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# Analysis of Human 'Scent' by sorptive extraction

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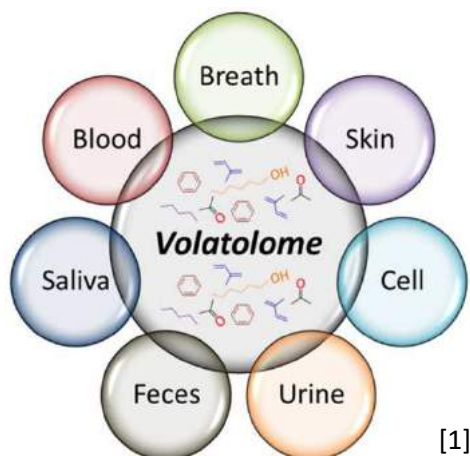


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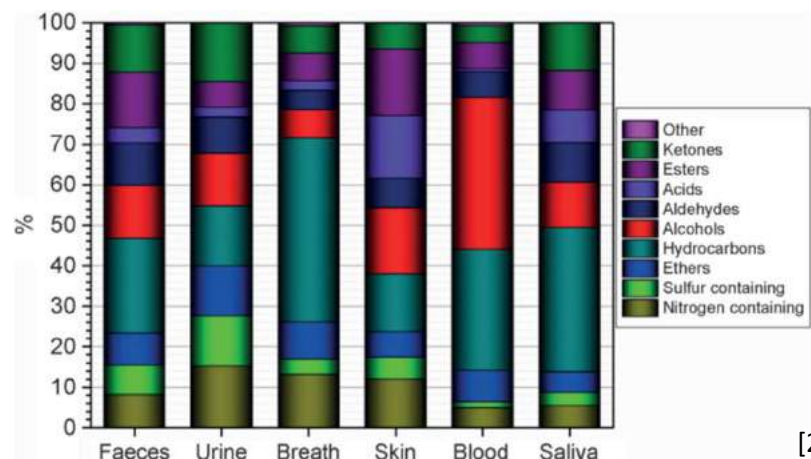
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# Human Body 'Scents'

- Origin



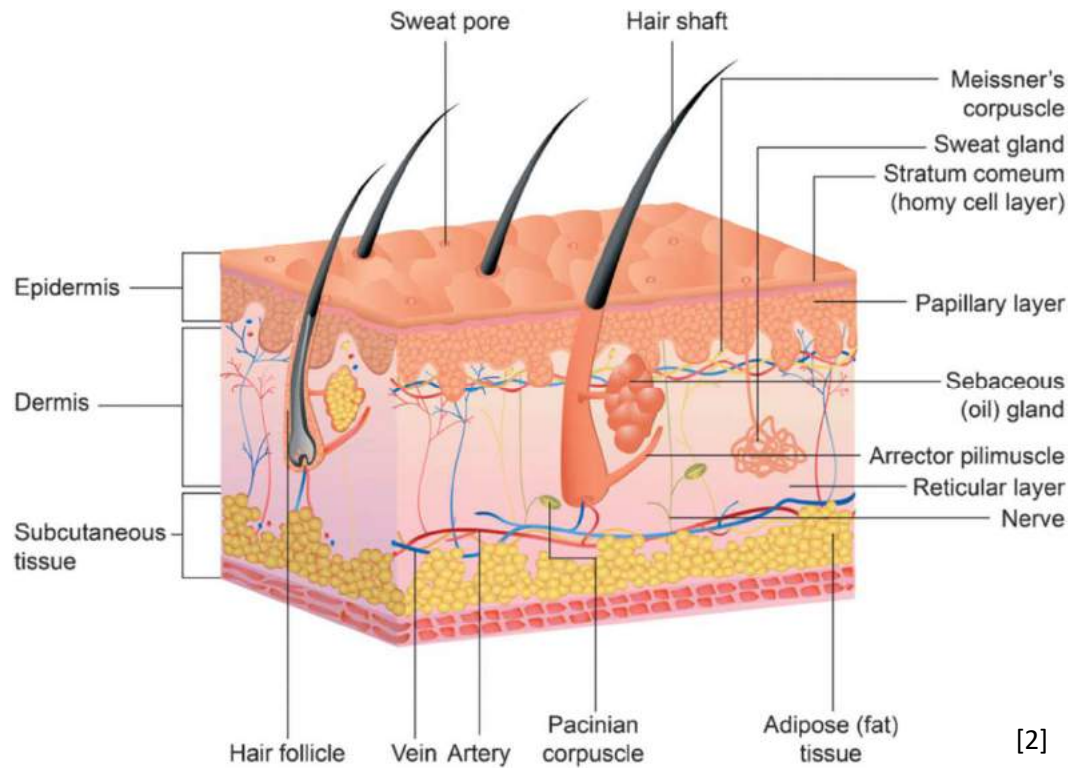
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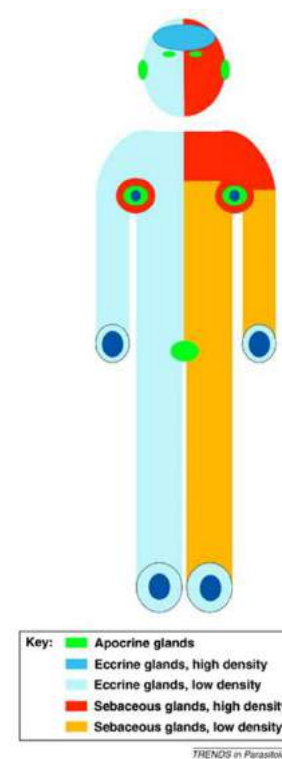
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- Application
  - » Biomonitoring
  - » Pharmacokinetics
  - » Forensic investigations
  - » Disease monitoring

