

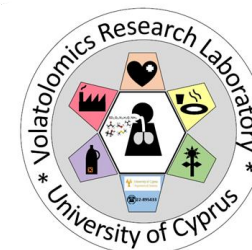


Aerial signatures in libraries

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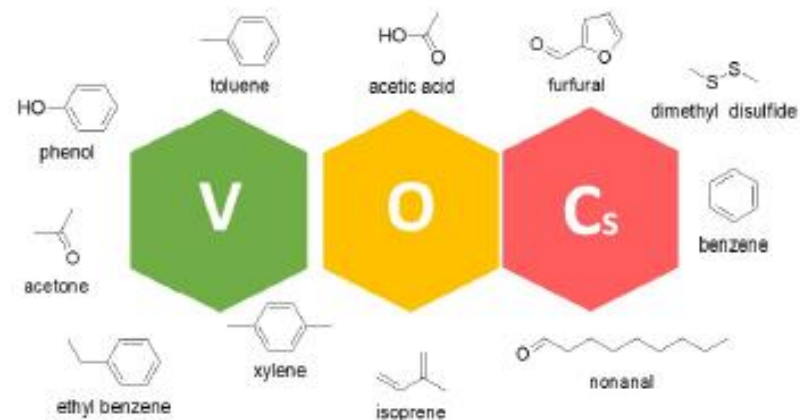
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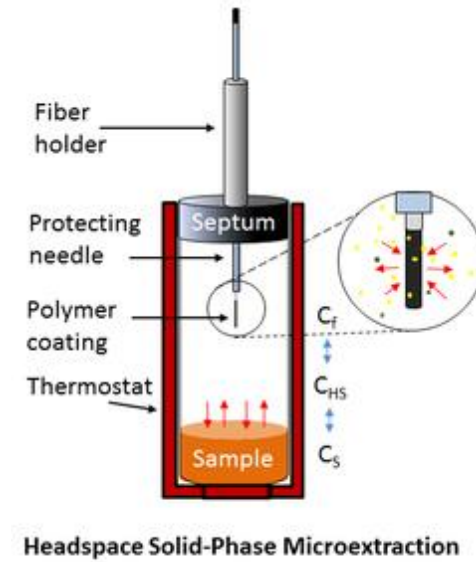
Introduction

- Indoor air quality (IAQ) has attracted a lot of attention due to its complexity and direct effect on human health.
- Indoor settings in libraries entail various volatile organic compounds (VOCs) linked to the aging and degradation of print material;
 - ❖ this is particularly interesting for archival collections and can be used to monitor their degradation over time.



Methodology

- The effect of the storage environment on paper life expectancy by targeting the VOC emissions of old and new books was performed using the headspace solid-phase micro extraction-gas chromatography/mass spectrometry (HS-SPME-GC/MS) analysis.



Learning Resource Centre "Stelios Ioannou"



Experimental Part

Number: 28 different books (19 old, 9 new) / from 1640 to 2018

Source: University of Cyprus Library

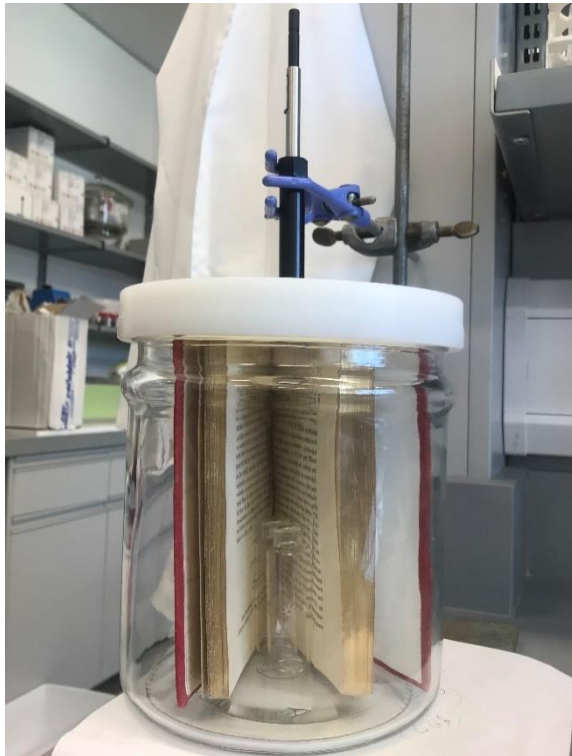
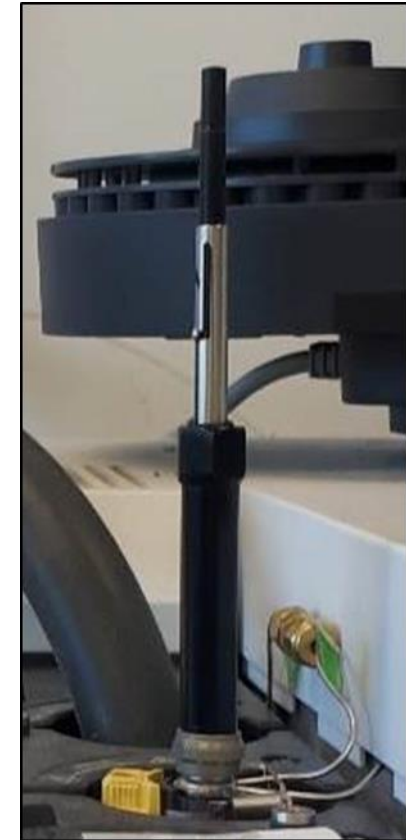


