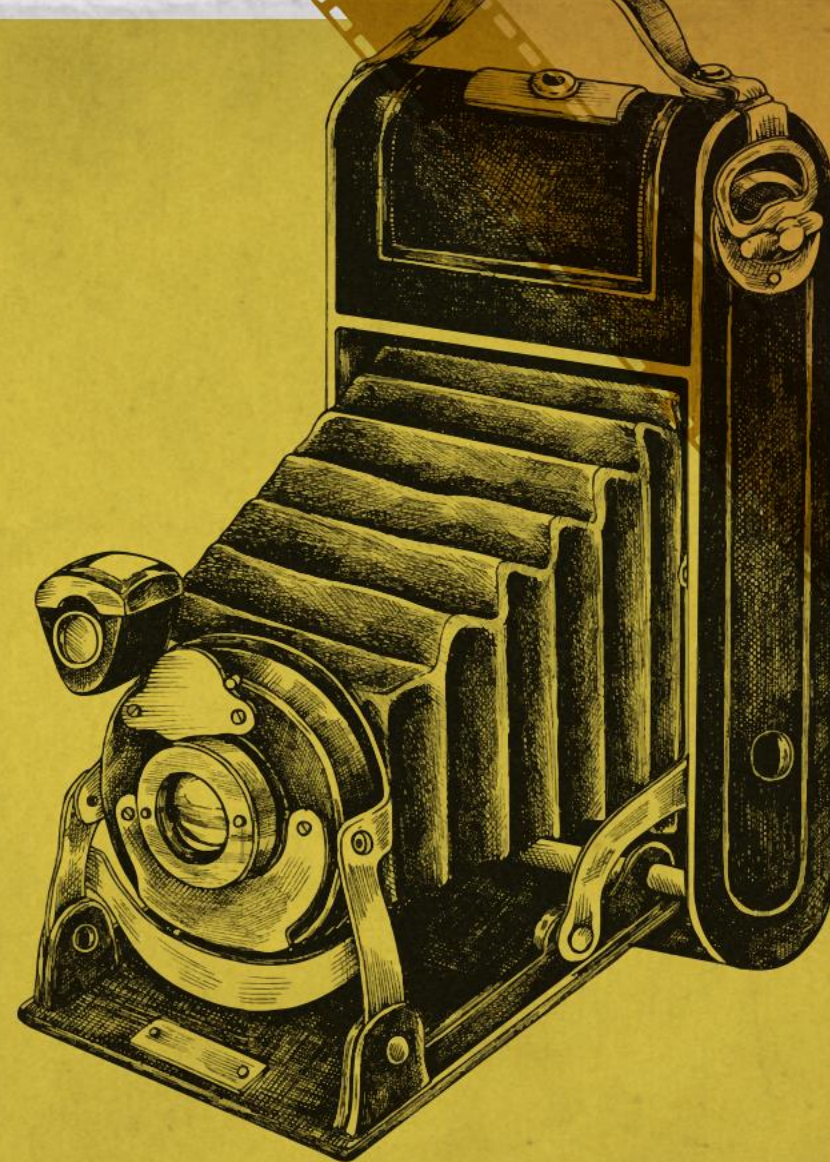
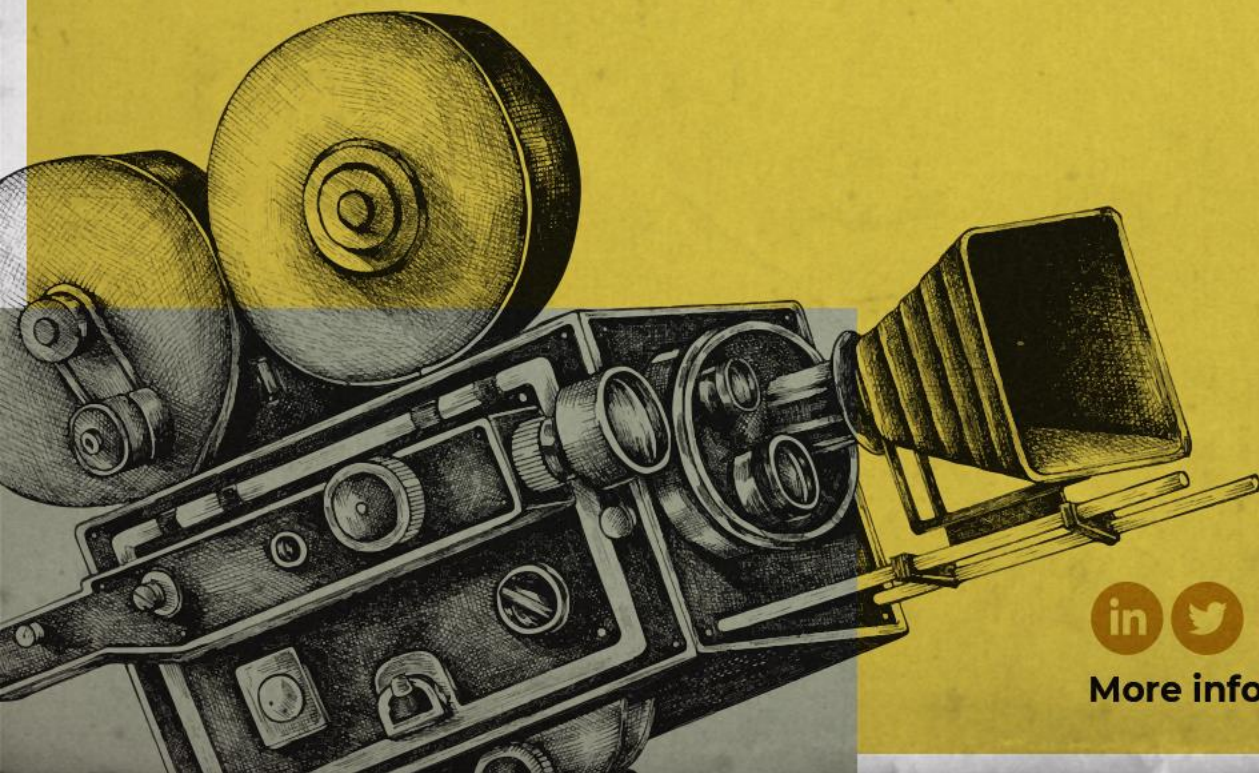
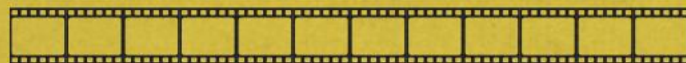


25<sup>TH</sup> MAY / 2022 ◊ VALENCIA, SPAIN

# FINAL WORKSHOP

The NEMOSINE innovative  
package for cultural  
heritage preservation



More info at: [nemosineproject.eu](https://nemosineproject.eu)



NEMOSINE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760801.



