# New adsorbents for cultural heritage applications: A SIFT-MS study

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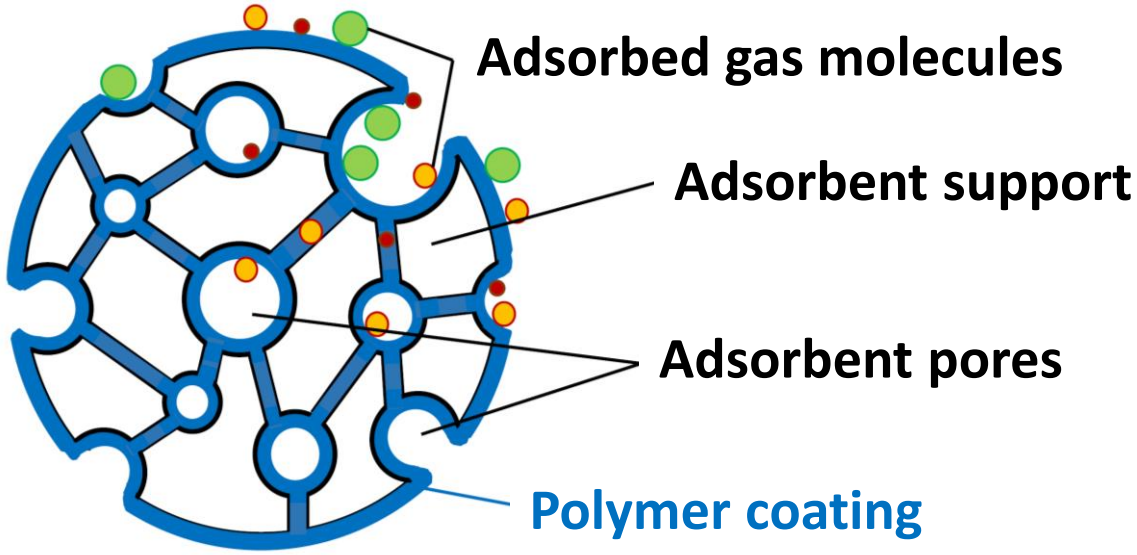
# Background

This study is part of the **Apache project**, with the goal to develop new tools and materials for the preventive preservation of cultural heritage.

**At Chalmers:** Development of new adsorbents for capturing gaseous pollutants that harm cultural heritage.

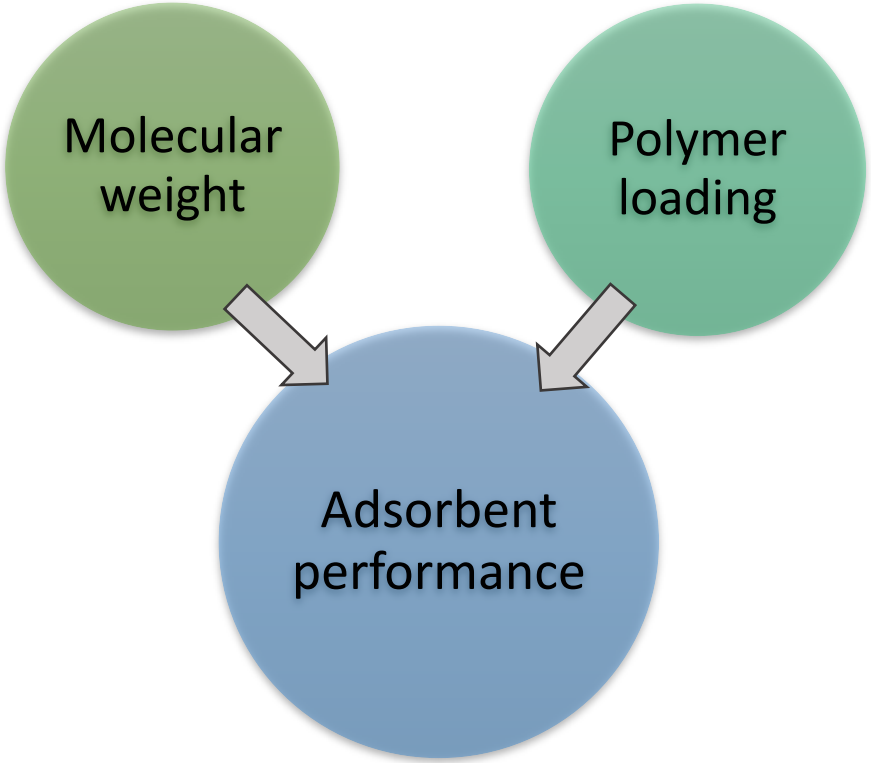
**The aim of this study:** determine adsorption / desorption performance when exposed to pollutants.

# The adsorbent




## Research questions:

- What is the effect of **polymer loading** on adsorption / desorption?
- What is the effect of polymer **molecular weight** on adsorption/ desorption?