Fig 1: (a) The HS-SPME-GC/MS sampling procedure



(b) Zoom-in to the enclosed jar



(c) VOCs desorption



Case study

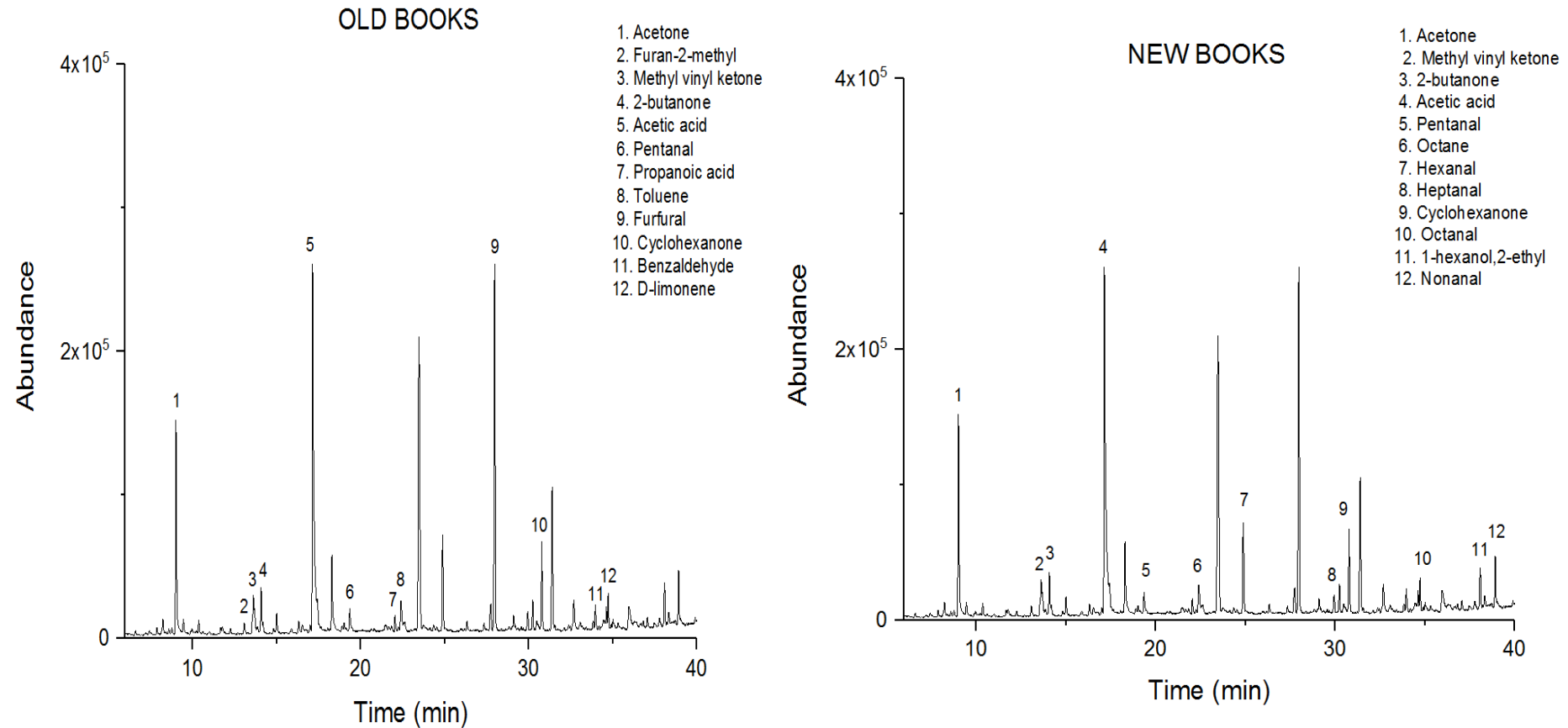


Figure 2: (a) typical chromatogram of old books

(b) typical chromatogram of new books



Case study