# Performance assessment of MOFs and MOF composites for acetic acid capture

Name of the speaker: Moisés L. Pinto

Organisation: Instituto Superior Técnico, ULisboa

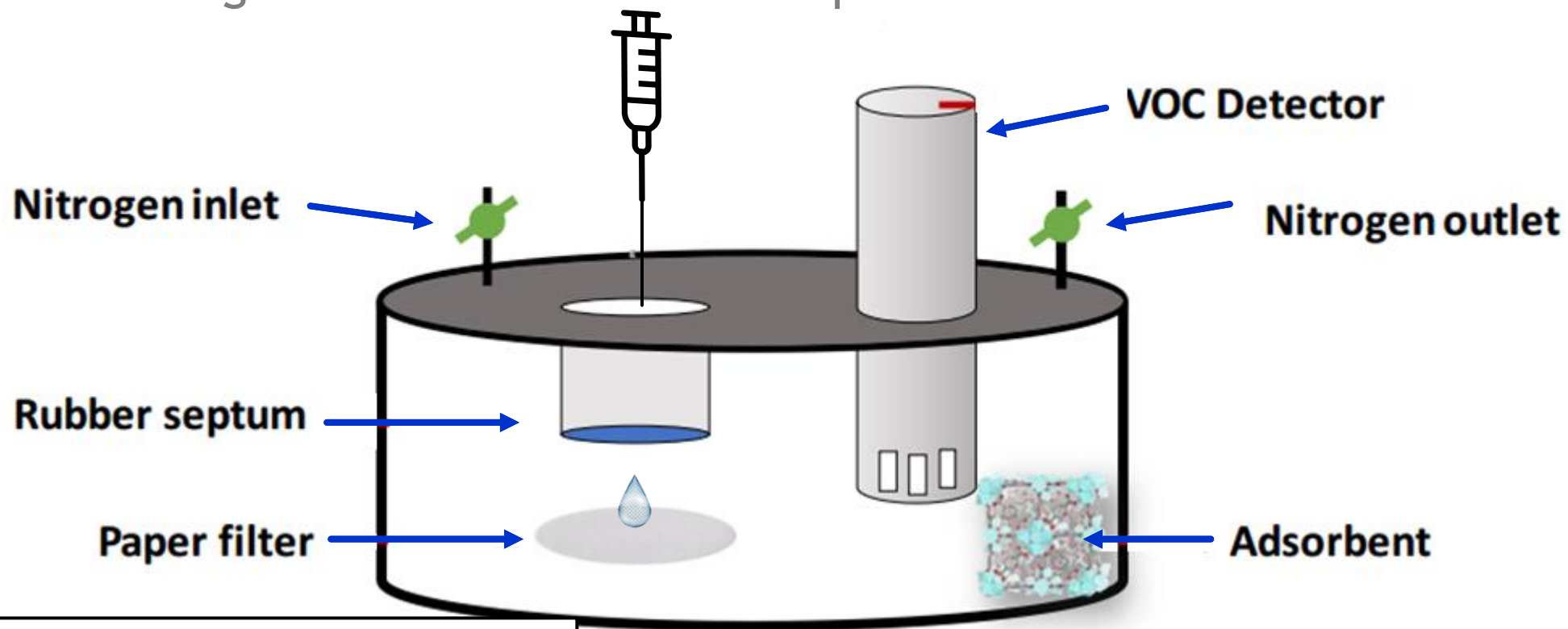


1. Acetic acid adsorption under controlled moisture level
2. Single component adsorption isotherms
3. Breakthrough curves with mass spectrometer setup with multiple gas inlets
4. Temperature Programmed Desorption with mass spectrometry detection



# Acetic acid adsorption under controlled moisture level

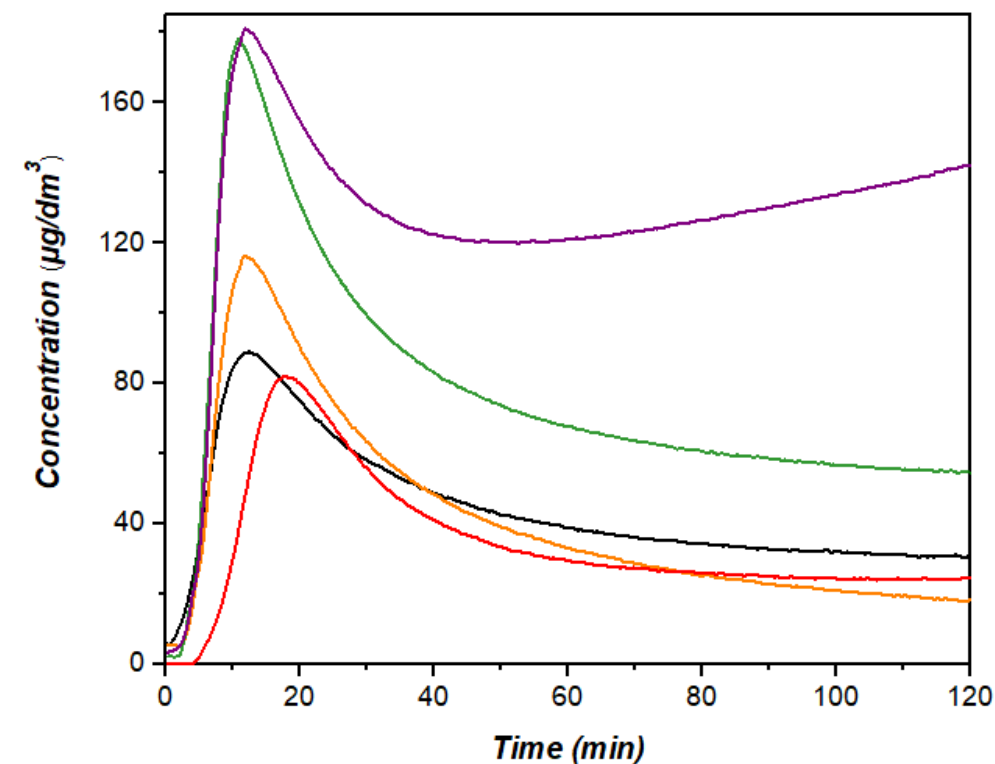
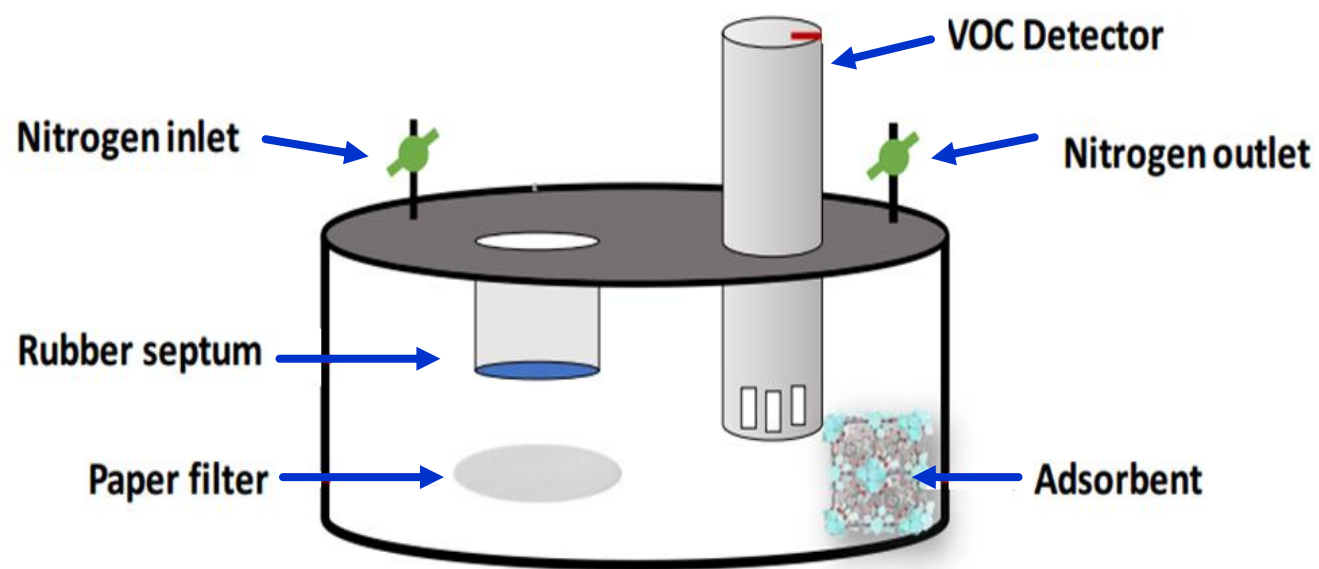
Screening test to understand adsorption behaviour



