MonoTrap™

Monolithic Material Sorptive Extraction

A State-of-Art media for the Extraction & Enrichment

Based on monolithic technology, Merck KGaA, Darmstadt, Germany

GL Sciences Inc.
The Ultimate Technology for Sample Concentration

MonoTrap is a newly-developed, state-of-the-art sorptive media, based on the high surface area of silica monolith technology. It’s designed for simple and rapid enrichment of flavors, aromas, and fragrances, and can be easily used for the analysis of volatile and semi-volatile compounds for quality control, environmental, and forensic applications.

Silica Monolith Structure

The large surface area provided by the three dimensional silica monolith’s network of through pores and mesopores offers unmatched adsorption and desorption efficiency.

Outline of adsorption

Samples are adsorbed on the surface of silica monolith structure either comically modified or embedded with active carbon or graphite carbon.

Through Pores and Meso Pores provide over 150m²/g surface area, therefore small hybrid adsorbent MonoTrap perform high adsorption and desorption.
Monolithic Material Sorptive Extraction

Features

- **Easy-to-use**
  MonoTrap performs a very low blank, it can be used directly without any conditioning.

- **Highly Efficient Adsorption**
  MonoTrap’s large surface area offers larger sample loading capacity, ensuring a higher concentration of adsorbed compounds.

- **Complete Desorption with low Solvent Volume**
  It only takes a small amount of solvent, 200 µL, to completely saturate the monolithic network and achieve desorption, though more solvent can be used to control the final concentration of your samples.

- **Hydrophobic Surface**
  MonoTrap’s monolithic network is functionalized using hydrophobic ODS groups, therefore, MonoTrap will not adsorb water from aqueous samples. No need to worry about injecting water onto your GC or GC/MS when using MonoTrap as with liquid-liquid extraction or other sorptive media. This also allows for the addition of ionic salts to improve sample adsorption with MonoTrap.

- **Multiple Injections & Analyses**
  Because compounds adsorbed to MonoTrap can be extracted using 200 µL (or more) of organic solvent, it is no problem to perform multiple injections of your sample. With MonoTrap, it is even possible to make injections on different GC systems utilizing different column phases! Solvent extraction can even be accomplished within a GC autosampler vial using the rod shaped MonoTrap.

Superior Enrichment Capabilities using Activated Carbon/Graphite Carbon in addition to ODS

The graph on the right shows a comparison between the recovery rate of DCC18 (containing activated carbon) and DSC18 (containing only ODS groups). For a relatively non-polar compound such as Indole, both the MonoTrap DCC18 and DSC18 have approximately the same enrichment capabilities.

With more polar compounds, such as Methylpyrazine, the activated carbon groups on the MonoTrap DCC18 do a much better job of enrichment than the MonoTrap DSC18, which contains only hydrophobic ODS groups. Recoveries were calculated using dichloromethane as the extraction solvent.

![Graph showing comparison of recovery rates between MonoTrap DCC18 and DSC18 for various compounds.](image)
How to use MonoTrap™

**MonoTrap™ Head Space Gas Sampling**

1. Grasp the MonoTrap with tweezers and insert the holder into the hole on the MonoTrap.
2. Use an agitation bath for heating and stirring.
3. For screening without heating, use the handleless shaker (Cat.No. 8500 - 50000) and special holder (Cat.No. 8500 - 50001).
4. We recommend EYELA NTS-4000 B series for agitation bath. Please contact our local dealer for more details of the agitation bath and vial rack.
5. Hold MT Holder with pliers whose ends have been cleaned and pass it through the septum. Put a cap on top of the holder.
6. Clean Pin Hole Septum with Vial (40 mL).
7. Tighten the septum on the vial.

**MonoTrap™ Stirring Sampling**

1. Put the sample into the vial and float MonoTrap.
2. Handsfree shaker and the holder

**MonoTrap™ Passive Sampling**

1. Please contact our local dealer for the Tedlar bags.

**Sample Adsorption**

**Solvent Extraction**

- **Extraction from the Disk Type**
  - Fill the MT Extract Cup with the extraction solvent.
  - Put the MonoTrap and tighten the septum.

