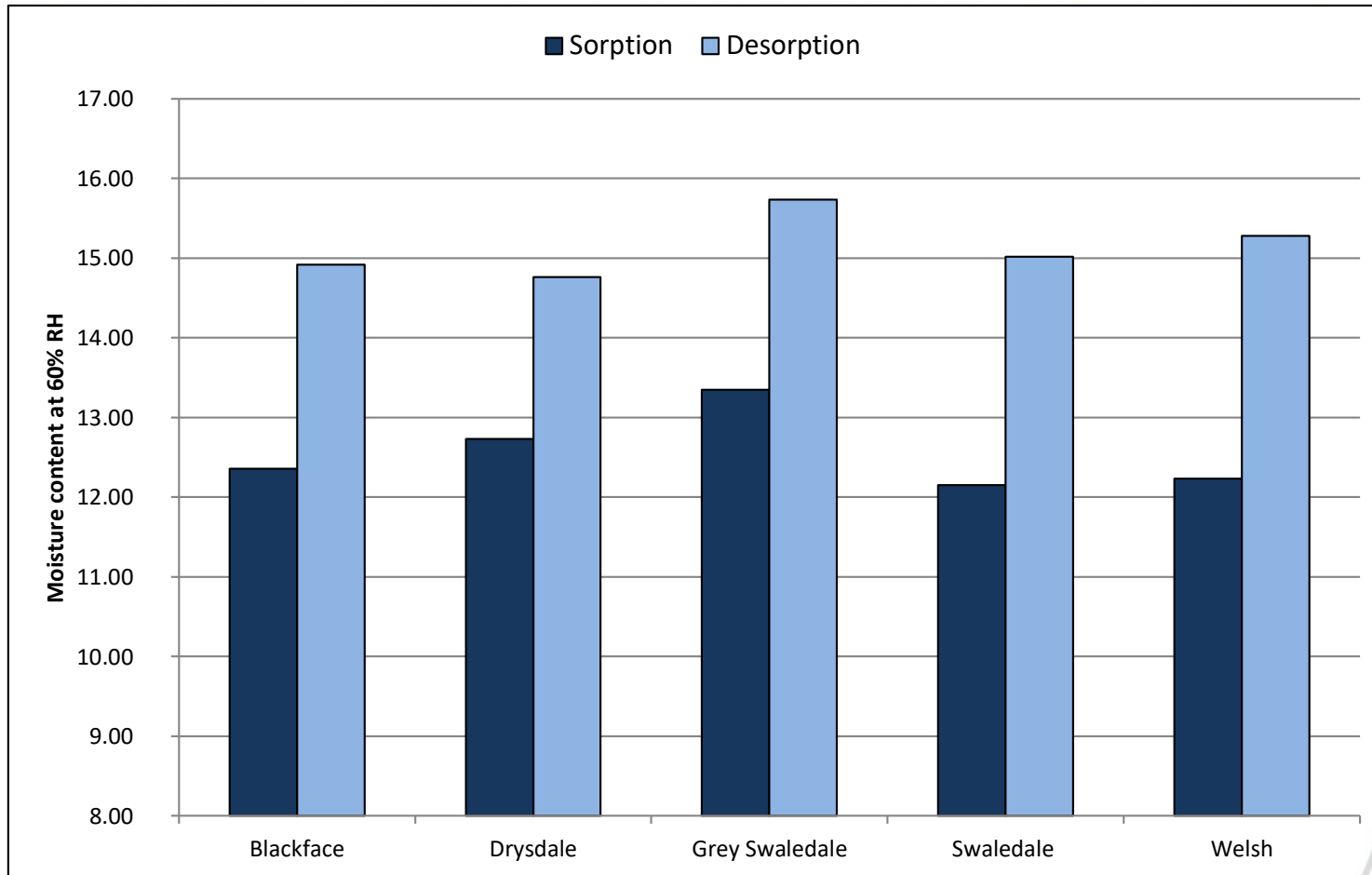
Isothermal curves



Wool fibres
exhibit
hysteresis







Why are the differences important?