Injection 1  $\mu\text{L}$  in 2.9  $\text{dm}^3$  chamber  
Relative humidity ~ 40-60 %  
Temperature = 25°C

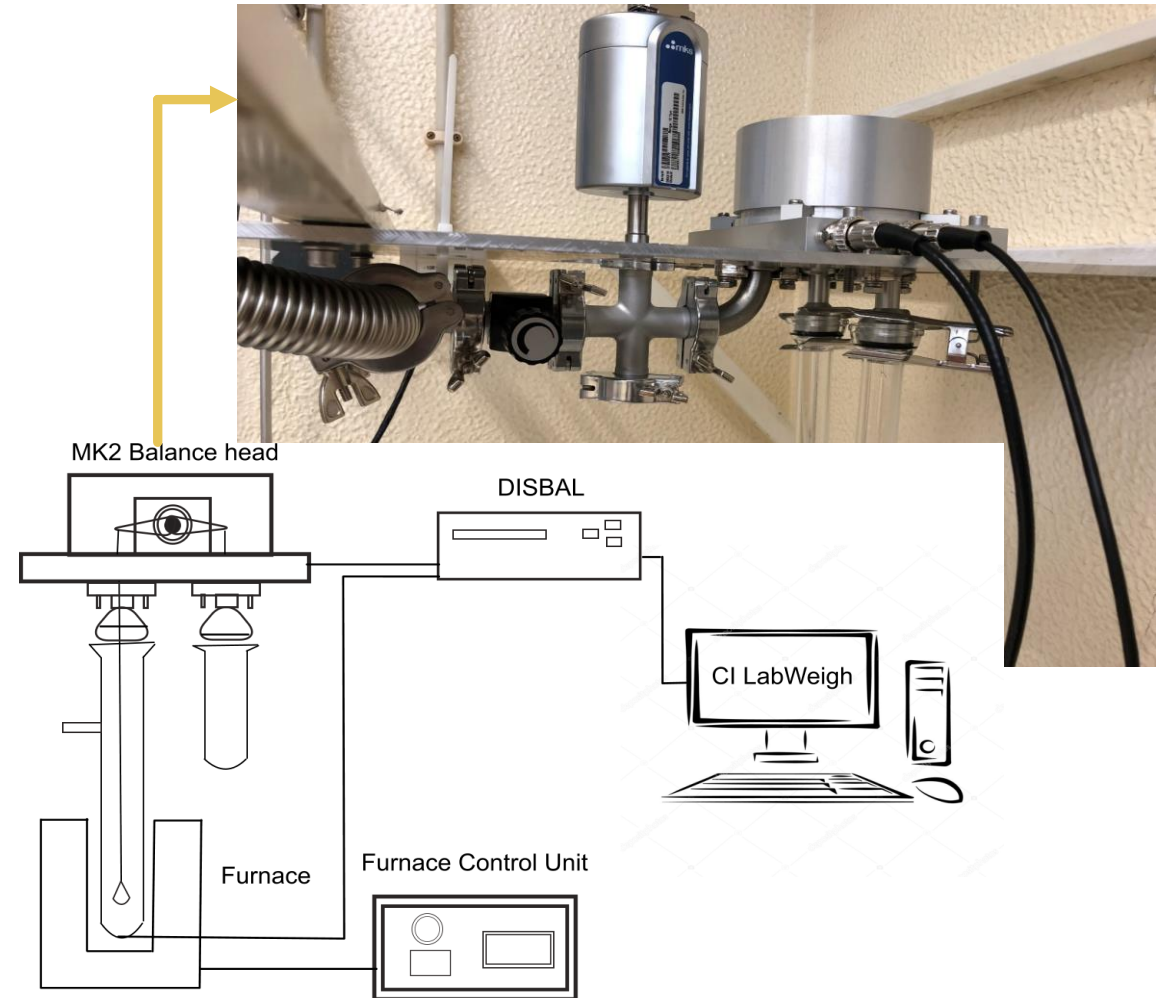
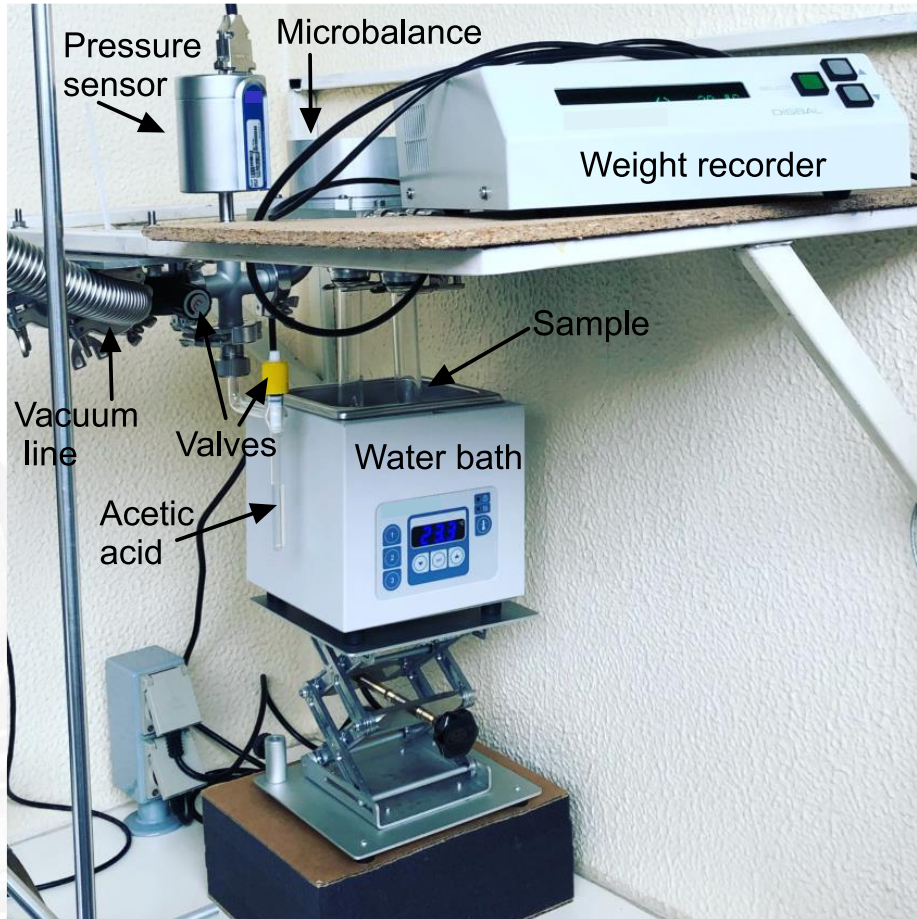
# Acetic acid adsorption under controlled moisture level