- **Extraction from the Rod Type**
  - Pour pure water into the vials.
  - Gerstel, T-Dex and Linex glass tubes are available.

**Thermal Desorption**

- Inserts for Autosampler
  - 200 µL Glass Insert
● MonoTrap performs high recovery

MonoTrap DCC18 shows high recovery rates for low to high logP compounds and hydrophilic to hydrophobic compounds. Unlike other products for which usable extraction solvents are limited to methanol and acetonitrile, dichloromethane with higher solvent extraction power can be used for MonoTrap. To obtain a high recovery MonoTrap is an easy-to-use media to select the types of extraction solvents.

Standard samples: Limonene, Cineol, β -Linalool, Methylpyrazine, 2,6-dimethylpyrazine, Indole, Camphor, Octanoic acid, Coumarin, 2'-acetonaphthone.
200 μg/mL of each in Methanol.

**Recovery rate comparison between MonoTrap DCC18 and other PDMS product A**

<table>
<thead>
<tr>
<th>Component</th>
<th>logP</th>
<th>MonoTrap DCC18 (with Active Carbon)</th>
<th>Other PDMS Product A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylpyrazine</td>
<td>0.21</td>
<td>18.8%</td>
<td>0.6%</td>
</tr>
<tr>
<td>2,6-Dimethylpyrazine</td>
<td>0.54</td>
<td>30.7%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Indole</td>
<td>2.14</td>
<td>32.0%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Cineol</td>
<td>2.74</td>
<td>107.0%</td>
<td>30.5%</td>
</tr>
<tr>
<td>Linalool</td>
<td>2.97</td>
<td>97.0%</td>
<td>29.8%</td>
</tr>
</tbody>
</table>

Here is an example of blue cheese, after sampling fragrance of blue cheese with MonoTrap RGPS TD, analysis was performed with Thermal Desorption system.

- **System**: GC/MS-Thermal Desorption (T-Dex II)
- **Column**: IntCap Pure-WAX 0.32 mm I.D. x 60 m df = 0.50 μm
- **Col.Temp.**: 40 ℃ (3 min hold) - 6 ℃/min - 250 ℃ (30 min hold)
- **Carrier Gas**: He 1 mL/min (constant flow)
- **Desorb Temp.**: 250 ℃
- **Time**: 5 min
- **Flow**: 7 mL/min
- **Split**: Splitless
- **Cryo Trapping**: -150 ℃
- **Injection Temp.**: 250 ℃
- **Detection**: MS Scan (28.5 - 600 m/z)

**Comparison of different sampling tools on the flavor of blue cheese analysis.**

**Sampling blue cheese with MonoTrap RGPS TD**
### MonoTrap™ Series Line-up

#### MonoTrap’s Nomenclature & Character

**Ex) MonoTrap**

<table>
<thead>
<tr>
<th>Shape</th>
<th>Adsorbent</th>
<th>Function Group/Stationary Phase</th>
<th>Desorption</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>C</td>
<td>Octadecyl C18, end-capped</td>
<td>TD</td>
</tr>
<tr>
<td>R</td>
<td>G</td>
<td>Chemical bonded with graphite carbon, C18, end-capped</td>
<td>TD</td>
</tr>
</tbody>
</table>

- **Shape**: D: disk type, R: rod type
- **Adsorbent**: C: Chemical bonded with active carbon, G: Chemical bonded with graphite carbon, S: without adsorbent
- **Function Group/Stationary Phase**: C18: octadecyl C18, end-capped
- **Desorption**: TD: for thermal desorption