# 'Scent' of Human Skin

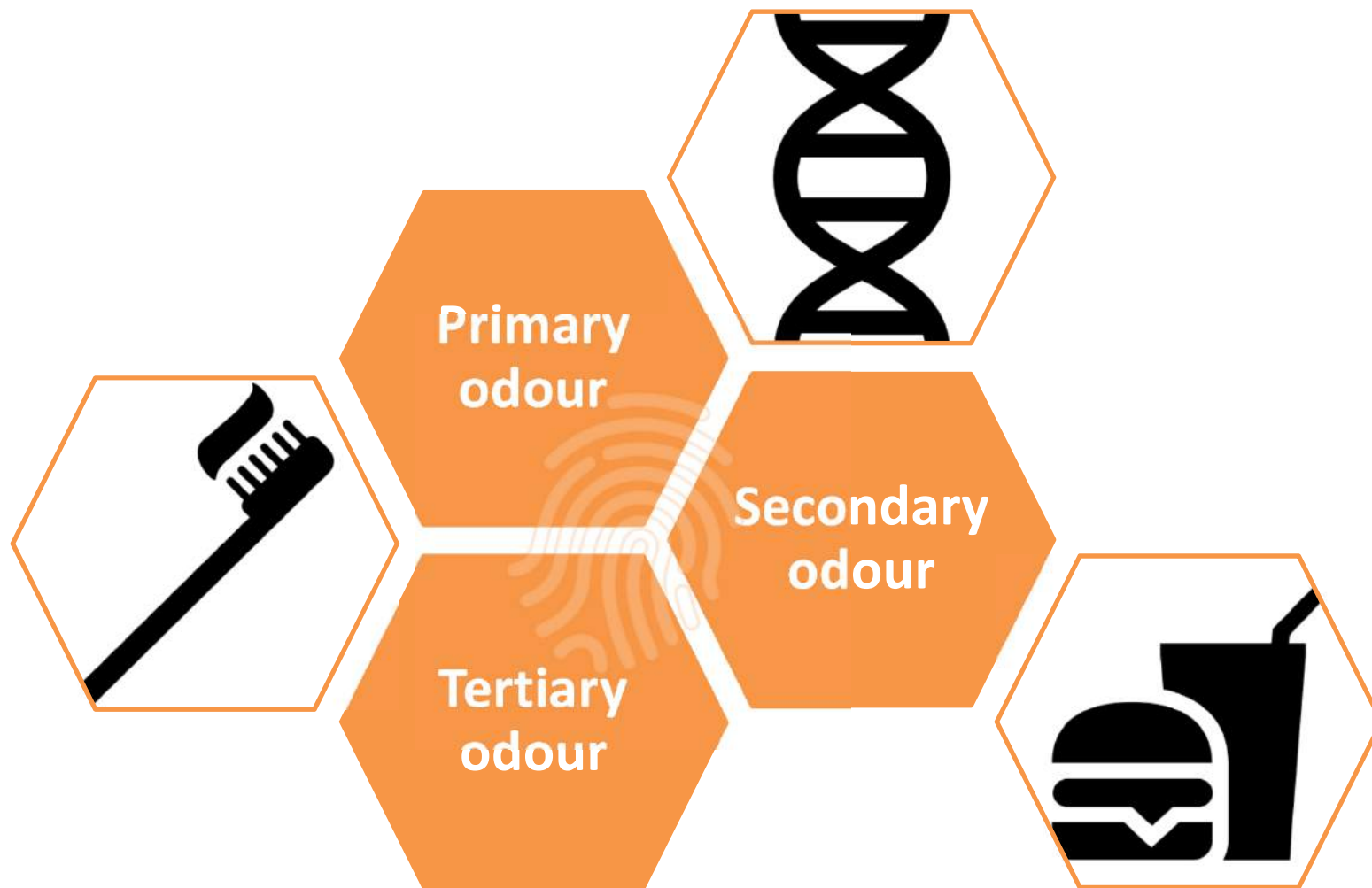


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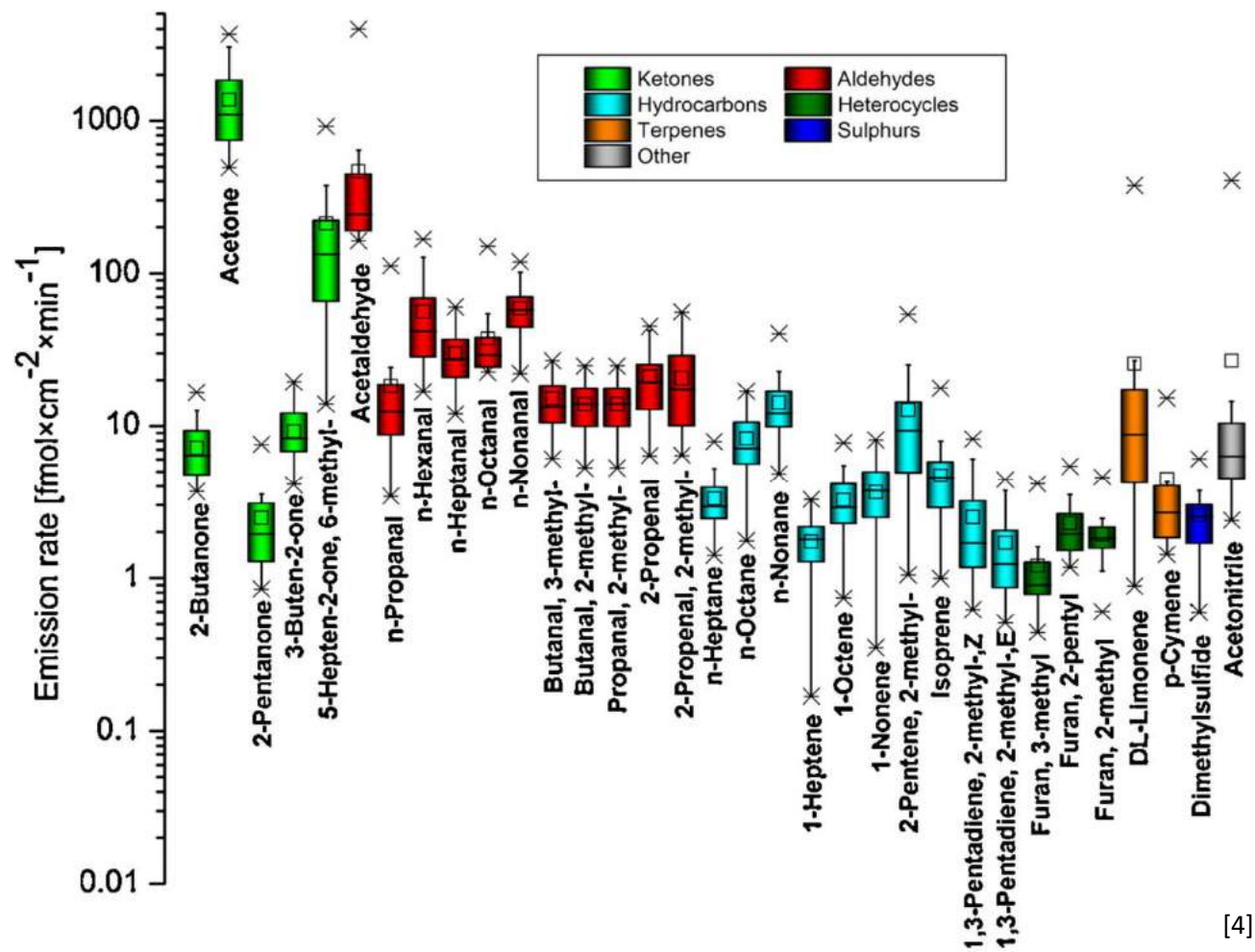


[3]