Screening test to understand adsorption behaviour

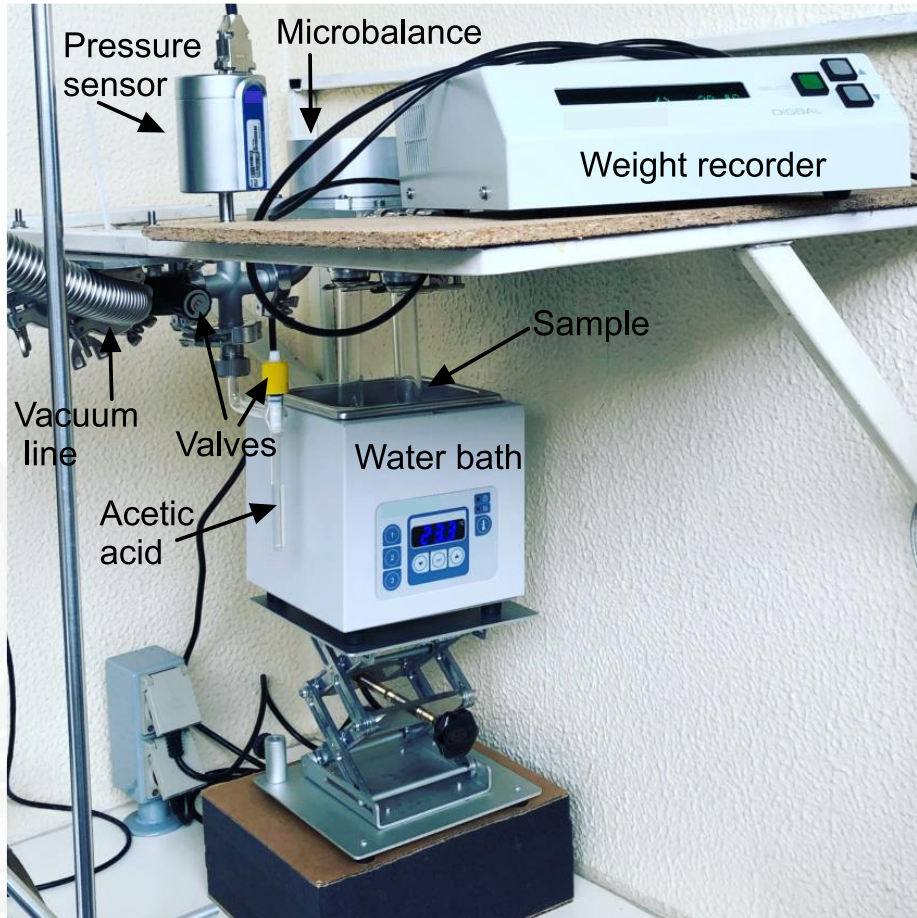




# Single component adsorption isotherms



## Single component adsorption isotherms



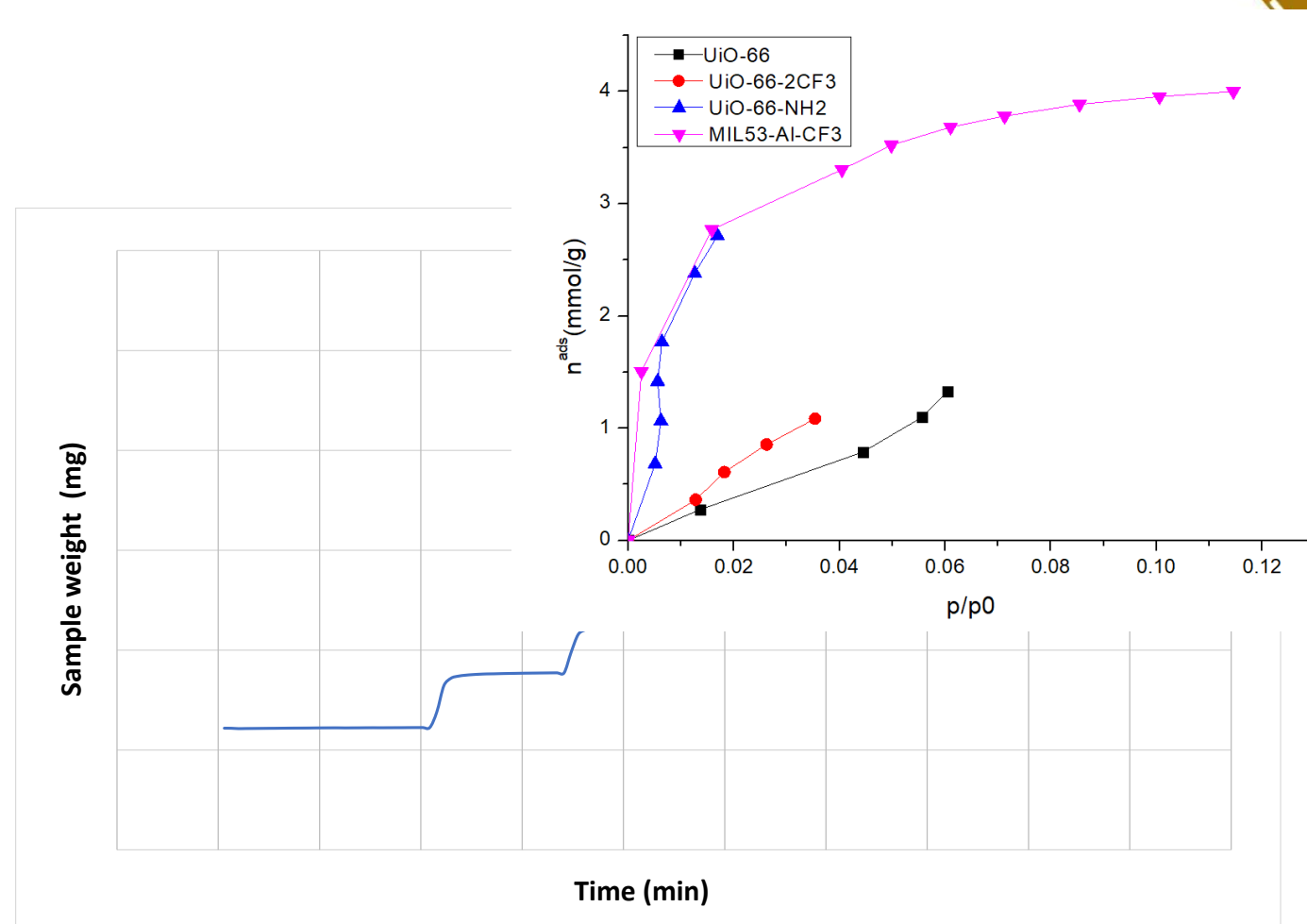
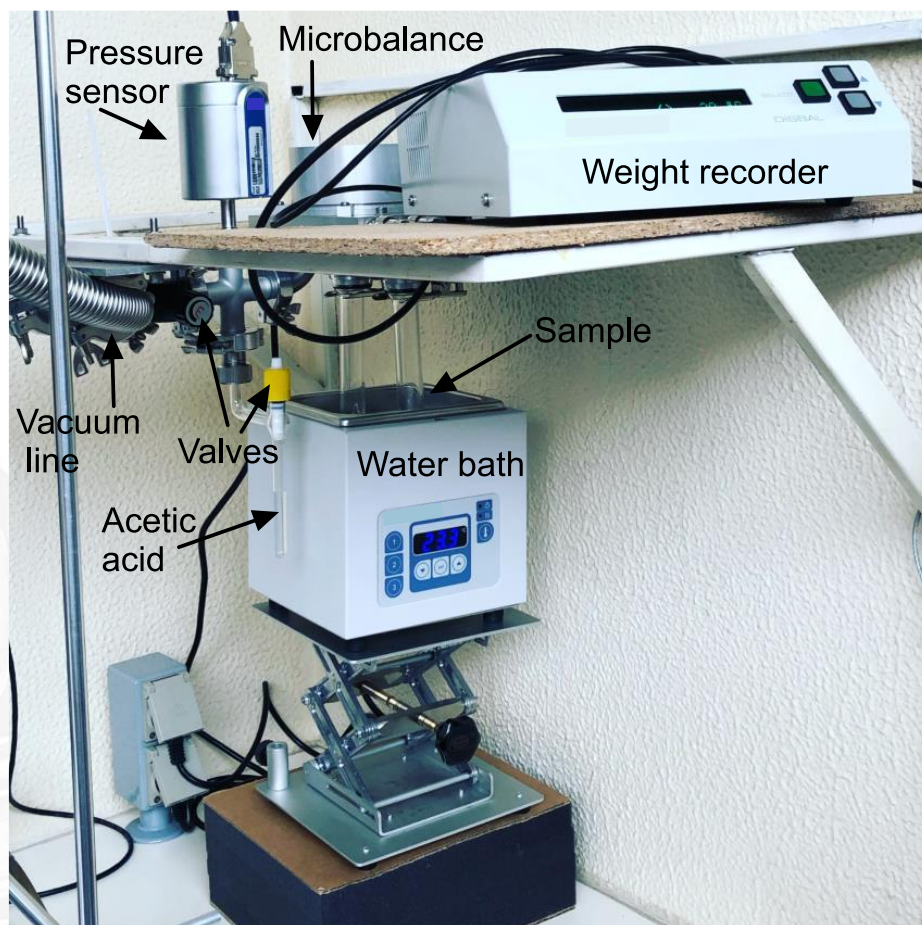
Measurements are performed under controlled temperature and pressure conditions