### Description

<table>
<thead>
<tr>
<th>Description</th>
<th>Recommended Operating Temperature</th>
<th>Appearance</th>
<th>Shape</th>
<th>Size</th>
<th>Active Carbon</th>
<th>Graphite Carbon</th>
<th>ODS Function</th>
<th>PDMS</th>
<th>Qty.</th>
<th>Cat.No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MonoTrap DCC18</td>
<td>—</td>
<td>Disk</td>
<td>Diameter: 10 mm Thickness: 1 mm</td>
<td>●</td>
<td>●</td>
<td>50 ea</td>
<td>1050-72101</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MonoTrap RCC18</td>
<td>—</td>
<td>Rod</td>
<td>Diameter: 2.9 mm Length: 5 mm</td>
<td>●</td>
<td>●</td>
<td>50 ea</td>
<td>1050-72201</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MonoTrap DSC18</td>
<td>—</td>
<td>Disk</td>
<td>Diameter: 10 mm Thickness: 1 mm</td>
<td>●</td>
<td>●</td>
<td>50 ea</td>
<td>1050-71101</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>MonoTrap RSC18</td>
<td>—</td>
<td>Rod</td>
<td>Diameter: 2.9 mm Length: 5 mm</td>
<td>●</td>
<td>●</td>
<td>50 ea</td>
<td>1050-71201</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MonoTrap RGPS TD*</td>
<td>250 ℃</td>
<td>Rod</td>
<td>Diameter: 2.9 mm Length: 10 mm</td>
<td>●</td>
<td>●</td>
<td>30 ea</td>
<td>1050-74202</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MonoTrap RSC18 TD*</td>
<td>200 ℃</td>
<td>Rod</td>
<td>Diameter: 2.9 mm Length: 10 mm</td>
<td>●</td>
<td>●</td>
<td>30 ea</td>
<td>1050-73201</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MonoTrap RGC18 TD*</td>
<td>200 ℃</td>
<td>Rod</td>
<td>Diameter: 2.9 mm Length: 10 mm</td>
<td>●</td>
<td>●</td>
<td>30 ea</td>
<td>1050-74201</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* *: MonoTrap for Thermal Desorption is packed individually in an ampoule

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**MonoTrap’s Nomenclature & Character**

- **Shape**: D: disk type, R: rod type
- **Adsorbent**: C: Chemical bonded with active carbon, G: Chemical bonded with graphite carbon, S: without adsorbent
- **Function Group/Stationary Phase**: C18: octadecyl C18, end-capped
- **Desorption**: TD: for thermal desorption
Monolithic Material Sorptive Extraction

Start-up kit

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Contents</th>
<th>Cat.No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvent Extraction</td>
<td>MMSE Start Up KIT for SE</td>
<td>①～④ x 20 pcs, ⑤～⑦ x 10 pcs, ⑧ x 5 pcs, ⑨ x 40 pcs</td>
<td>1050-79001</td>
</tr>
<tr>
<td>Thermal Desorption</td>
<td>MMSE Start Up KIT for TD (OPTIC/LINEX)</td>
<td>⑤～⑦ x 10 pcs, ⑧～⑩, ⑪ x 5 pcs, ⑫ x 3 pcs</td>
<td>1050-78001</td>
</tr>
<tr>
<td></td>
<td>MMSE Start Up KIT for TD (TD-20)</td>
<td>⑤～⑦ x 10 pcs, ⑧～⑩, ⑪ x 5 pcs, ⑫ x 3 pcs</td>
<td>1050-78002</td>
</tr>
<tr>
<td></td>
<td>MMSE Start Up KIT for TD (Gerstel-TDS)</td>
<td>⑤～⑦ x 10 pcs, ⑧～⑩, ⑪ x 5 pcs, ⑫ x 3 pcs</td>
<td>1050-78003</td>
</tr>
<tr>
<td></td>
<td>MMSE Start Up KIT for TD (Gerstel-TDU)</td>
<td>⑤～⑦ x 10 pcs, ⑧～⑩, ⑪ x 5 pcs, ⑫ x 3 pcs</td>
<td>1050-78005</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty.</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>⑧ MT Holder</td>
<td>5 pcs</td>
<td>1050-79003</td>
</tr>
<tr>
<td>⑨ MT Stand</td>
<td>1 pcs</td>
<td>1050-79004</td>
</tr>
<tr>
<td>⑩ MT Extract Cup with Vial (20 mL)</td>
<td>5 pcs</td>
<td>1050-79005</td>
</tr>
<tr>
<td>⑪ Clean Pin Hole Septum with Vial (40 mL)</td>
<td>72 pcs</td>
<td>1050-79006</td>
</tr>
<tr>
<td>⑫ 200 μL glass insert</td>
<td>500 pcs</td>
<td>1030-17211</td>
</tr>
</tbody>
</table>