# 'Scent' of Human Skin – Classification

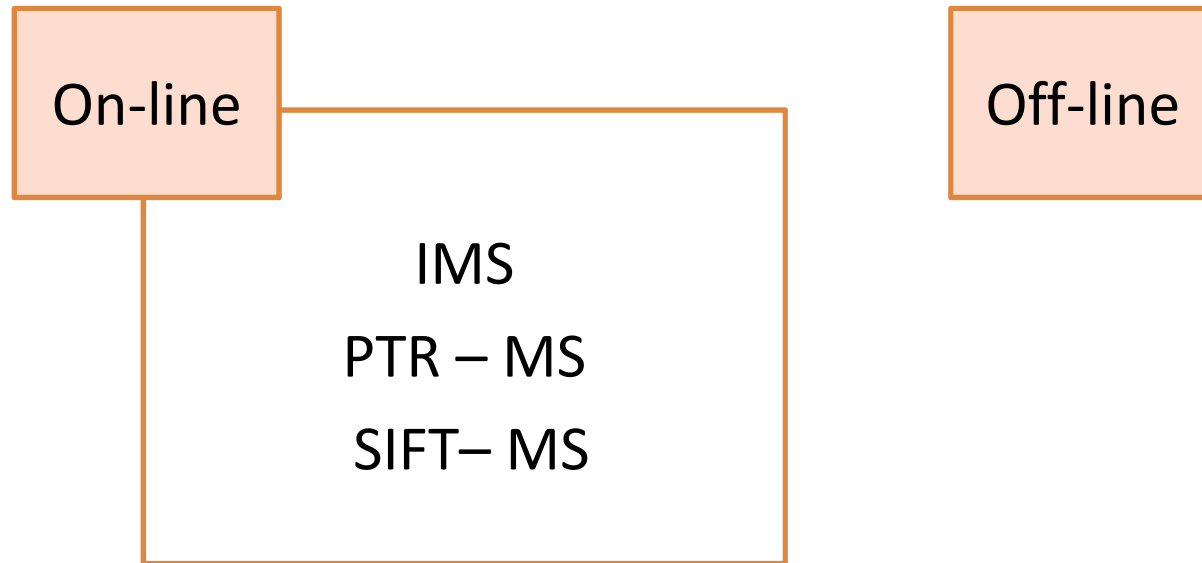


# 'Scent' of Human Skin – Composition



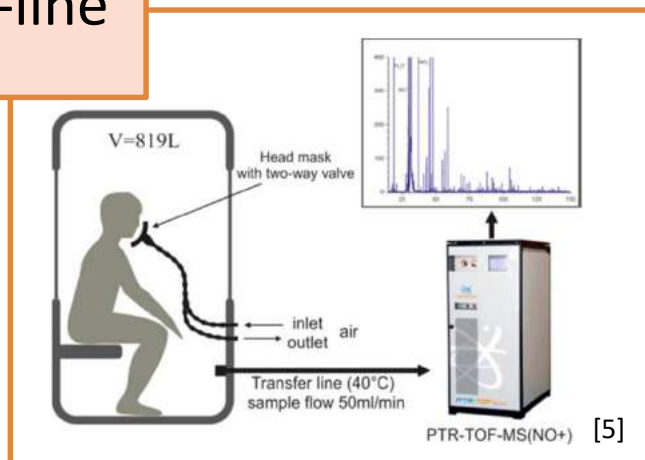
[4]

# 'Scent' of Human Skin – Analysis Methods



# 'Scent' of Human Skin – Analysis Methods

On-line



Off-line



# 'Scent' of Human Skin – Analysis Methods

On-line



**Time-resolved  
Real-time**

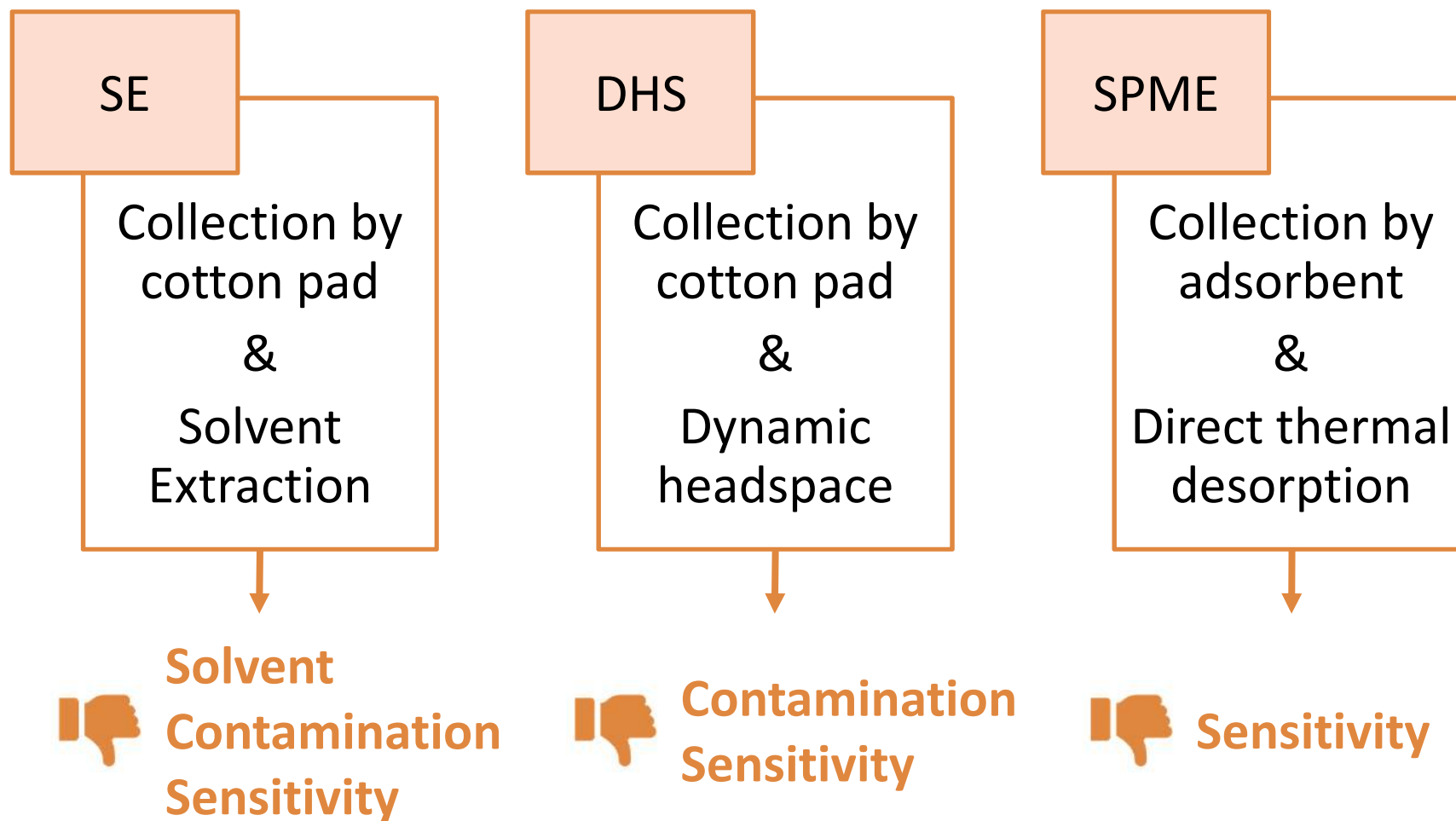
Off-line

Sample Collection  
&  
GC – MS



**Sensitive  
Selective**

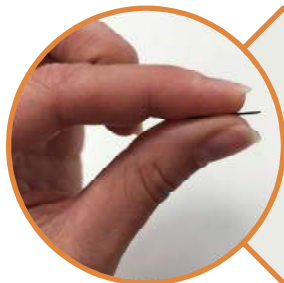
# 'Scent' of Human Skin – Sample Collection Methods