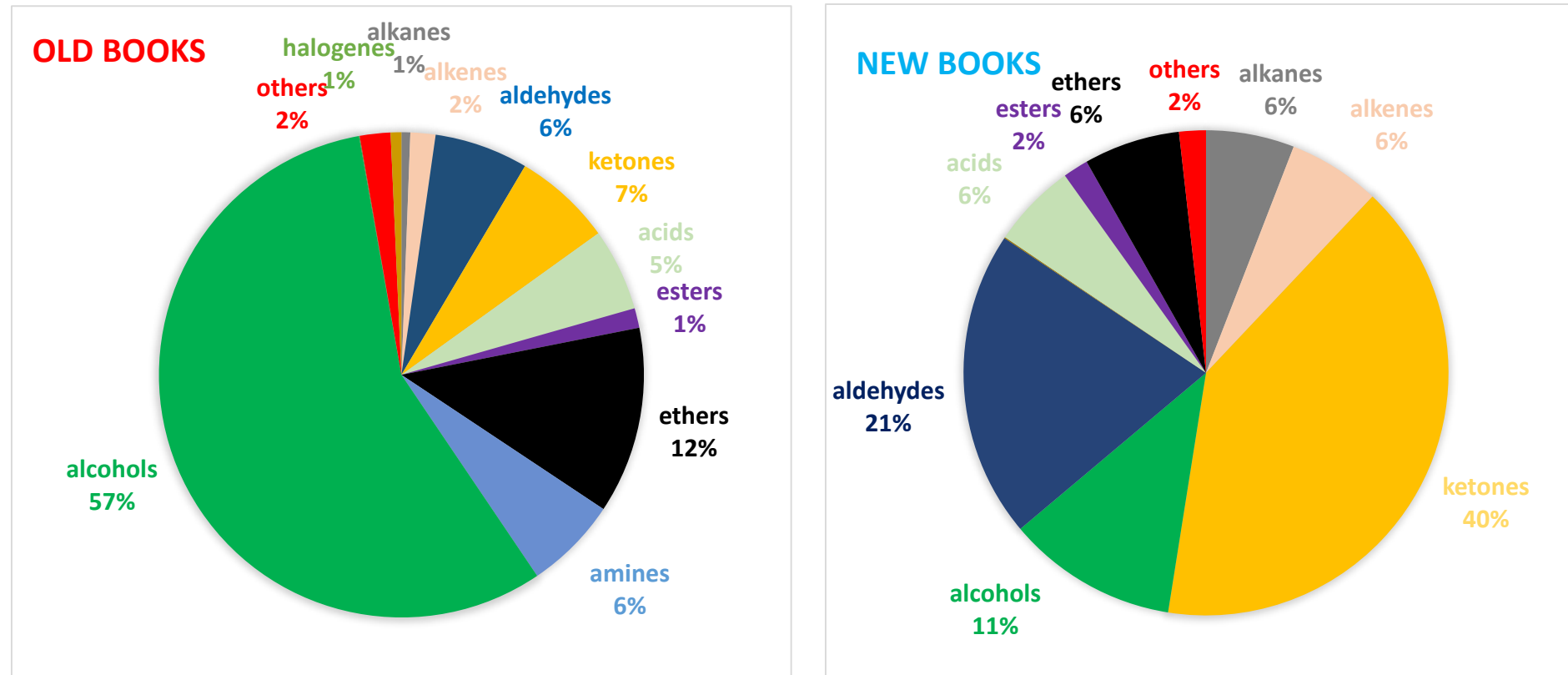


Figure 3: Chemical classes of emitted VOCs

The most prominent VOCs evolved from **old books** are **furfural, acetic acid and acetone**. Moreover, the components of old books are **mostly alcohols, ethers and ketones/aldehydes**.