Glass tube for Thermal Desorption

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty.</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>⑬ MonoTrap TD Liner for OPTIC/LINEX</td>
<td>1 pcs</td>
<td>1003-75001</td>
</tr>
<tr>
<td>⑭ MonoTrap TD Liner for T-Dex/ATD/TD-20</td>
<td>1 pcs</td>
<td>1003-75002</td>
</tr>
<tr>
<td>⑮ Gerstel-MT Tube</td>
<td>1 pcs</td>
<td>1003-75003</td>
</tr>
<tr>
<td>⑯ Gerstel-MT-U Tube</td>
<td>1 pcs</td>
<td>1003-75004</td>
</tr>
</tbody>
</table>

GC, GC/MS Capillary column

InertCap™ Pure-WAX

New inner treatment technology, InertCap Pure-WAX performs the highest inertness, an optimal column for aromatic and flavor compounds.

<table>
<thead>
<tr>
<th>I.D.(mm)</th>
<th>Length(m)</th>
<th>Thickness(μm)</th>
<th>Max. operating Temp. (℃)</th>
<th>Cat.No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>30</td>
<td>0.25</td>
<td>iso.260-prog.260</td>
<td>1010-68142</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>0.25</td>
<td>iso.260-prog.260</td>
<td>1010-68162</td>
</tr>
<tr>
<td>0.32</td>
<td>30</td>
<td>0.25</td>
<td>iso.260-prog.260</td>
<td>1010-68242</td>
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<tr>
<td></td>
<td>60</td>
<td>0.25</td>
<td>iso.260-prog.260</td>
<td>1010-68262</td>
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<tr>
<td>0.53</td>
<td>15</td>
<td>1.00</td>
<td>iso.240-prog.240</td>
<td>1010-68425</td>
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<td></td>
<td>30</td>
<td>1.00</td>
<td>iso.240-prog.240</td>
<td>1010-68445</td>
</tr>
</tbody>
</table>

For more information, please contact.
### Easy Enrichment of Coffee Fragrance

**Sample (coffee)** 3.0 g

**Sampling (HS)** MonoTrap RGPS TD 1 ea

60 ℃, 10 min

**TD-GC/MS**

| System | GC/MS-Thermal Desorption (OPTIC-4) |
| Column | InertCap Pure-WAX                      |
| Col.Temp. | 40 ℃ (3 min hold) - 5 ℃ /min - 250 ℃ |
| Carrier Gas | He 1 mL/min (constant flow) |
| Desorb Temp. | 250 ℃ |
| Time | 10 min |
| Flow | 1 mL/min |
| Split | Split 1:20 (split flow 20 mL/min) |
| Cryo Trapping | -150 ℃ |
| Injection Temp. | 250 ℃ |
| Detection | MS Scan (28.8 - 600 m/z) |

#### Compounds

1. Pyridine
2. Pyrazine
3. Methylpyrazine
4. 3-Hydroxy-2-butanone
5. 1-Hydroxy-2-propanone
6. Dimethylpyrazine
7. Dimethylpyrazine
8. Ethylpyrazine
9. Dimethylpyrazine
10. 1-Hydroxy-2-butanone
11. Ethylmethylpyrazine
12. Ethylmethylpyrazine
13. Trimethylpyrazine
14. Acetylfuran
15. Furfuryl acetate
16. 2-Formyl-5-methylfuran
17. 2-Formyl-1-methylpyrrole
18. 2-Furancarbon alcohol
19. 1-Acetyl-1,4-dihydropyridine
20. 1-Furfurylpyrrole
21. Guaiacol
22. Maltol
23. 1H-Pyrrole-2-carboxaldehyde
24. 2-Methoxy-4-vinylphenol

### Fragrance of Peach Juice

**Peach juice** 30 mL

**Sampling (agitate)** MonoTrap RGPS TD 1 ea

36 ℃, 10 min, 160 rpm

**Rinse**

**TD-GC/MS**

| System | GC/MS-Thermal Desorption (OPTIC-4) |
| Column | InertCap Pure-WAX                      |
| Col.Temp. | 40 ℃ (5 min hold) - 4 ℃ /min - 250 ℃ |
|Carrier Gas | He 1 mL/min (constant flow) |
| Desorb Temp. | 250 ℃ |
| Time | 10 min |
| Flow | 1 mL/min |
| Split | Split 1:20 (split flow 20 mL/min) |
| Detection | MS Scan (28.8 - 600 m/z) |