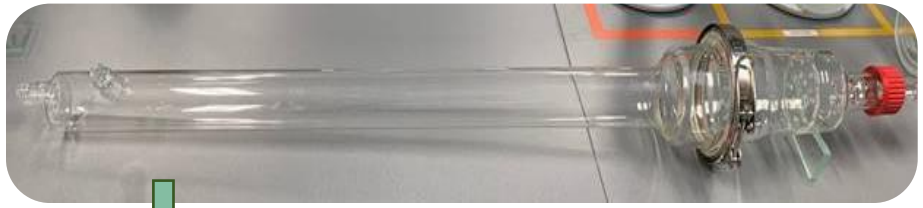


# SIFT-MS

**S**elected-**i**on **f**low-**t**ube **m**ass **s**pectrometry

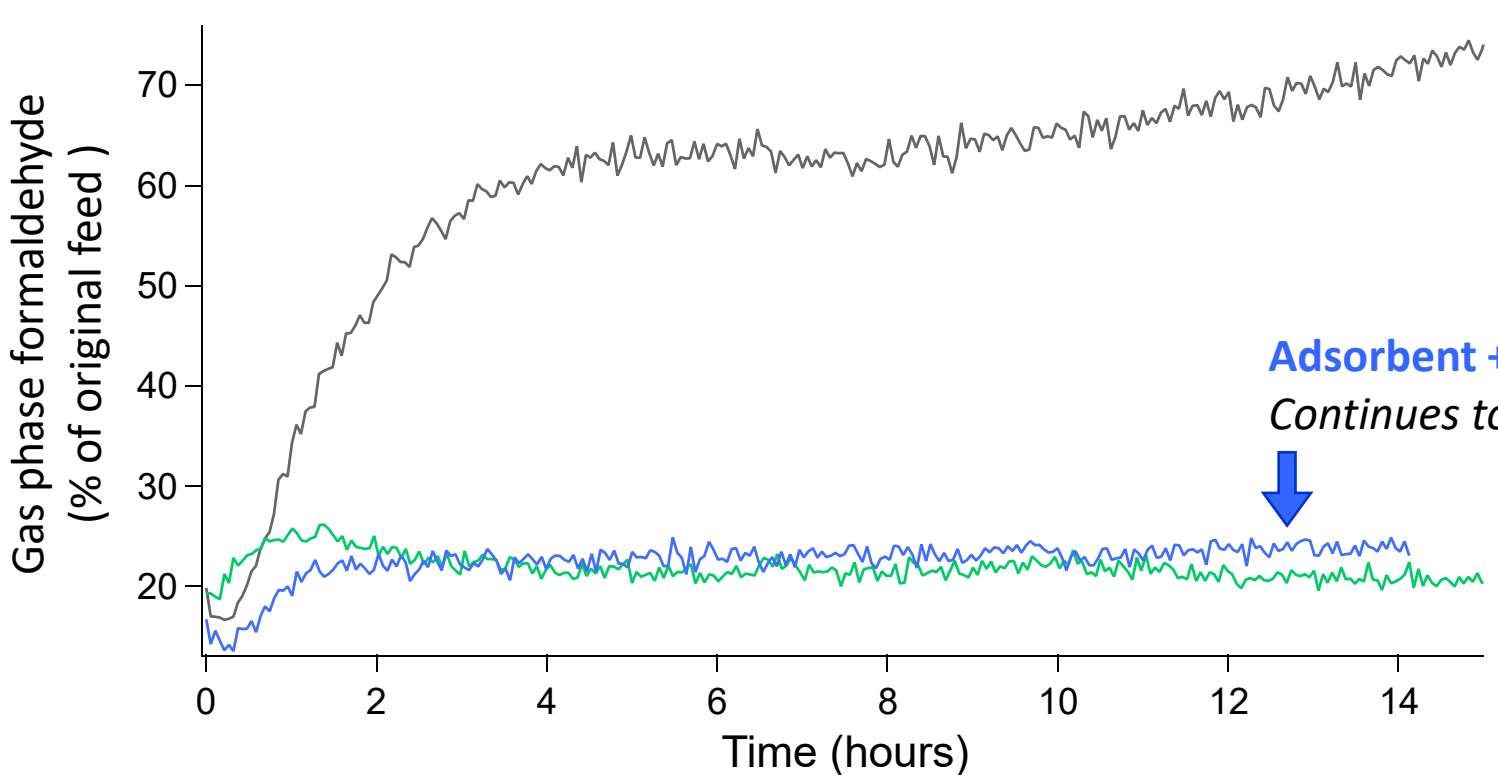
- Real-time gas phase analysis
- Quantitative
- Detection of low (< 1 µg/m$^3$) concentrations
- Adsorption and desorption analysis

3 liter chamber for gas flow, contains 50 mg of adsorbent in aluminum boat:



# Results - adsorption

*Formaldehyde gas*
*Original feed concentration: 85 µg/m³*
*Flow rate: 28 mL/min*
*Sample amount: 50 mg*



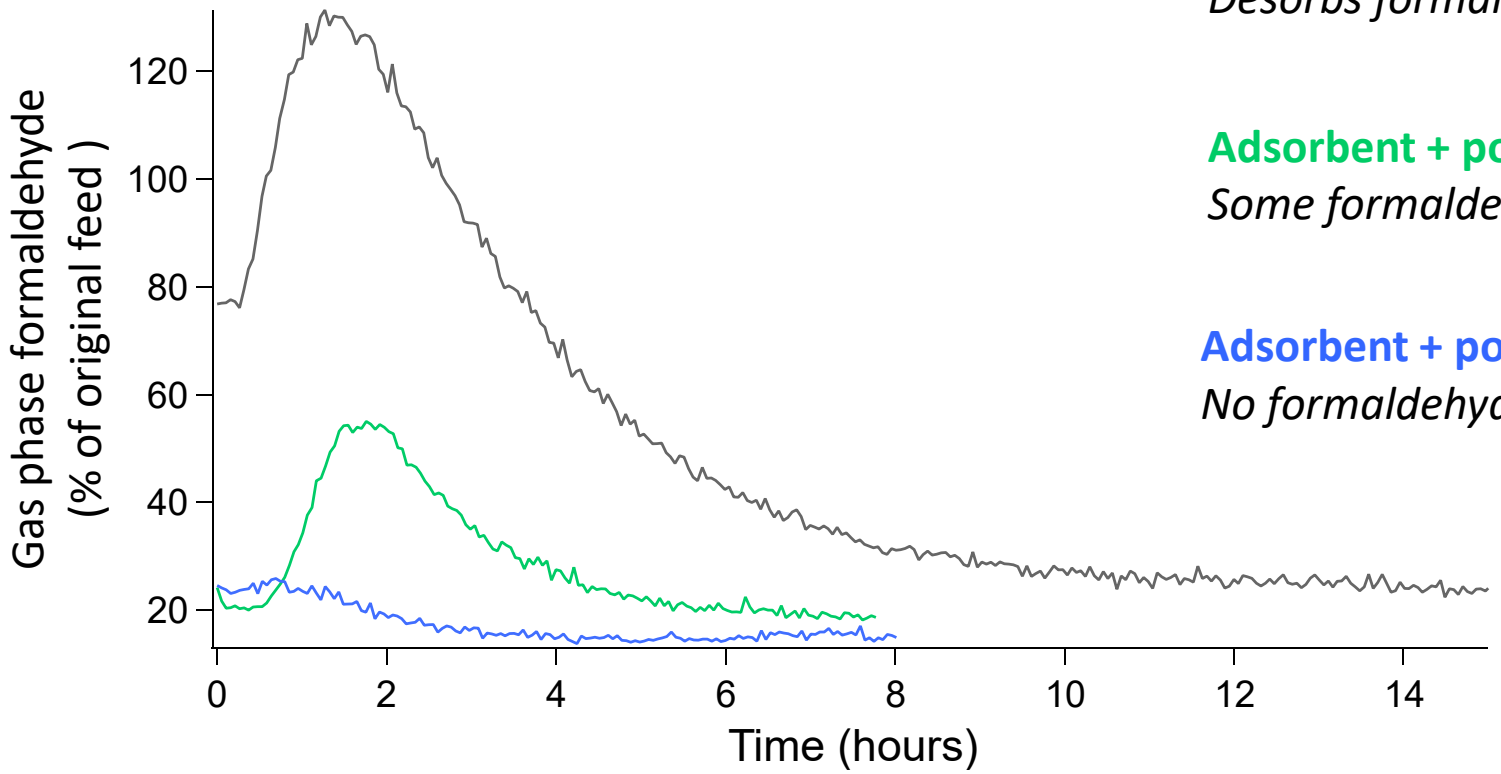

**Adsorbent, no polymer**
*Begins to saturate at 4 hours*

**Adsorbent + polymer, high Mw**
*Continues to adsorb at 14 hours*

**Adsorbent + polymer, low Mw**
*Continues to adsorb at 14 hours*

# Results - desorption

*Fresh air flow, formaldehyde gas turned off*
*Flow rate: 28 mL/min*
*Sample amount: 50 mg*




**Adsorbent, no polymer**
*Desorbs formaldehyde - **physisorption***

**Adsorbent + polymer, low Mw**
*Some formaldehyde desorption – **physi + chemisorption***

**Adsorbent + polymer, high Mw**
*No formaldehyde desorption - **chemisorption***

# Conclusions

Polymer-coated adsorbent shows promise as new material for conservation

- Polymer increases adsorption capacity
- Provides chemisorption capabilities
- High Mw further reduces desorption

**Future:** Continue study with other gases: acetic acid and formic acid

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