To access the material acetic acid adsorption capacities and study their hydrophobicity

More recently: study of adsorption of other volatile organic compounds released by the aging of cellulose acetate materials and films



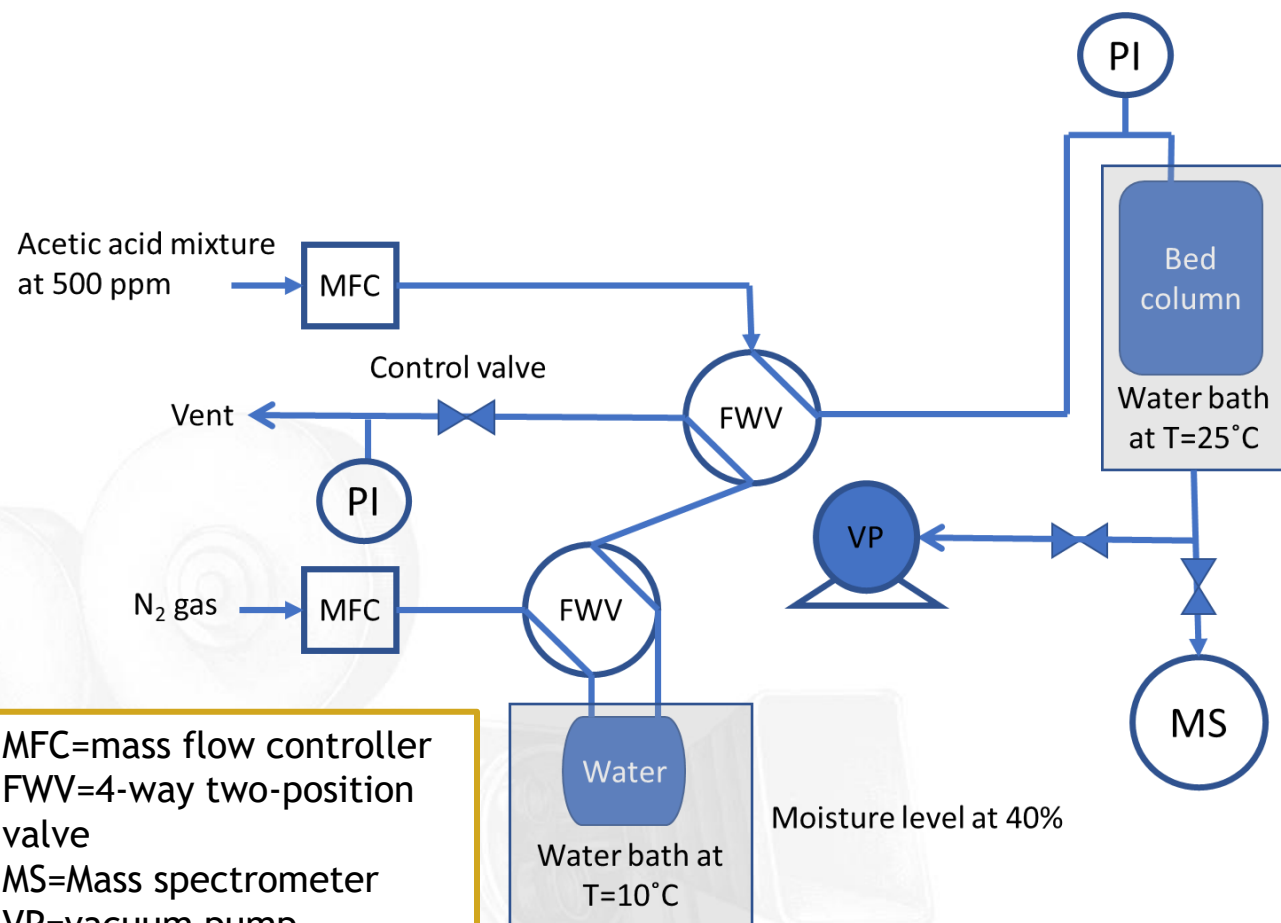
# Single component adsorption isotherms



Dedecker, Kevin, et al. "Metal-Organic Frameworks for Cultural Heritage preservation: the case of acetic acid removal." *ACS applied materials & interfaces* 10.16 (2018)