#### Compounds

1. Isoamyl acetate
2. Isopentanol
3. Ethyl hexanoate
4. Hexyl acetate
5. Hexyl acetate
6. Hexenyl acetate
7. Hexanol
8. Hexenol
9. 2-Hexenol
10. Furfural
11. Benzaldehyde
12. p-Menth-2-one
13. Linalool
14. Terpineol
15. Geranyl acetate
16. Damascenone
17. α-Decalactone
18. β-Decalactone
19. 6-Pentyl-5,6-dihydro-2H-pyran-2-one
20. δ-Decalactone
21. γ-Decalactone
22. δ-Decalactone
23. 2-Methoxy-4-vinylphenol
**Flower Hyacinth Aroma**

**Sample**

**Sampling (passive)**
MonoTrap DCC18 1 ea

- Leave at room temperature for 3 h

**Solvent Extraction**

- Dichloromethane 1000 μL
- Ultrasonication for 5 min
- Enrich by N₂ purge to 100 μL

**TD-GC/MS**

<table>
<thead>
<tr>
<th>Time(min)</th>
<th>8</th>
</tr>
</thead>
</table>

1. β-cis-Ocimene
2. β-Linalool
3. Caryophyllene
4. Benzoic acid, methyl ester
5. α-Farnesene
6. Benzyl Alcohol
7. Indole
8. Benzyl Benzoate

**Red Wine Aroma**

**Sample**

- 20 mL

**Sampling (HS)**
MonoTrap DCC18 1 ea

- 60 ℃, 30 min

**Solvent Extraction**

- Dichloromethane 300 μL
- Ultrasonication for 5 min

**TD-GC/MS**

<table>
<thead>
<tr>
<th>Time(min)</th>
<th>8</th>
</tr>
</thead>
</table>

1. 2,2,6-Trimethyl-6-vinyltetrahydropyran
2. Isoamyl acetate
3. Limonene
4. 1-Pentanol
5. Ethyl hexanoate
6. Maleic anhydride
7. 3-Methylpentanol
8. 1,1-Dimethoxy-2-propanol
9. Ethyl 2-hexenoate
10. 1-Hexanol
11. cis-3-Hexen-1-ol
12. Nonanal
13. cis-2-Hexen-1-ol
14. Ethyl 2-hydroxy-3-methylbutanoate
15. Ethyl octanoate
16. Furfural
17. 2-Ethyl-1-hexanol
18. Benzaldehyde
19. 3-Ethyl-4-methylpentanol
20. 2-Bornene
21. n-Propyl propionate
22. Ethyl dl-2-hydroxycaproate
23. β-Cyclocitrinal
24. Ethyl decanoate
25. α-D-Galactopyranose methyl glycoside
26. Diethyl succinate
27. 3- (Methylthio) -1-propanol
28. 1,2,5,8-Trihydroxy-1,2-dihydronaphthalene
29. Hexanoic acid
30. Benzyl Alcohol
31. Phenethyl Alcohol
32. Diethyl dl-malate
33. Octanoic Acid
Mushroom Fragrance

Sample

2 kinds of Mushrooms produced in different areas 38 g/each

Sampling (Still Standing)
MonoTrap DCC18 5 ea

Room temperature, 12 h

Solvent Extraction
Concentration

Diethylether 1000 μL
Ultrasonication for 5 min
Enrich by N₂ purge to a few μL

GC/MS

< Comparison of Fragrances by Area % >

<table>
<thead>
<tr>
<th>Mushroom A</th>
<th>Mushroom B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 3-Octanone</td>
<td>1.8 %</td>
</tr>
<tr>
<td>2. Dimethyl trisulfide</td>
<td>1.7 %</td>
</tr>
<tr>
<td>3. 3-Octanol</td>
<td>1.7 %</td>
</tr>
<tr>
<td>4. 1-Octen-3-ol</td>
<td>2.3 %</td>
</tr>
</tbody>
</table>