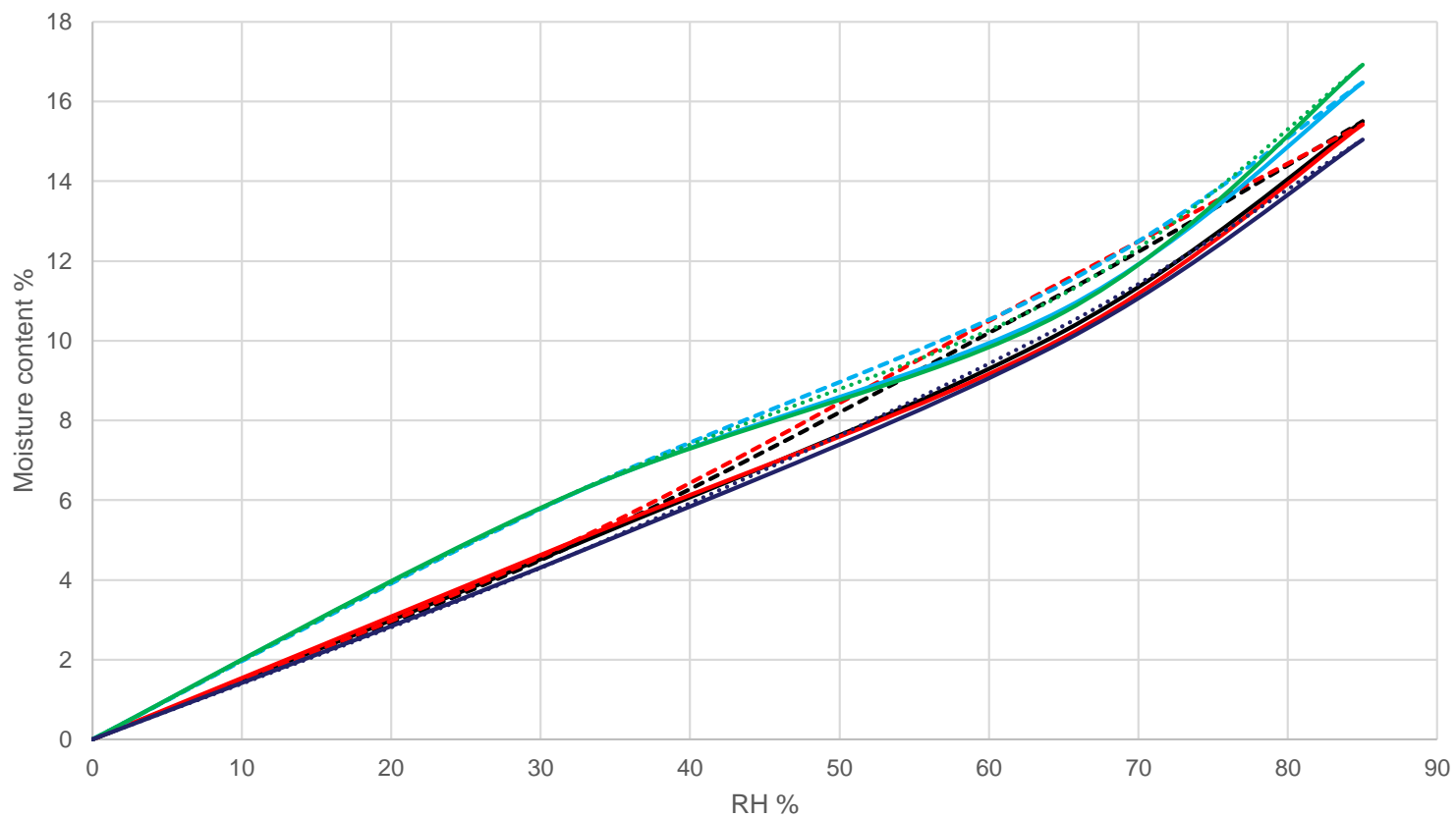
- The thermal properties of the wool will change with moisture content.
- Different sheep breeds wool will have differing moisture contents at similar RH values.
- This will have impact where thermal properties are key