# 'Scent' of Human Skin – Sorptive Extraction Methods



SBSE



Thin film – SPME



Thin film – Membrane

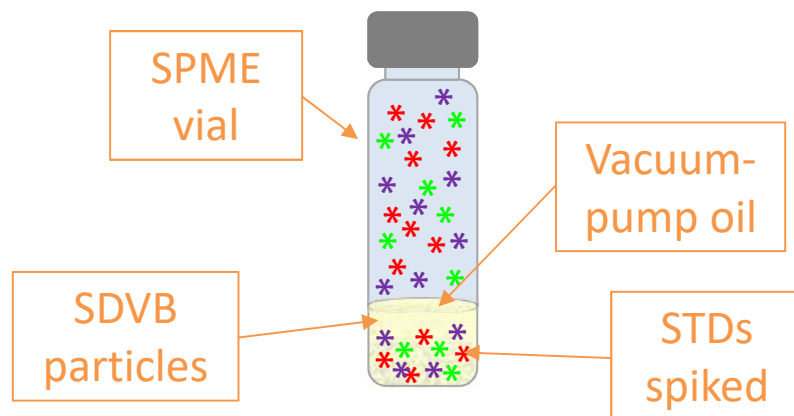


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# Sorptive HS Extraction – Evaluation

- In-vial standard gas system (Pawliszyn Research Group)



**Reproducible  
Reusable**

- STDs spiked

Nonane, Decane, Undecane, Dodecane, Hexanal, Octanal, Nonanal, Decanal, Ethylbenzene, p-Xylene, o-Xylene, DI-Limonene

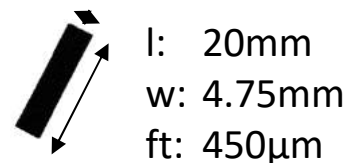
# Sorptive HS Extraction – Sampling

- Sorptive sampling devices

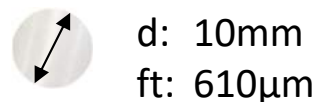
- Twister GERSTEL – PDMS



- TF-SPME GERSTEL –DVB/PDMS



- TF-Membrane PDMS



- HS Extraction



# TD – GC-MS – Analysis

- TD(U) – GC-MS



Agilent  
5977A  
MSD



- TD(3.5+) – GC-MS

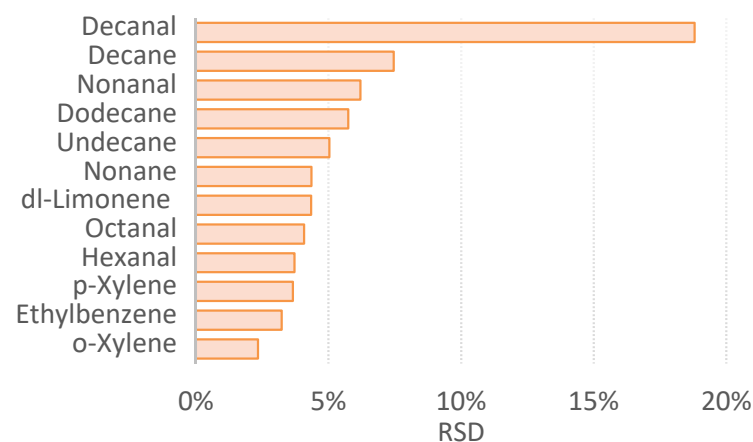


Agilent  
5977B  
MSD (HES)