Pu-erh Tea

Sample

Brew 5 g tea leaves with 15 mL hot water

Sampling
MonoTrap DCC18 1 ea

60 ℃, 30 min

Solvent Extraction

Dichloromethane 1000 μL
Ultrasonication for 5 min

Enrichment

Enrich by N₂ purge to 100 μL

GC/MS

<table>
<thead>
<tr>
<th>1. Methylpyrazine</th>
<th>11. 2-Acetylfuran</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Dimethylpyrazine</td>
<td>12. Benzaldehyde</td>
</tr>
<tr>
<td>3. Dimethylpyrazine</td>
<td>13. 2-Formyl-5-methylfuran</td>
</tr>
<tr>
<td>4. Ethylpyrazine</td>
<td>14. Methyl 2-furoate</td>
</tr>
<tr>
<td>5. 6-Methyl-5-hepten-2-one</td>
<td>15. 2-Furanmethanol</td>
</tr>
<tr>
<td>6. 2-Ethyl-6-methylpyrazine</td>
<td>16. Dimethoxybenzene</td>
</tr>
<tr>
<td>7. Trimethylpyrazine</td>
<td>17. Trimethoxybenzene</td>
</tr>
<tr>
<td>10. 2,4-Heptadien-1-al</td>
<td>20. Caffeine</td>
</tr>
</tbody>
</table>
Monolithic Material Sorptive Extraction

### Cinnamon

**Sample**

**Sampling (HS)**
MonoTrap RCC 18 - 2 ea

**Solvent Extraction**
Ethanol 200 μL
Ultrasonication 5 min

**GC/MS**

1. Cyclosativene
2. α -Cubebene
3. Sativen
4. β -Elemene
5. γ-Muurolene
6. Eudesma-4(14),11-diene
7. β-Chamigrene
8. α-Muurolene
9. δ-Cadinene
10. Calamenene
11. β-Calacorene
12. α-Calacorene
13. Cinnamaldehyde
14. 3-Methyl-7,8-dihydroquinolin-5(6H)-one
15. Cedran-3,9(11)-diene-10-peroxy
16. α-Cadinol
17. Cadalene
18. Cymene
19. Coumarin

### VOC from Burnt Materials

**Sample**

Put the wood (12.75 g) on soil, pour gasoline over the wood and burn.

**Sampling (Passive)**
MonoTrap RCC 18 - 2 ea

**Rinse**
Take the MonoTrap out after sampling. Rinse lightly with pure water to remove soil and dirt from the surface.

**Solvent Extraction**
Acetone 200 μL
Ultrasonication 5 min

**GC/MS**

1. 2-Methylpentane
2. 3-Methylpentane
3. Hexane
4. Methylcyclopentane
5. 2-Methylhexane
6. 2,3-Dimethylpentane
7. 3-Methylhexane
8. Trimethylpentane
9. Heptane
10. Benzene
11. Trimethylpentane
12. Trimethylpentane
13. 2-Methylheptane
14. Toluene
15. 2-Methylcyclohexane
16. Ethylbenzene
17. m,p-Xylene
18. α-Xylene
19. Propyl benzene
20. Ethyl methyl benzene
21. Trimethyl benzene
22. Ethyl methyl benzene
23. Trimethyl benzene
24. Propyl toluene
25. Cymene
26. Indane
27. Cymene
18. 1-Ethyl-3,5-dimethylbenzene
29. Naphthalene
30. 1-Methylnaphthalene
**VOC from Putrid Cabbage**

**Sample**
- Cut into strips, put 25 g into 100 mL vial

**Putrefacient cabbage**
- 60 °C, a certain period

**Sampling (Passive)**
- MonoTrap RCC18 3 ea

**Solvent Extraction**
- Diethyl ether / n-pentane = 1:1
- Mixed sample 500 μL
- Ultrasonication for 5 min

**GC/FPD**

![Graph showing peaks for different compounds]

**VOC from Papers Before & After Printing**

**Sample**
- 1. Chopped paper before color print 10 g
- 2. Chopped paper after color print 10 g

**Sampling**
- MonoTrap RCC18 5 ea
- Put MonoTrap into the vial and leave for 3 days at 60 °C

**Solvent Extraction**
- Dichloromethane 500 μL
- Ultrasonication for 5 min

**GC/MS**

![Graph showing peaks for different compounds]