Traditional salt chambers

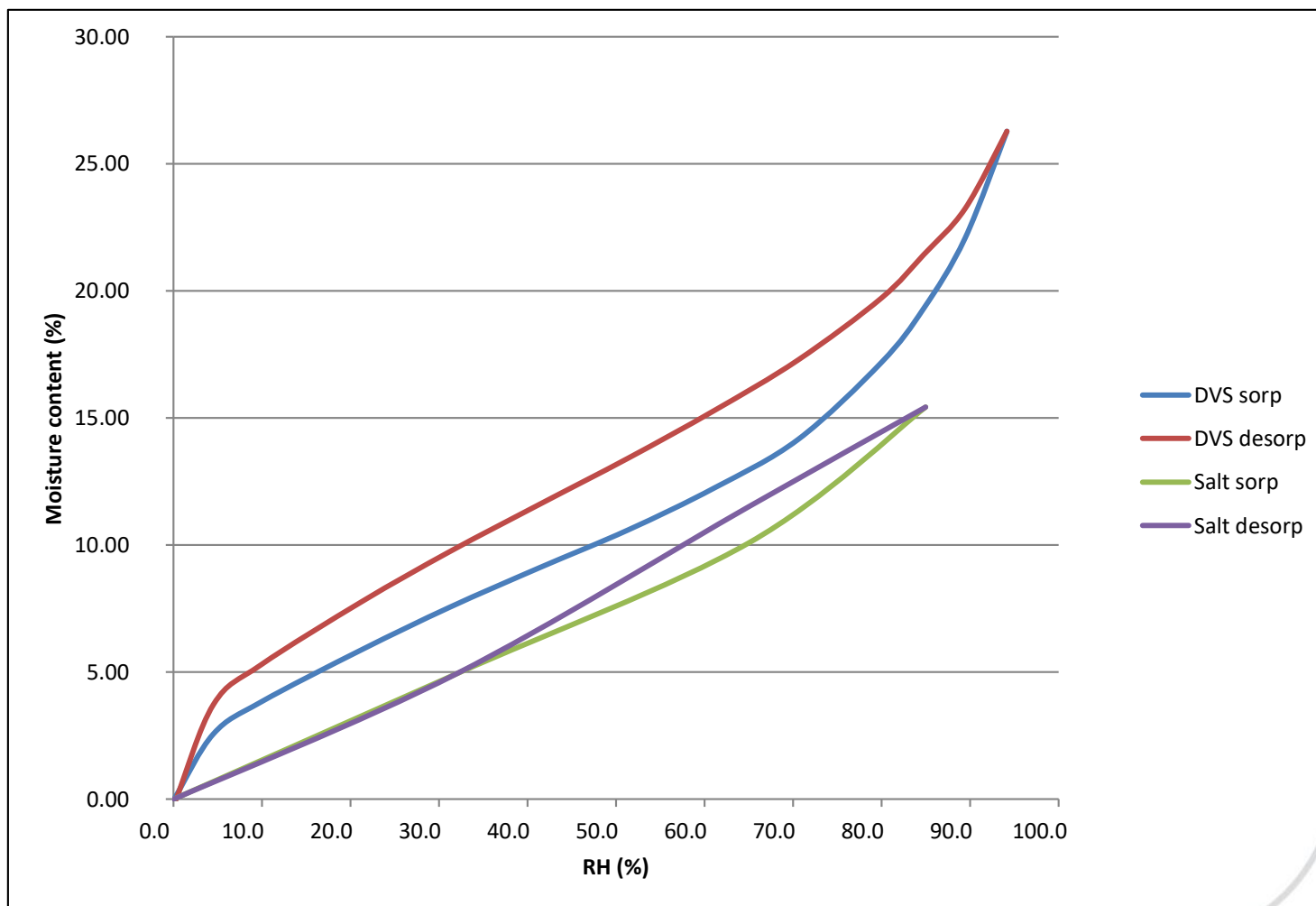
- Humidity over specific salt solutions
- Larger samples
- Long test time



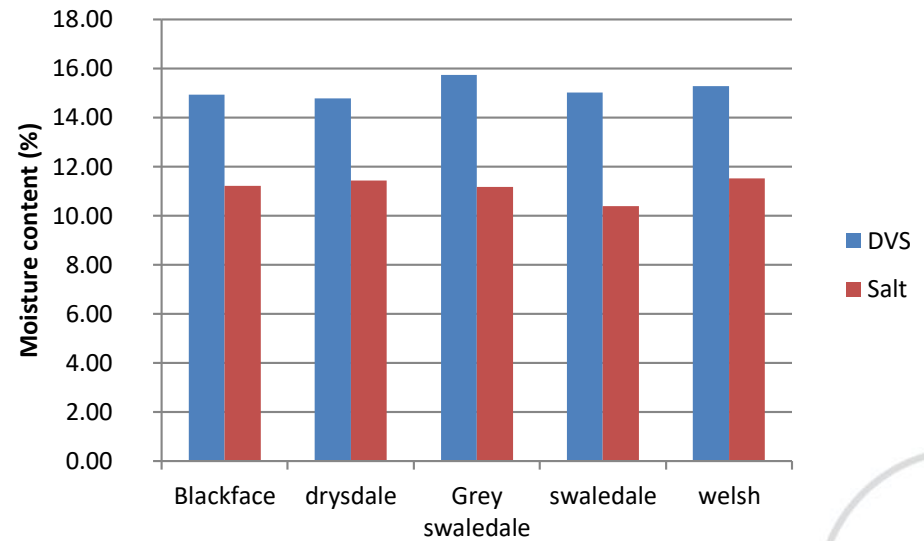
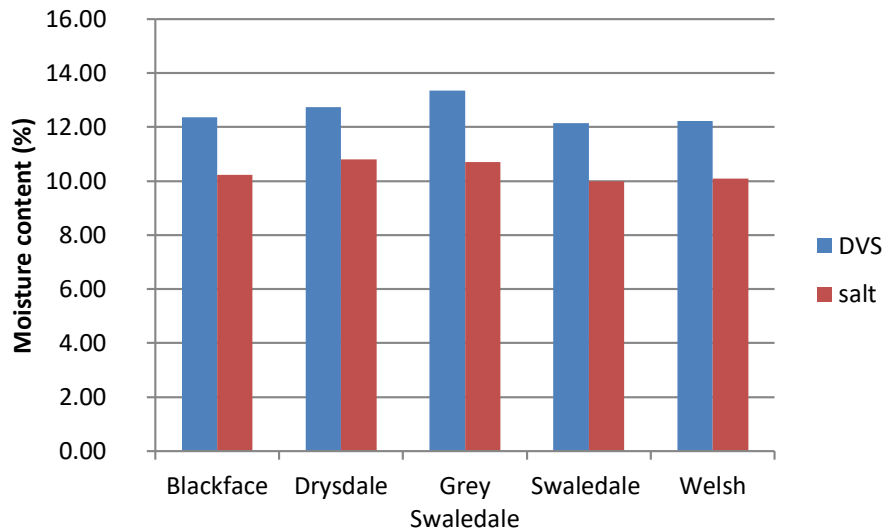