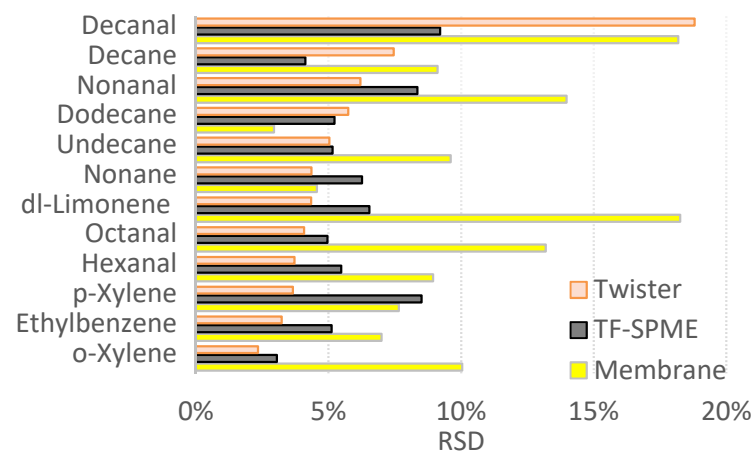


# In-vial Sorptive HS Extraction – Repeatability

- / Twister GERSTEL
  - » PDMS
  - » length 20mm
  - » film thickness 1mm

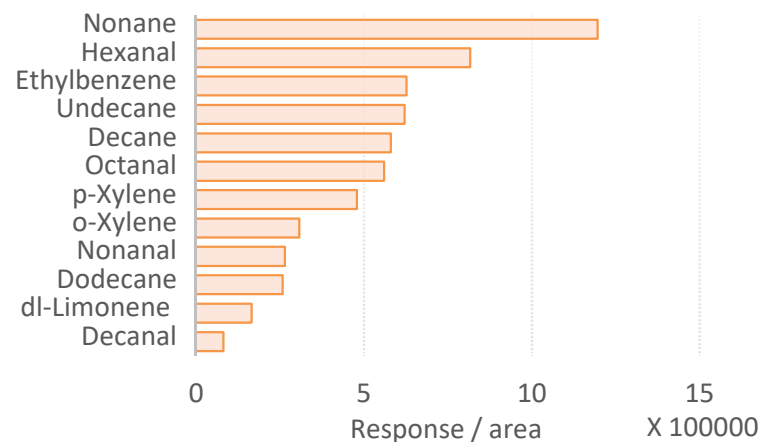


- / Twister GERSTEL – PDMS
- / TF-SPME GERSTEL – DVB/PDMS
- TF-Membrane PDMS

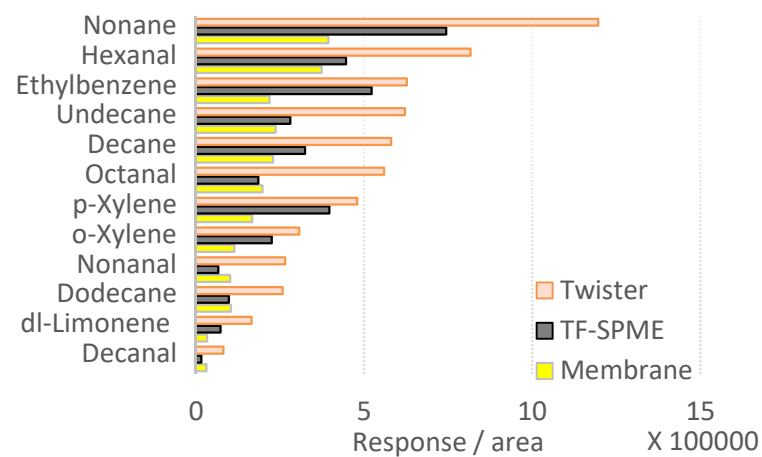


# In-vial Sorptive HS Extraction – Extraction efficiency

- / Twister GERSTEL
  - » PDMS
  - » length 20mm
  - » film thickness 1mm

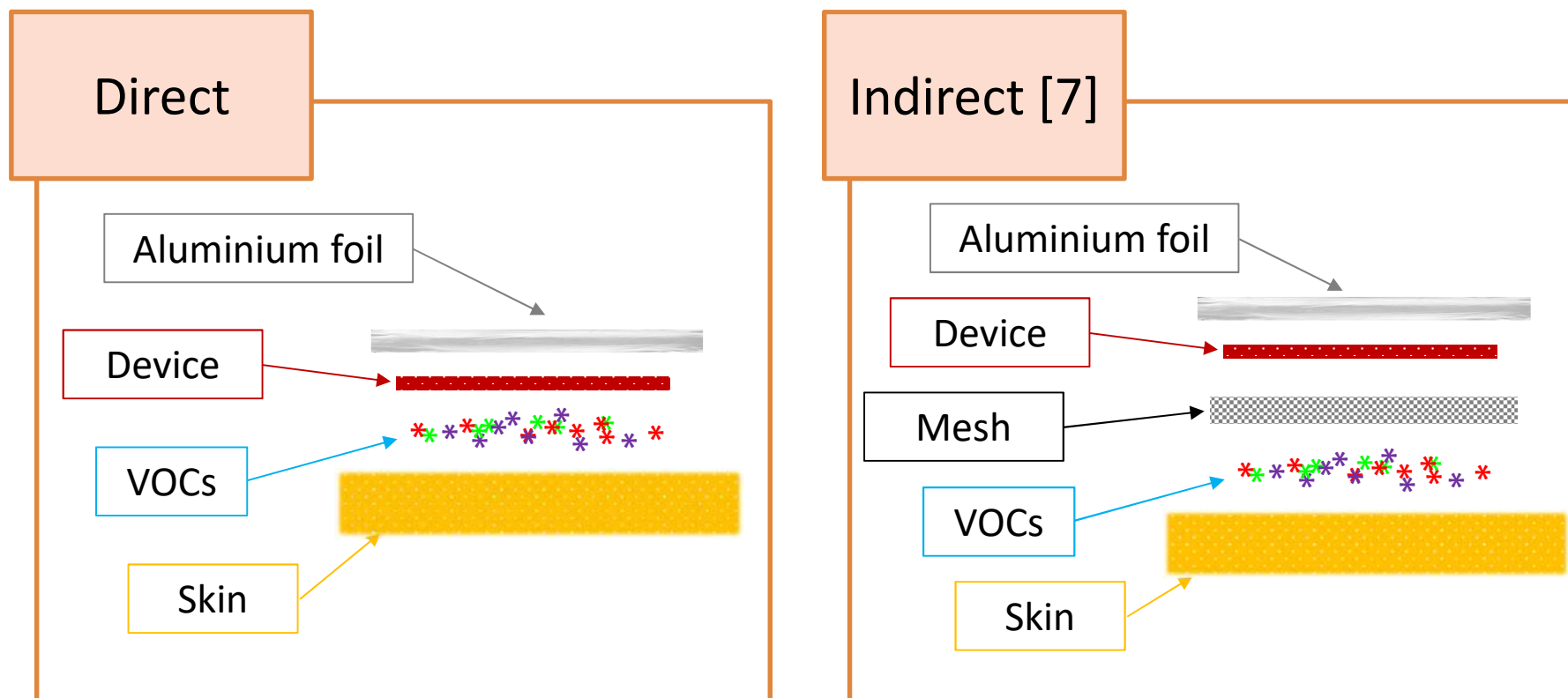


- / Twister GERSTEL – PDMS
- / TF-SPME GERSTEL – DVB/PDMS
- TF-Membrane PDMS