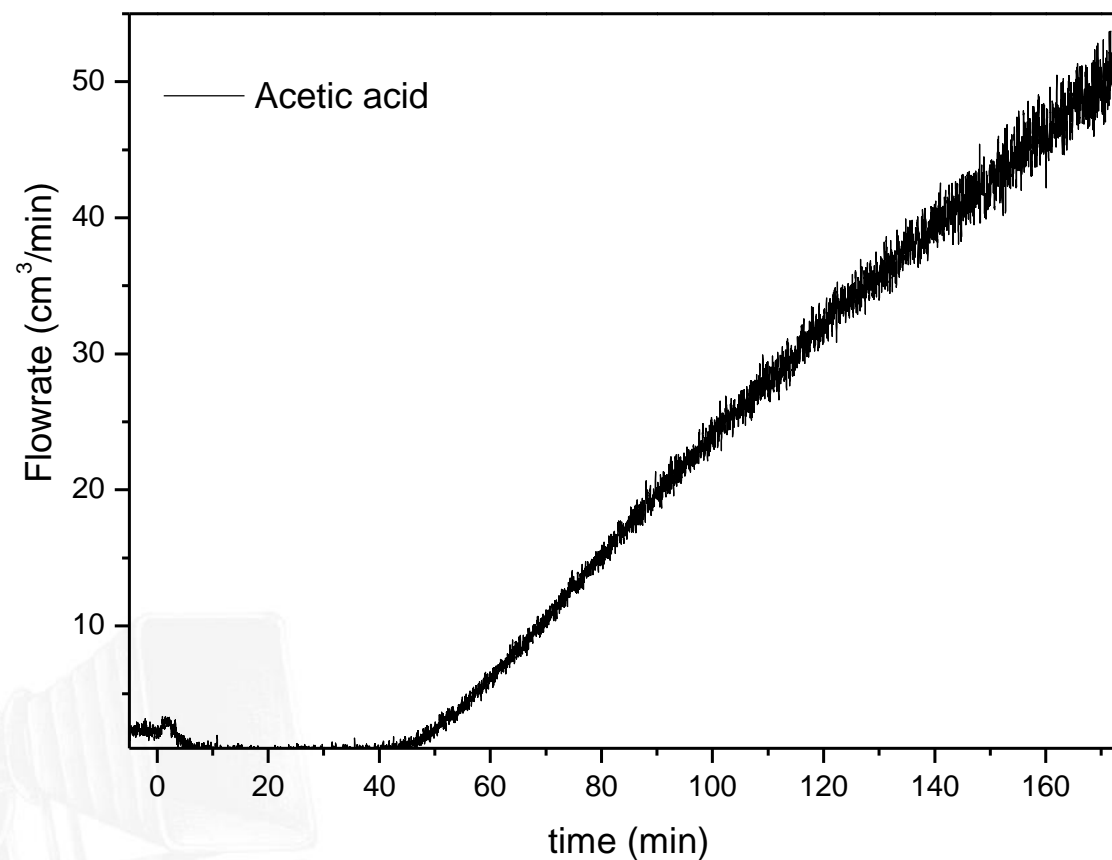
# Mass spectrometer setup with multiple gas inlets



MFC=mass flow controller  
FWV=4-way two-position valve  
MS=Mass spectrometer  
VP=vacuum pump  
PI=pressure sensor