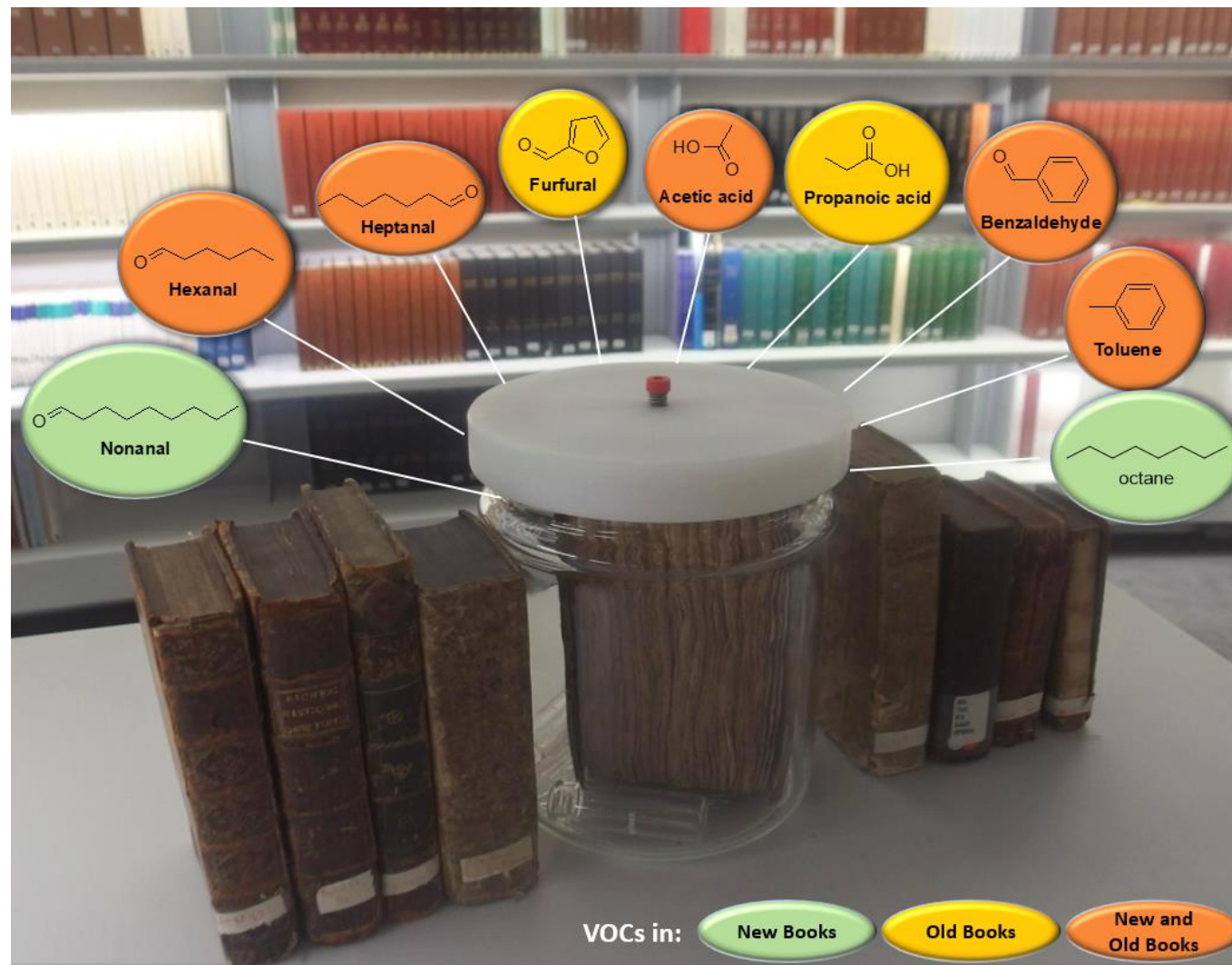
The most prominent VOCs evolved from **new books** are **pentanal, acetone and heptanal**. The main components of new books are **mostly ketones, aldehydes and alcohols**.



Results

➤ Chemometric processing of the results with principal component analysis (PCA) corroborated our initial observations and was able to discriminate the books by age into three groups:

1. very old books (from the 1600s to mid-1700),
2. old books (from the 1800s to the early 1900s), and
3. modern books (from the mid-20th century onwards) based on their gaseous markers.