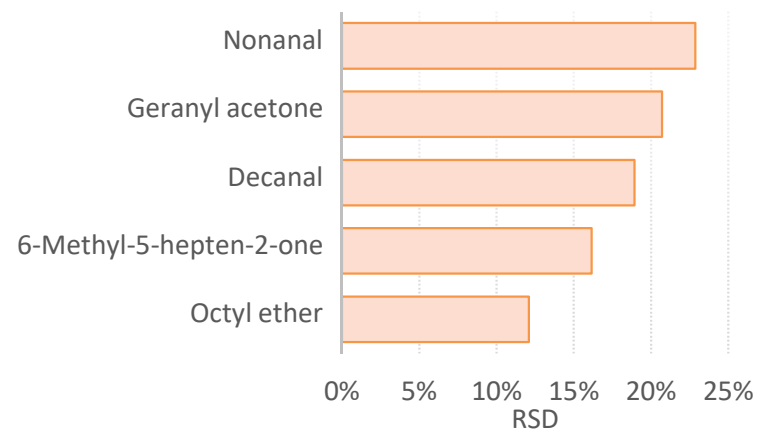


# 'Scent' of Human Skin – Sampling setups

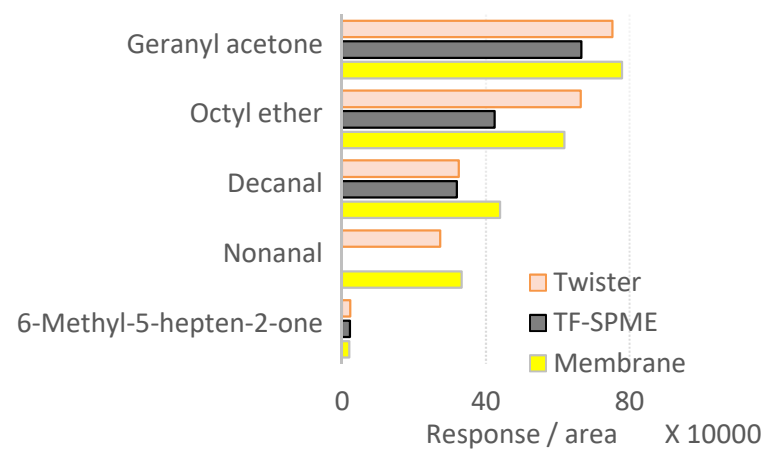


# 'Scent' of Human Skin – direct Sampling

- / Twister GERSTEL
  - » PDMS
  - » length 20mm
  - » film thickness 1mm

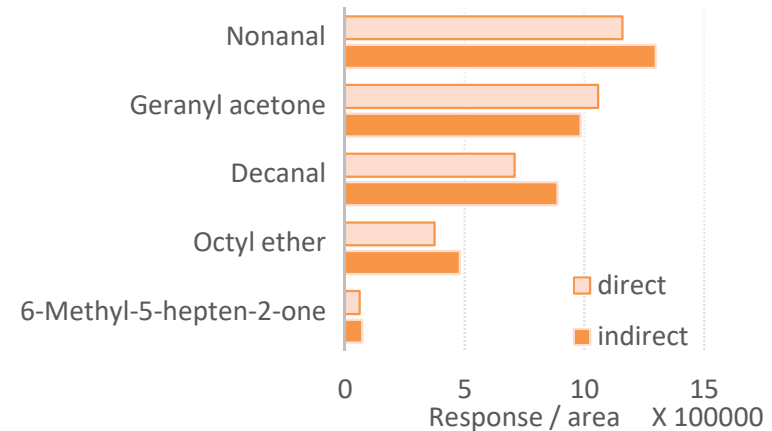


- / Twister GERSTEL – PDMS
- / TF-SPME GERSTEL – DVB/PDMS
- TF-Membrane PDMS

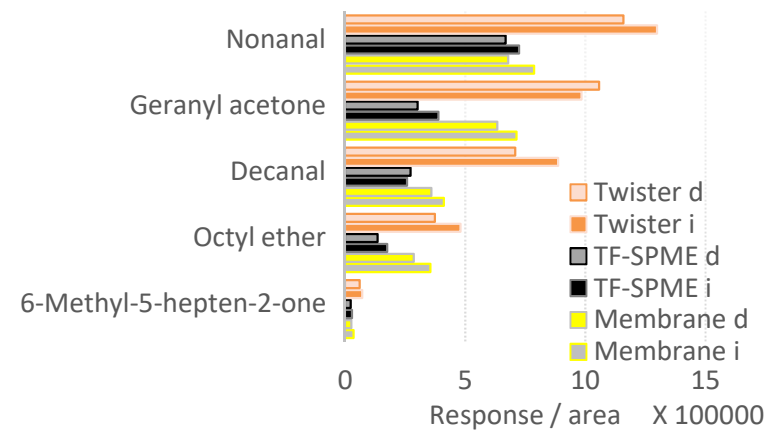


# 'Scent' of Human Skin – direct vs. indirect Sampling

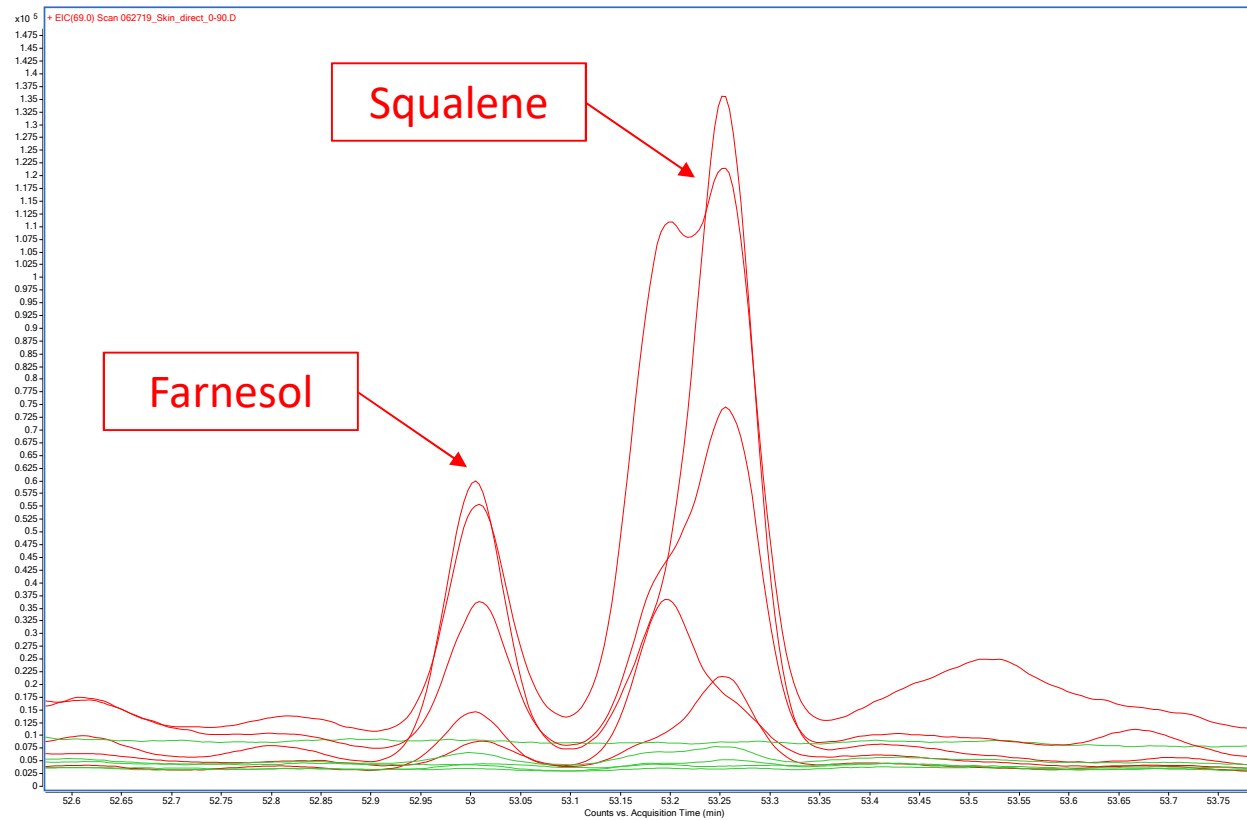
- / Twister GERSTEL
  - » PDMS
  - » length 20mm
  - » film thickness 1mm