**System**
- GC/MS

**Column**
- InertCap Pure-WAX
- 0.25 mm I.D. × 30 m df = 0.25 μm

**Col. Temp.**
- 40 °C (5 min hold) - 4 °C/min - 250 °C

**Carrier Gas**
- He 1 mL/min

**Injection**
- Splitless
- 250 °C

**Detection**
- MS Scan (35-500 m/z)

**Sample Size**
- 1.0 μL

**Applications**
### VOC from Scalp

**Sample**

**Sampling (Passive)**
- MonoTrap RGP5 TD 1 ea
- Room temperature 3 h

**TD-GC/MS**

<table>
<thead>
<tr>
<th>System</th>
<th>GC/MS-Thermal Desorption (T-Dex II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column</td>
<td>InertCap Pure-WAX 0.25 mm I.D. × 30 m df = 0.25 µm</td>
</tr>
<tr>
<td>Col.Temp.</td>
<td>40 °C (5 min hold) - 4 °C/min - 250 °C</td>
</tr>
<tr>
<td>Carrier Gas</td>
<td>He 1 mL/min (constant flow)</td>
</tr>
<tr>
<td>Desorb Temp.</td>
<td>200 °C</td>
</tr>
<tr>
<td>Time</td>
<td>5 min</td>
</tr>
<tr>
<td>Flow</td>
<td>5 mL/min</td>
</tr>
<tr>
<td>Split</td>
<td>Splitless</td>
</tr>
<tr>
<td>Cryo Trapping</td>
<td>-160 °C</td>
</tr>
<tr>
<td>Injection Temp.</td>
<td>250 °C</td>
</tr>
<tr>
<td>Detection</td>
<td>MS Scan (28.8 - 600 m/z)</td>
</tr>
</tbody>
</table>

1. D-Limonene
2. 6-Methyl-5-hepten-2-one
3. Nonanal
4. Linalool
5. Octadecane
6. Hexanoic acid
7. Dinonyl sebacate
8. Phenoxethanol alcohol
9. Octanal, 2-(phenylmethylene) -
10. 1-Octadecanol
11. Benzyl Benzoate
12. Tetradecanoic acid
13. Squalane

### Tabacco

**Sample**

**Sampling (Still Standing)**
- MonoTrap RGC 18 TD 1 ea
- 60 °C, 90 min

**TD-GC/MS**

<table>
<thead>
<tr>
<th>System</th>
<th>GC/MS-Thermal Desorption (T-Dex II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column</td>
<td>InertCap Pure-WAX 0.25 mm I.D. × 30 m df = 0.25 µm</td>
</tr>
<tr>
<td>Col.Temp.</td>
<td>40 °C (5 min hold) - 4 °C/min - 250 °C</td>
</tr>
<tr>
<td>Carrier Gas</td>
<td>He 1 mL/min (constant flow)</td>
</tr>
<tr>
<td>Desorb Temp.</td>
<td>200 °C</td>
</tr>
<tr>
<td>Time</td>
<td>5 min</td>
</tr>
<tr>
<td>Flow</td>
<td>5 mL/min</td>
</tr>
<tr>
<td>Split</td>
<td>Splitless</td>
</tr>
<tr>
<td>Cryo Trapping</td>
<td>-160 °C</td>
</tr>
<tr>
<td>Injection Temp.</td>
<td>250 °C</td>
</tr>
<tr>
<td>Detection</td>
<td>MS Scan (40 - 600 m/z)</td>
</tr>
</tbody>
</table>

1. 6-Methyl-5-hepten-2-one
2. trans-Geranylacetone
3. Megastigmatriene
4. Megastigmatriene
### Parmesan Cheese

**Sample**

**Sampling (HS)**

MonoTrap RGC 18 TD 1 ea

60°C, 30 min

**TD-GC/MS**

**System**

: GC/MS-Thermal Desorption (T-Dex II)

**Column**

: InertCap Pure-WAX

0.25 mm I.D. × 60 m df = 0.25 μm

**Col.Temp.**

: 40 °C (5 min hold) - 6 °C /min - 250 °C

**Carrier Gas**

: He 1 mL/min (constant flow)