- Blackface Sorp
- Blackface DeSorp
- Welsh sorp
- Welsh desorp
- Drysdale sorp
- Drysdale desorp
- Grey Swaledale sorp
- Grey Swaledale desorp
- Swaledale desorp
- Swaledale desorp





- Moisture content determined by salt tanks is consistently lower than DVS..



Material vs product?

- Clear indication of the differences between testing the material and the product
- Both give useful and valuable data
- So both material and product scale tests should be used in evaluating existing and new products

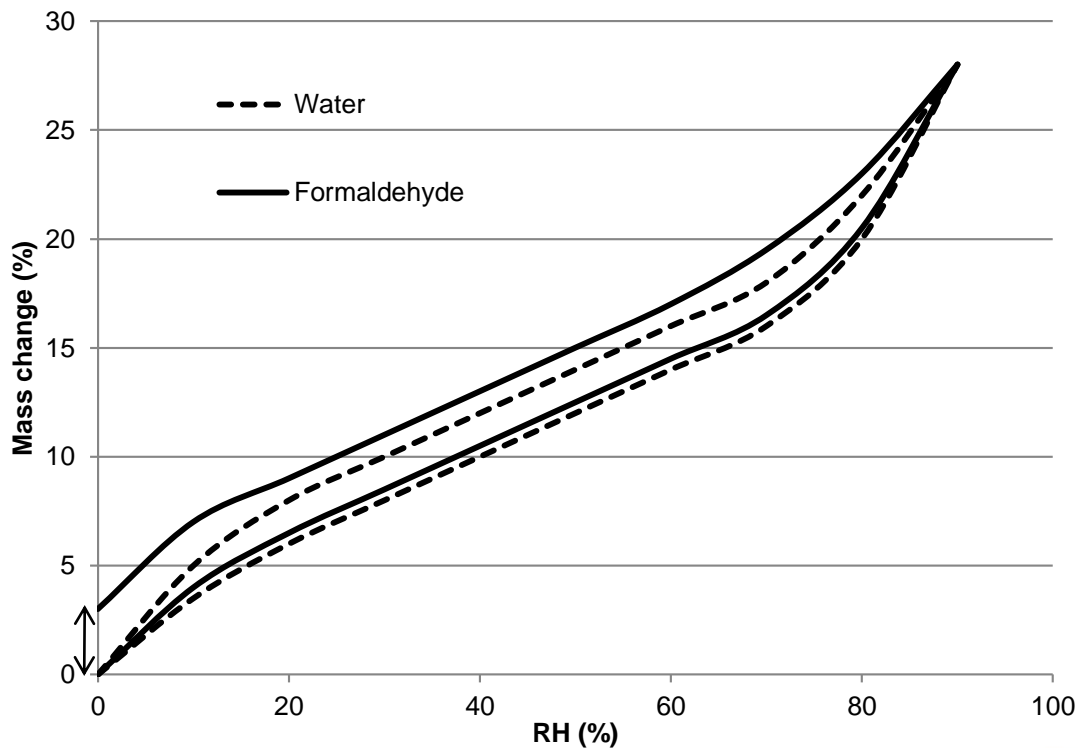


Apply to other sorption processes

- E.g. formaldehyde sorption
- Investigating formaldehyde sorption by wool in order to improve indoor air quality
- Using a DVS method



Formaldehyde sorption



- Difference in mass at 0% due to formaldehyde sorption



- Can it be assumed that the bulk properties of the wool will affect formaldehyde sorption in similar way to moisture sorption
- Important when designing experiments and products!



Summary

- Moisture content of wool is breed dependent
- Salt chamber method gives lower values than DVS
- Material vs product testing





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Thank you for listening

- Any questions