- / Twister GERSTEL – PDMS
- / TF-SPME GERSTEL – DVB/PDMS
- TF-Membrane PDMS



# 'Scent' of Human Skin – **direct** vs. **indirect** Sampling

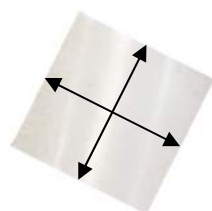


# TF-Membrane PDMS – Optimization

## Membrane Size



l: 10mm  
ft: 610 µm



l: 20mm  
ft: 610 µm

## Temperature

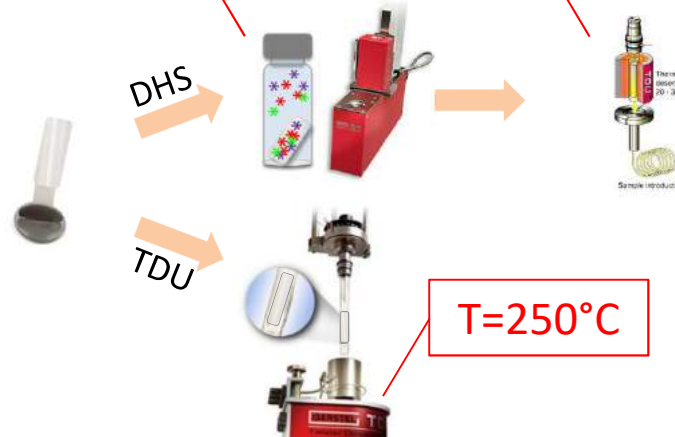
150 °C – GERSTEL DHS

250 °C – GERSTEL TDU



T=150°C

T=250°C

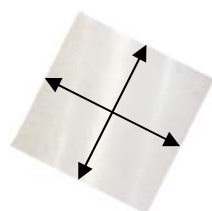


# TF-Membrane PDMS – Optimization

## Membrane Size



l: 10mm  
ft: 610  $\mu\text{m}$

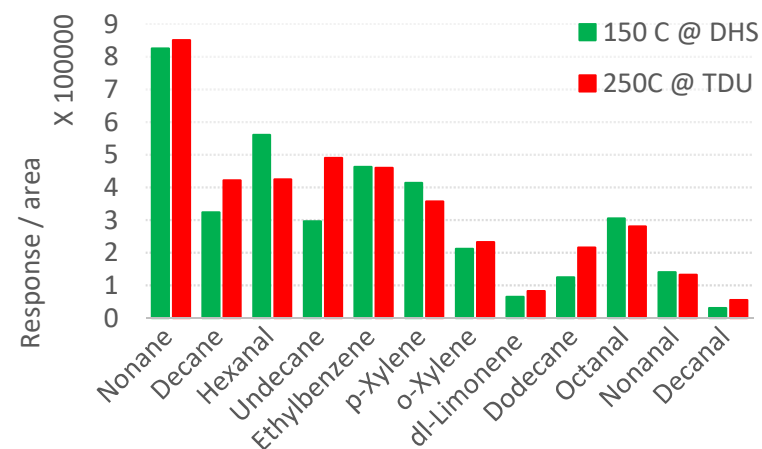
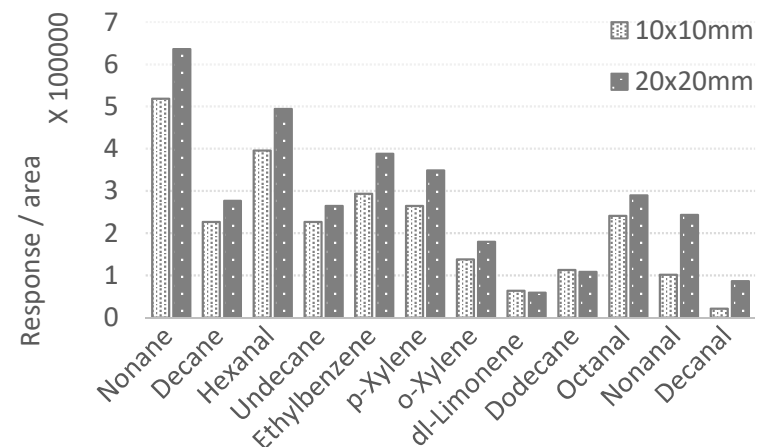