**Desorb Temp.**

: 200 °C

**Time**

: 5 min

**Flow**

: 1 mL/min

**Split**

: Splitless

**Cryo Trapping**

: -150 °C

**Injection Temp.**

: 250 °C

**Detection**

: MS Scan (28.5 - 600 m/z)

**Applications**

1. Methanethiol
2. Ethyl Acetate
3. 2-Butanone
4. 2-methylbutanal
5. 3-methylbutanal
6. 1-Propanol
7. Toluene
8. Dimethyl disulfide
9. Hexanal
10. 2-Pentenal
11. 3-Penten-2-one
12. 2-Heptanone
13. D-Limonene
14. Acetoin
15. Acetol
16. Dimethylpyrazine
17. Dimethylpyrazine
18. Dimethylpyrazine
19. 2-Nonanone
20. 2,5-Dimethyl-3-ethylpyrazine
21. Benzaldehyde
22. Isobutyric acid
23. 2-Undecanone
24. Butanoic acid
25. 2-Furanmethanol
26. Acetamide
27. 2-Tetradecanol
28. 2-Tridecanone
29. Hexanoic acid
30. Dimethyl sulfone
31. δ-Octalactone
32. 2-Pentadecanone
33. Octanoic acid
34. δ-Decalactone
35. Decanoic acid

### Maple Sugar

**Sample**

**Sampling (HS)**

MonoTrap RGC 18 TD 1 ea

60°C, 1 h

**TD-GC/MS-O**

**System**

: GC/MS-Thermal Desorption (T-Dex II)

**Column**

: InertCap Pure-WAX

0.25 mm I.D. × 60 m df = 0.25 μm

**Col.Temp.**

: 40 °C (5 min hold) - 6 °C /min - 250 °C

**Carrier Gas**

: He 1 mL/min (constant flow)

**Desorb Temp.**

: 200 °C

**Time**

: 5 min

**Flow**

: 1 mL/min

**Split**

: Split 1:2 (Desorb 10 mL/min, Split 20 mL/min)

**Cryo Trapping**

: -150 °C

**Injection Temp.**

: 250 °C

**Detection**

: MS Scan (28.8 - 600 m/z)

**Applications**

1. Ethylpyrazine
2. Methanethiol
3. Ethyl Acetate
4. 2-Butanone
5. 2-methylbutanal
6. 3-methylbutanal
7. 1-Propanol
8. Toluene
9. Dimethyl disulfide
10. Hexanal
11. 2-Pentenal
12. 3-Penten-2-one
13. 2-Heptanone
14. D-Limonene
15. Acetoin
16. Acetol
17. Dimethylpyrazine
18. Dimethylpyrazine
19. 2-Nonanone
20. 2,5-Dimethyl-3-ethylpyrazine
21. Benzaldehyde
22. Isobutyric acid
23. 2-Undecanone
24. Butanoic acid
25. 2-Furanmethanol
26. Acetamide
27. 2-Tetradecanol
28. 2-Tridecanone
29. Hexanoic acid
30. Dimethyl sulfone
31. δ-Octalactone
32. 2-Pentadecanone
33. Octanoic acid
34. δ-Decalactone
35. Decanoic acid

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**Screen of Olfactory Voicogram Software**

<table>
<thead>
<tr>
<th>No.</th>
<th>Start (min)</th>
<th>End (min)</th>
<th>Intensity</th>
<th>Smell</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18.05</td>
<td>18.11</td>
<td>weak</td>
<td>fission</td>
</tr>
<tr>
<td>2</td>
<td>18.11</td>
<td>18.18</td>
<td>weak</td>
<td>sweet</td>
</tr>
<tr>
<td>3</td>
<td>18.30</td>
<td>18.36</td>
<td>weak</td>
<td>mushroom</td>
</tr>
<tr>
<td>4</td>
<td>19.10</td>
<td>19.23</td>
<td>weak</td>
<td>nuts pyrazine</td>
</tr>
<tr>
<td>5</td>
<td>19.64</td>
<td>19.68</td>
<td>weak</td>
<td>pyrazine</td>
</tr>
</tbody>
</table>