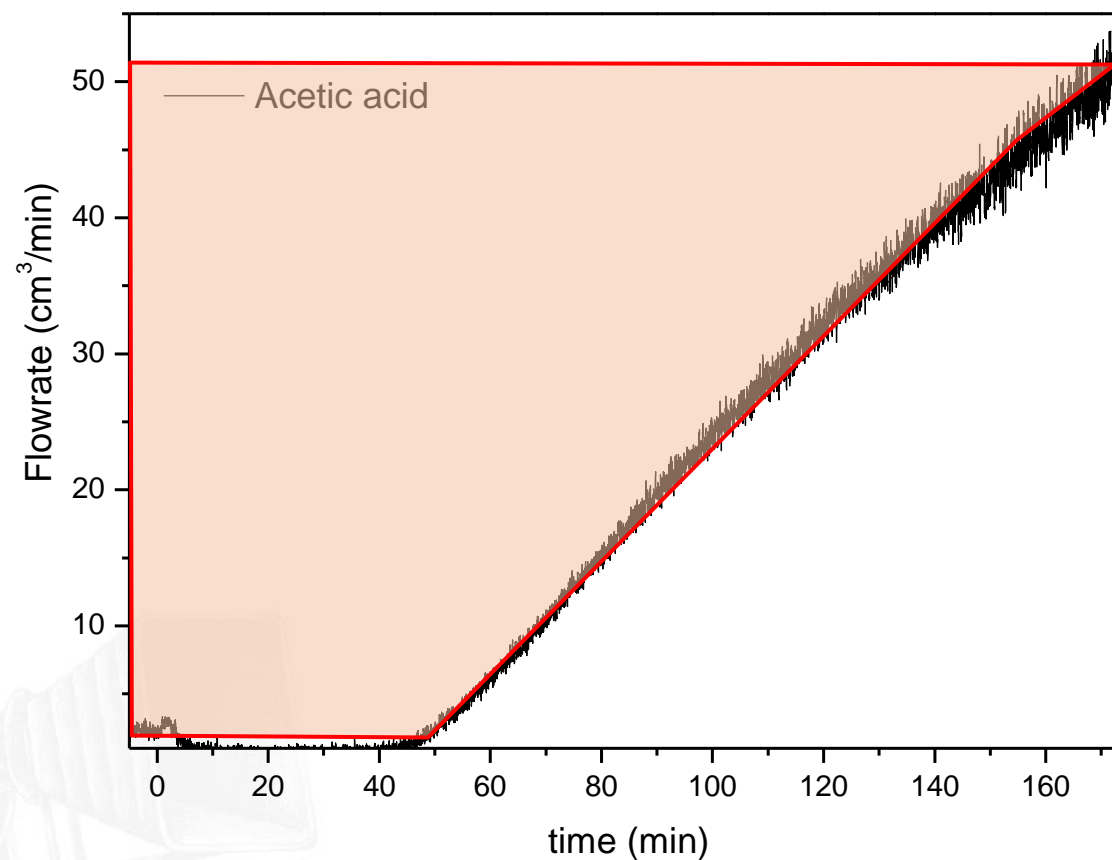


## Breakthrough curves

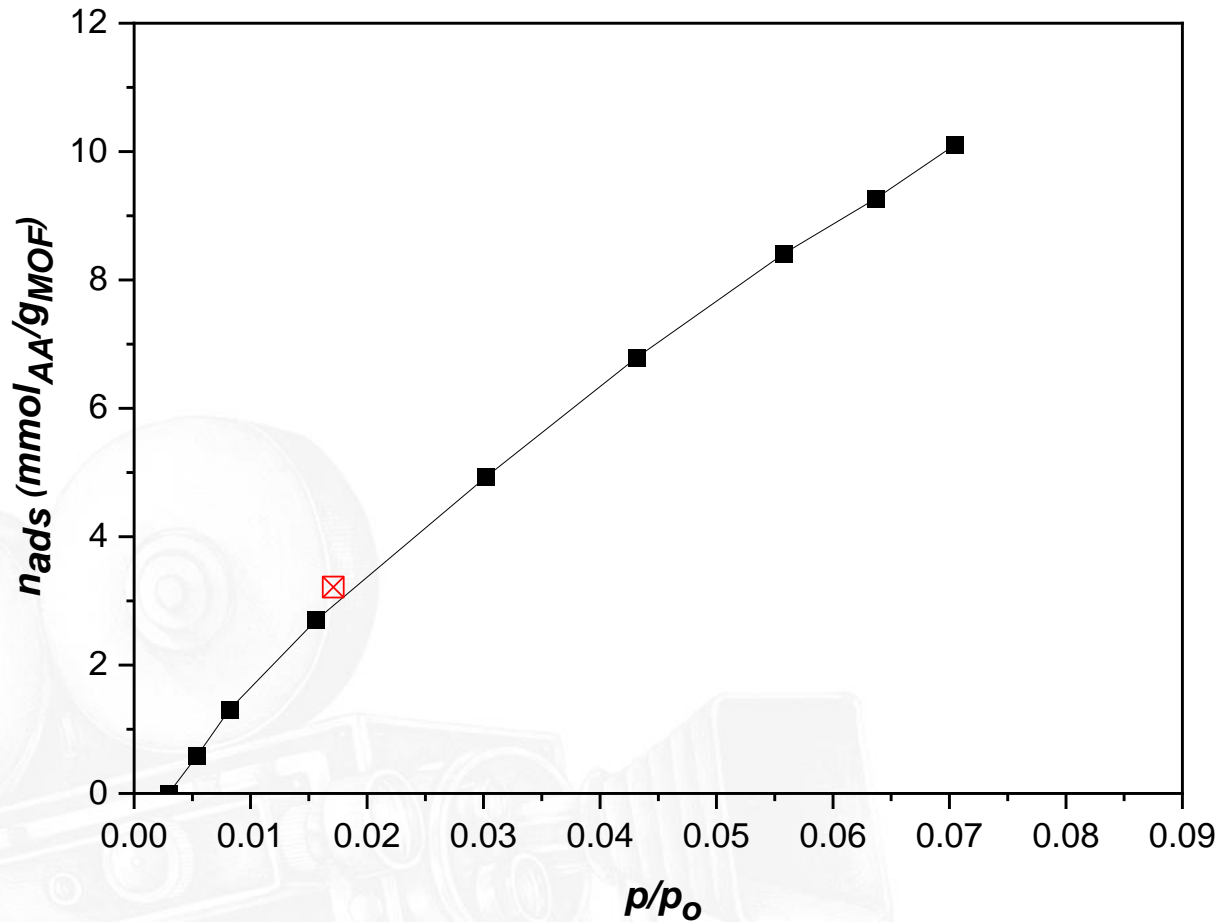




# Breakthrough curves



## Results comparison - cross confirmation of amounts



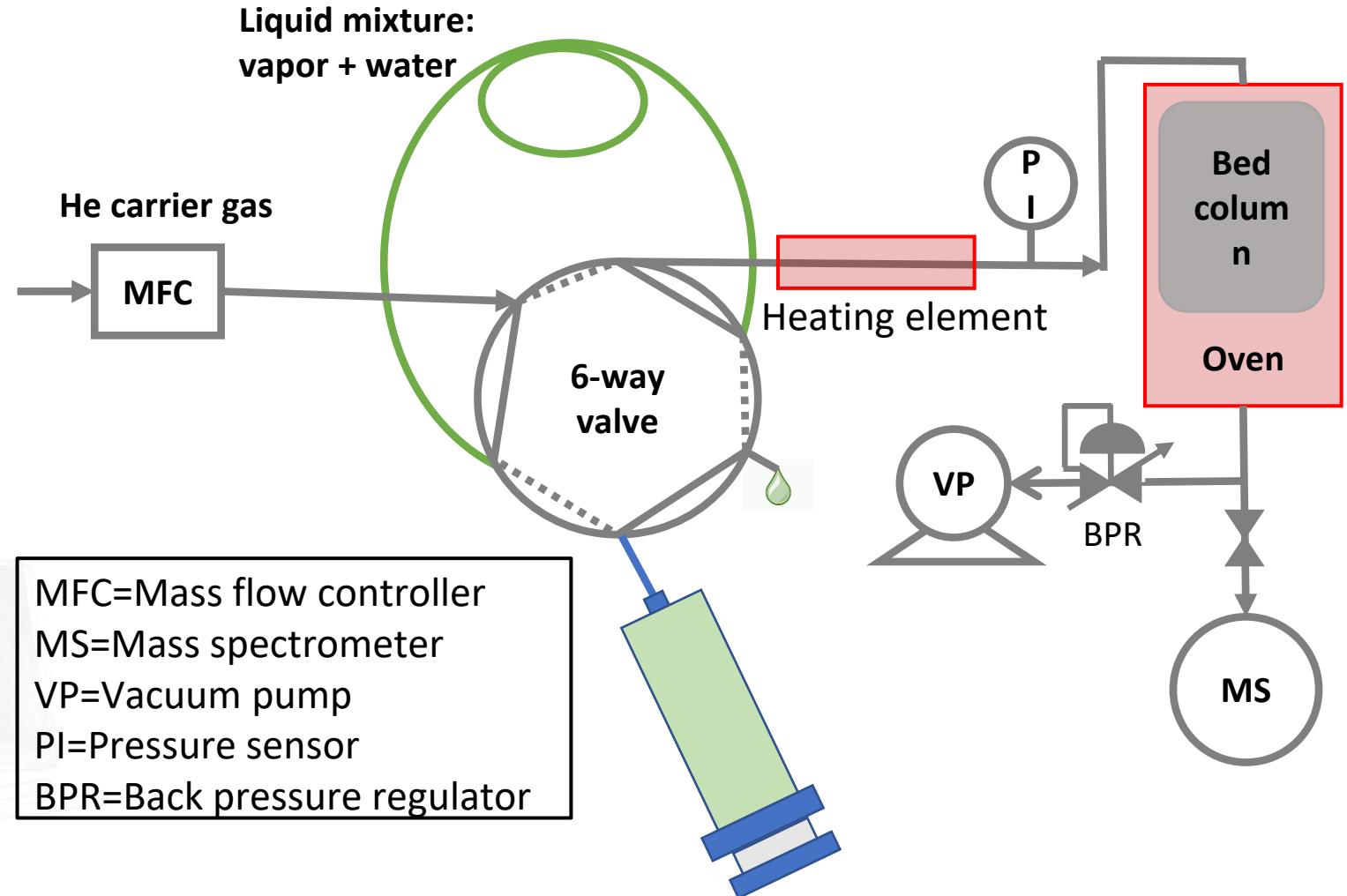
The adsorbed amount using breakthrough experiment is in perfect agreement with that using single component isotherm.

This gives us confidence about the performance of the selected material under moisture (in real life application).



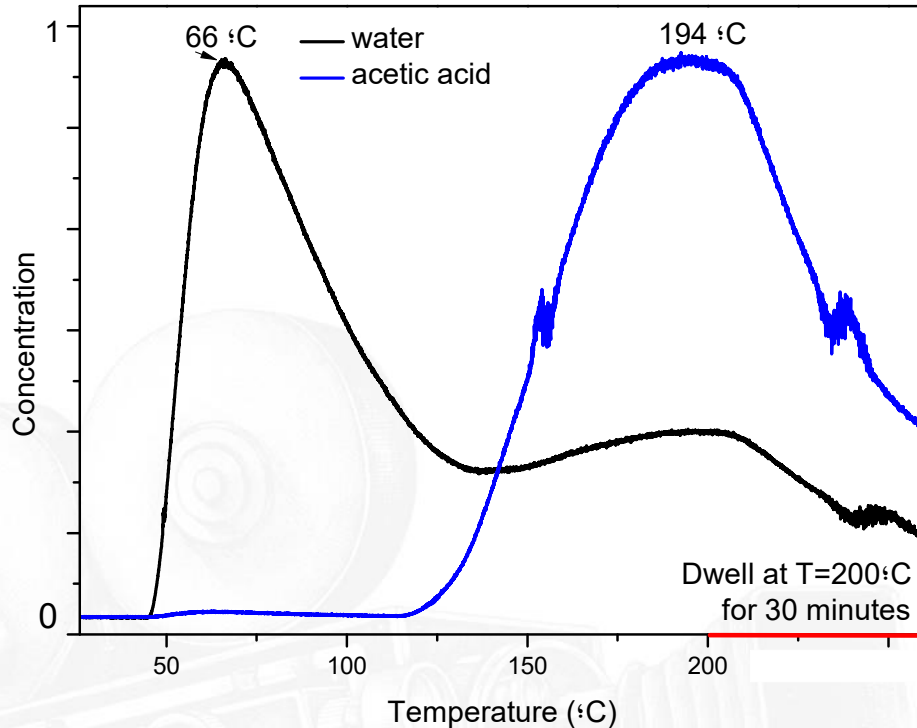
# Temperature Programmed Desorption with mass spectrometry detection