l: 20mm  
ft: 610  $\mu\text{m}$

## Temperature

150 °C – GERSTEL DHS

250 °C – GERSTEL TDU

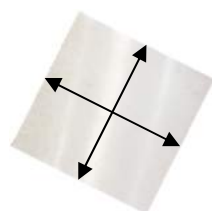


# TF-Membrane PDMS – Optimization

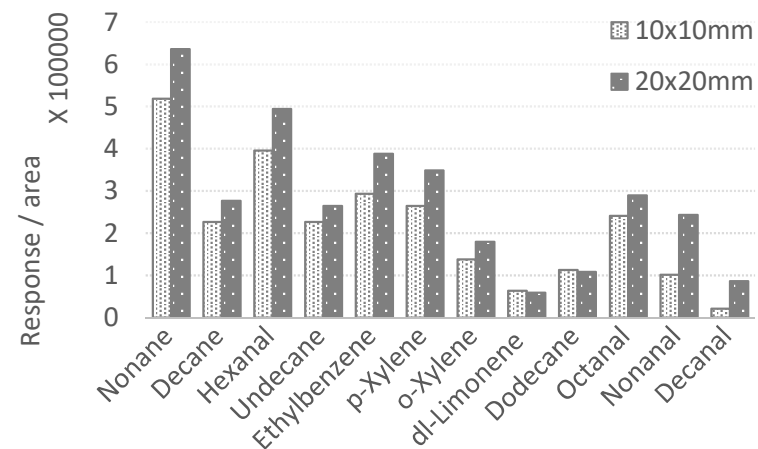
## Membrane Size



l: 10mm  
ft: 610 µm



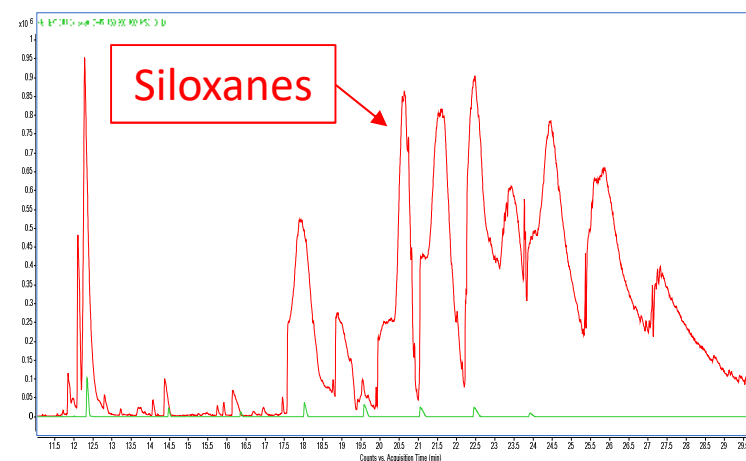
l: 20mm  
ft: 610 µm



## Temperature

150 °C – GERSTEL DHS

250 °C – GERSTEL TDU



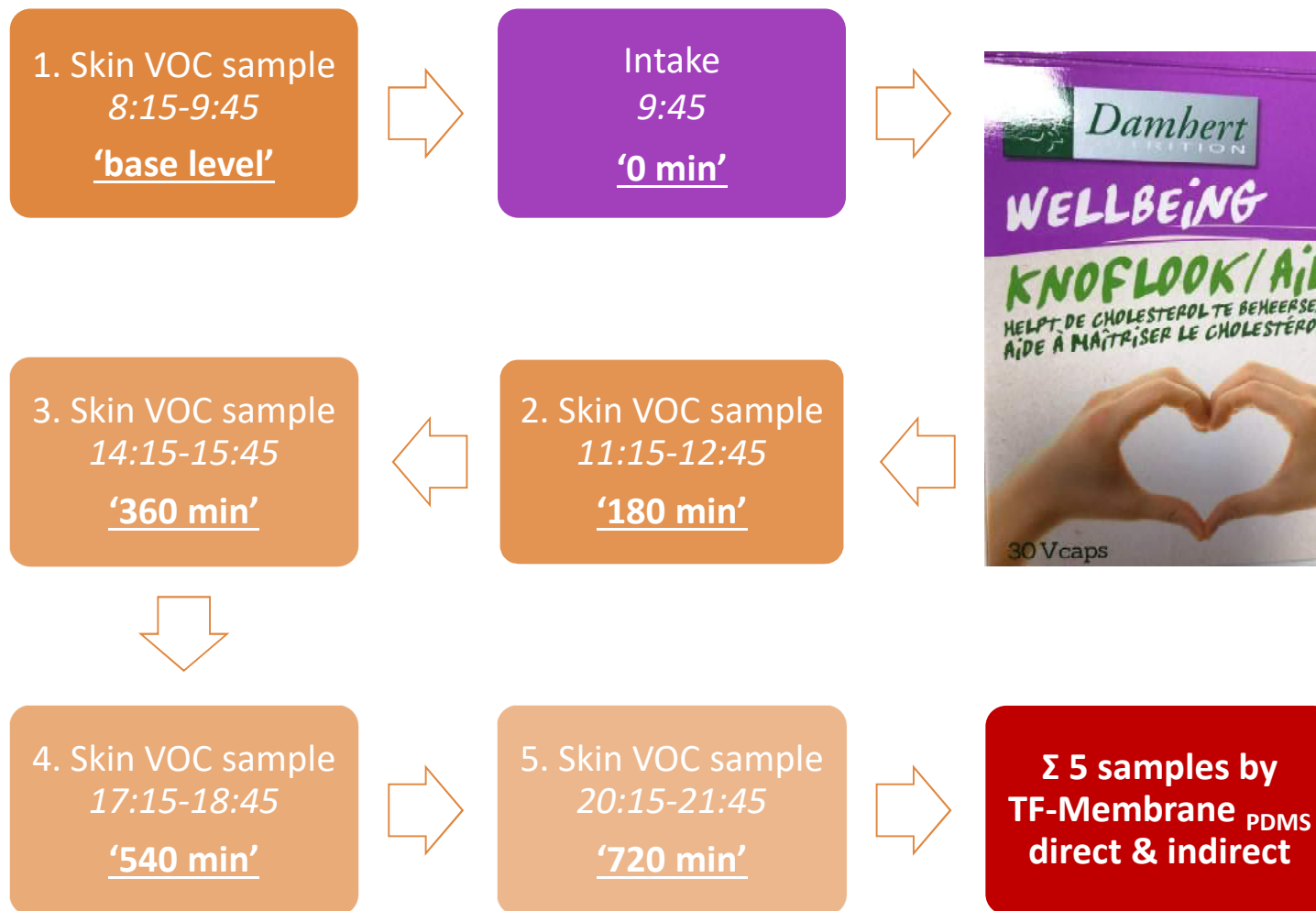
# 'Scent' of Human Skin – Dietary Study

## Experimental setup

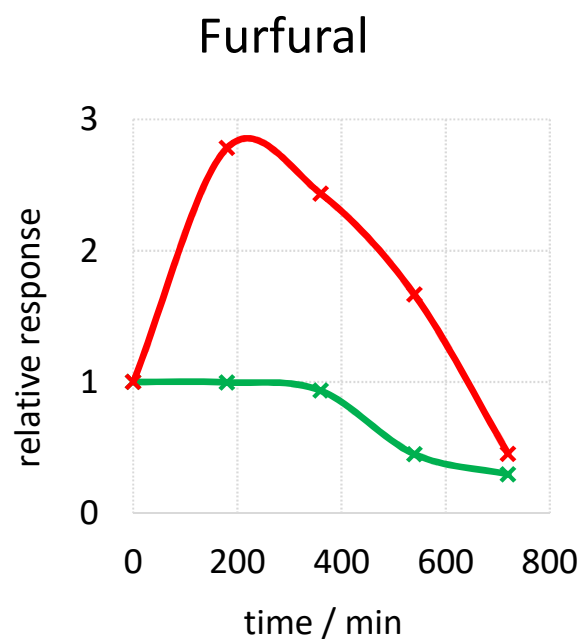
- Intake of 5 garlic capsules
- Sampling by PDMS Membranes (20x20mm)
- Extraction time of 90min
- Sampling during 12h after intake
- Direct and indirect sampling



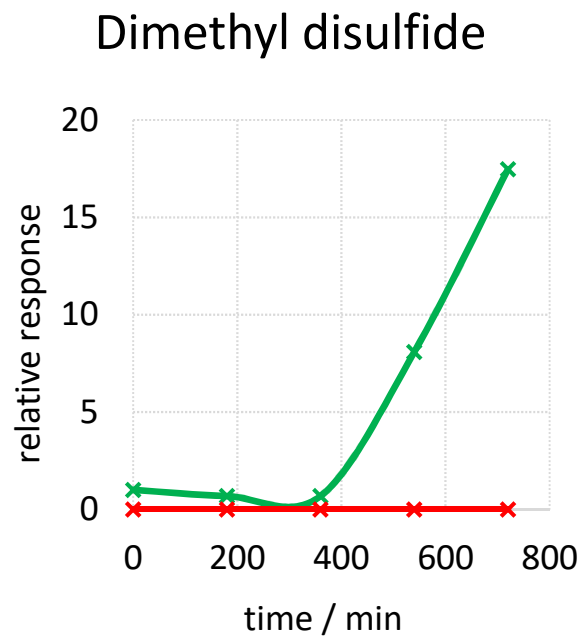
# 'Scent' of Human Skin – Dietary Study



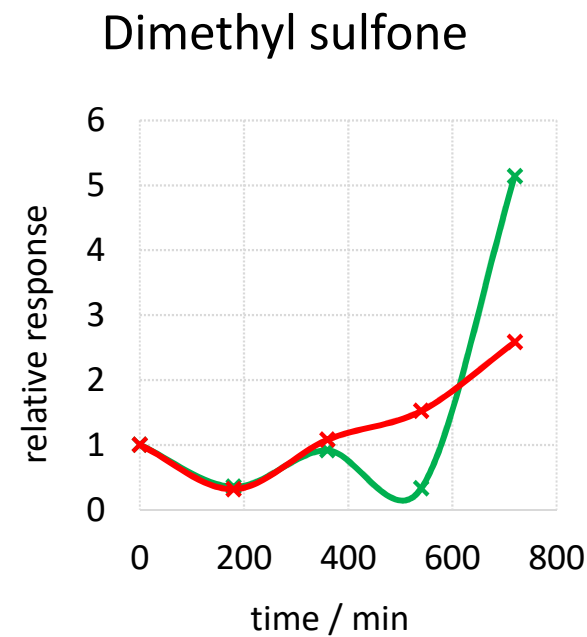
# 'Scent' of Human Skin – Dietary Study



—x— indirect      —x— direct



—x— indirect      —x— direct



—x— indirect      —x— direct

# Analysis of Human 'Scent' by sorptive extraction

- ✓ Comparison of sorptive sampling approaches
  - / Twister GERSTEL – PDMS
  - / TF-SPME GERSTEL –DVB/PDMS
  - TF-Membrane PDMS
- ✓ Evaluation of direct and indirect sampling to analyse the 'Scent' of Human Skin
- ✓ Detection of volatile garlic biomarker in the 'Scent' of Human Skin

# References

- [1] <https://lnbd.technion.ac.il>
- [2] Broza et al., doi: 10.1002/anie.201500153
- [3] Smallegange et al., doi: 10.1016/j.pt.2010.12.009
- [4] Mochalski et al., doi: 10.1016/J.JCHROMB.2014.04.006
- [5] Mochalski et al., doi: 10.1021/ac404242q
- [6] Turner et al., doi: 10.1002/rcm.3402
- [7] Jiang et al., doi: 10.1016/j.aca.2013.09.056



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