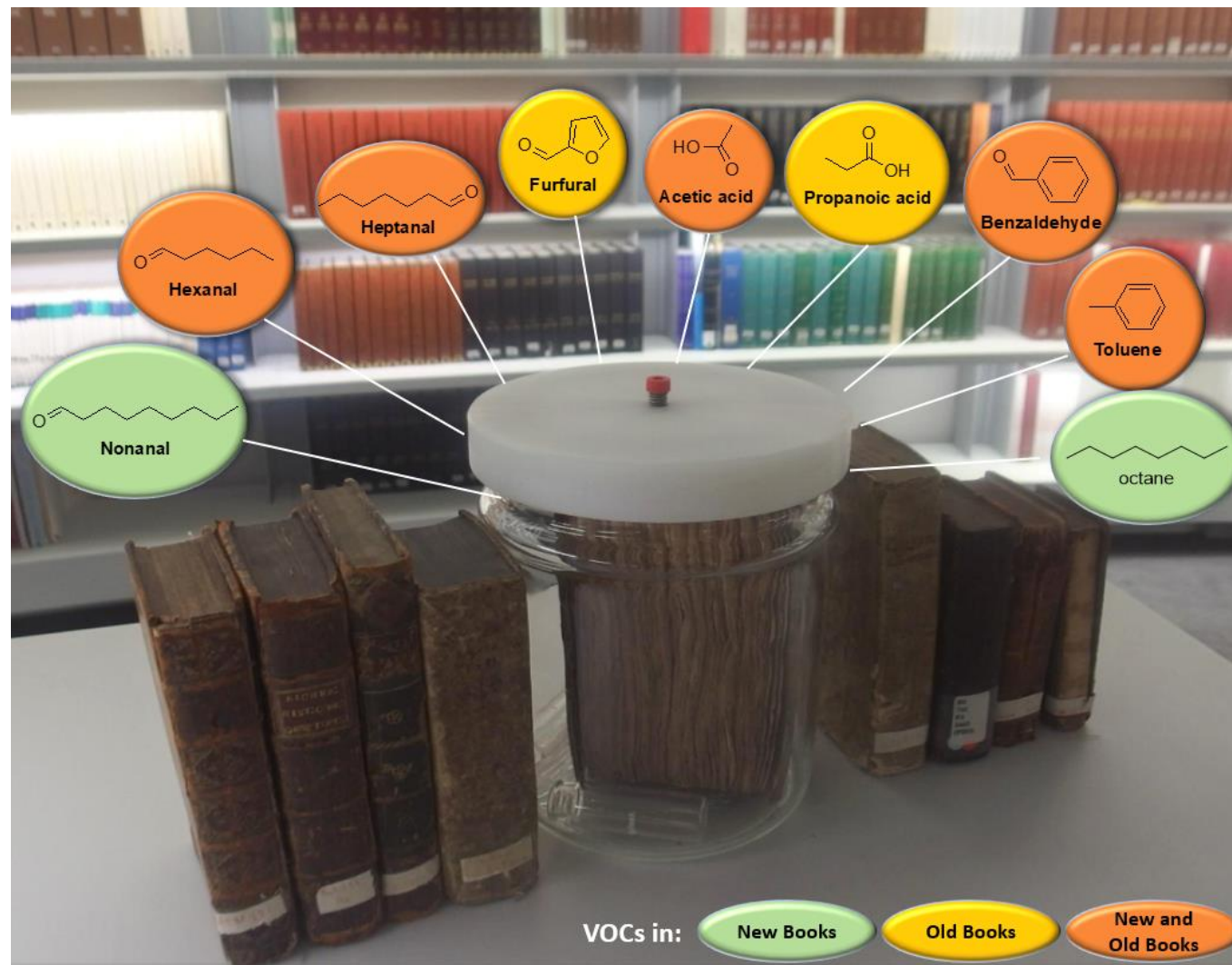


PCA analysis of old and new books



Conclusions

- The applied non-invasive, green analytical methodology (HS-SPME-GC/MS) can assist librarians, stakeholders, and researchers to evaluate the IAQ, as well as the degree of degradation, and take the appropriate measures for items restoration and monitoring protocols.



PCA analysis of old and new books





THANK YOU !