- ❑ Adsorption of 50% water + 50% vapor at room temperature
- ❑ Thermal desorption is achieved by increasing the temperature from 25°C to 200 °C with a ramp of 2°C/min under a He carrier gas flow
- ❑ The desorbed species are recorded as function of time by the mass spectrometer
- ❑ This technique gives a clear idea about the selectivity of the materials between the moisture and studied vapor

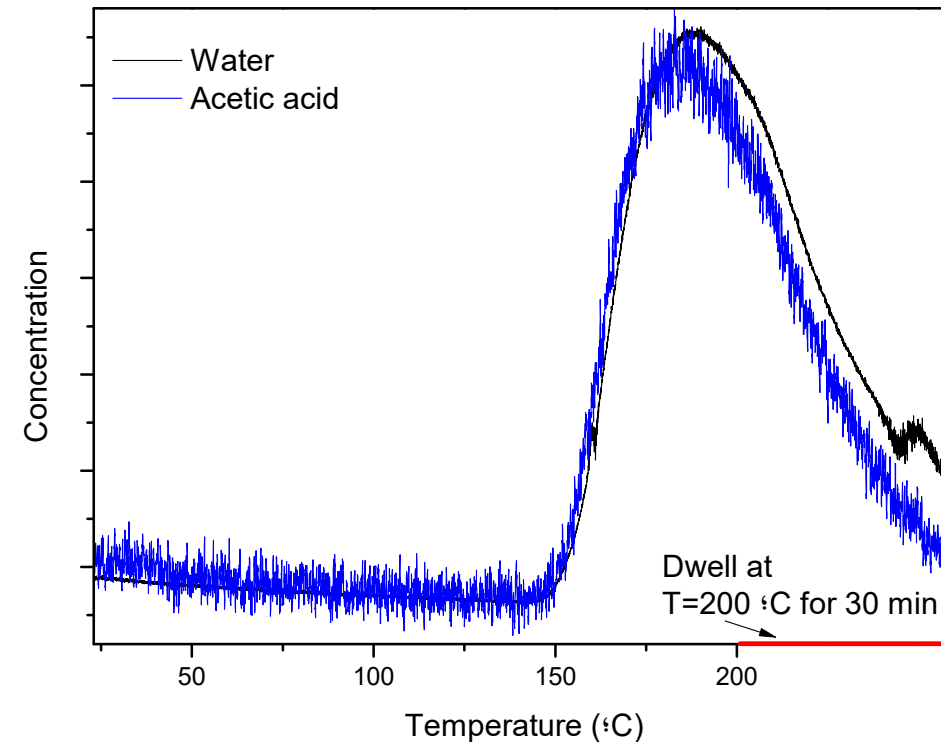


# Temperature Programmed Desorption with mass spectrometry detection

MOF

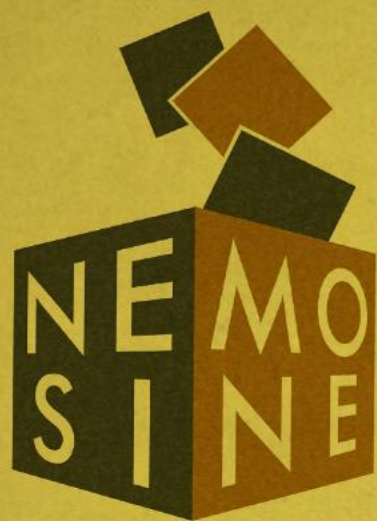


Zeolite NaY



- Water is desorbed mainly at a temperature of 65°C
- Acetic acid desorbs at T=195°C indicating a much higher bonding
- Even higher bonding is observed for the propionic acid, where it only desorbs upon dwelling at T=200°C



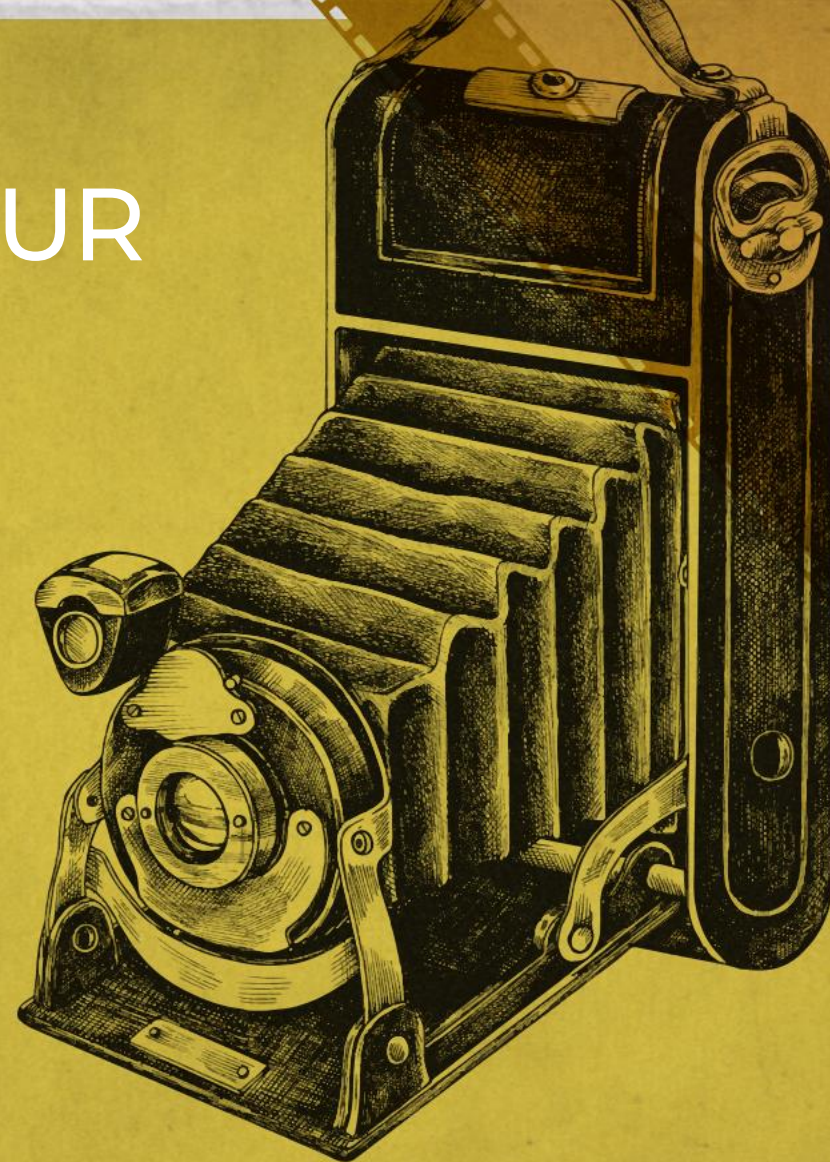


# THANKS FOR YOUR ATTENTION

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**TÉCNICO**  
LISBOA



More info at: [nemosineproject.eu](http://nemosineproject.eu)



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