

# Sorbent Pens™

For Next Generation Headspace Analysis

## Featured Chromatograms



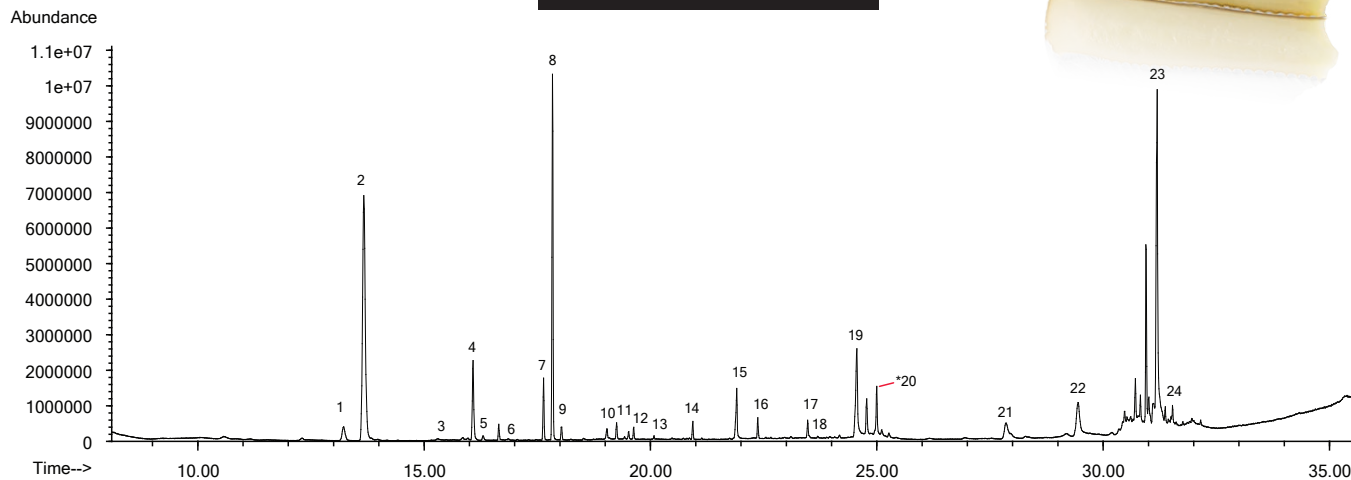
See What's Really There™

# Brie Cheese Duplicate Analysis

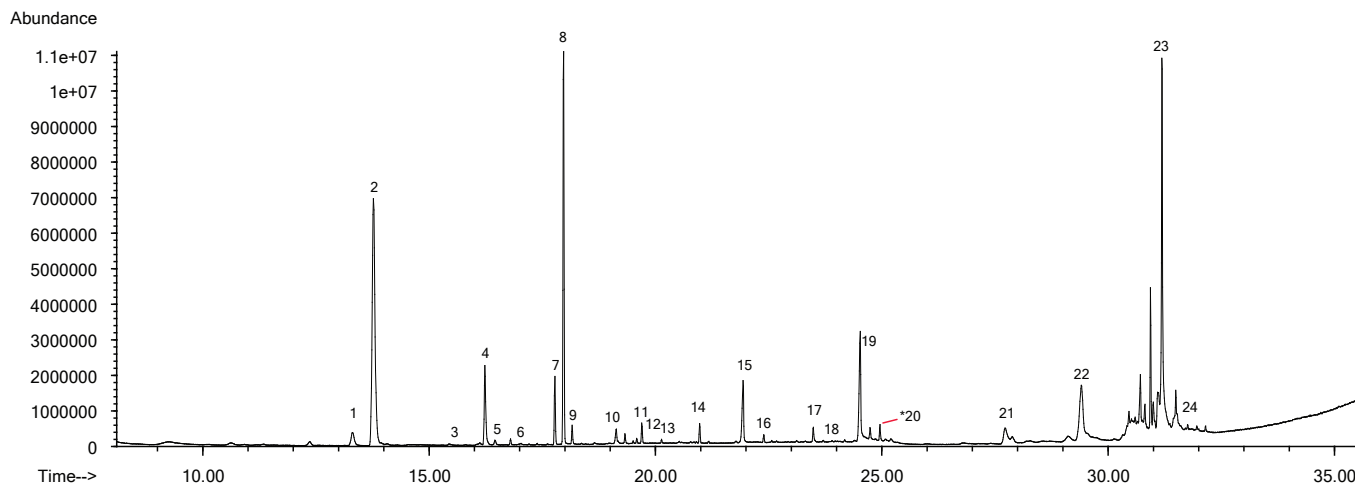
TIC: 16081501.D\data.ms



## SORBENT PEN™ #1



## SORBENT PEN™ #2



\*Difference in Dodecanoic acid, ethyl ester caused by difficulty in maintaining exact amount of cheese sample oxidation from run to run, and expected variations in sample homogeneity.

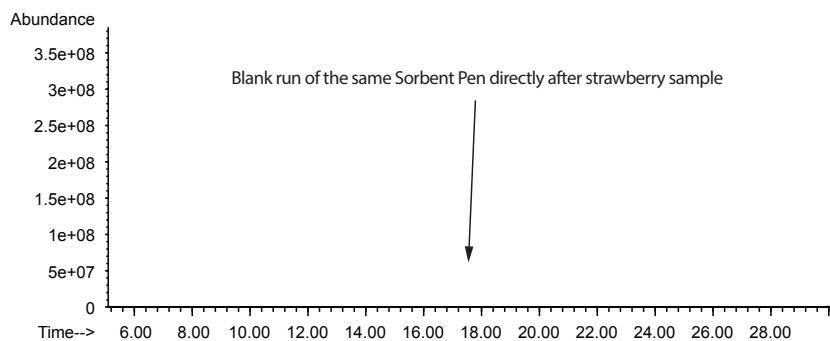
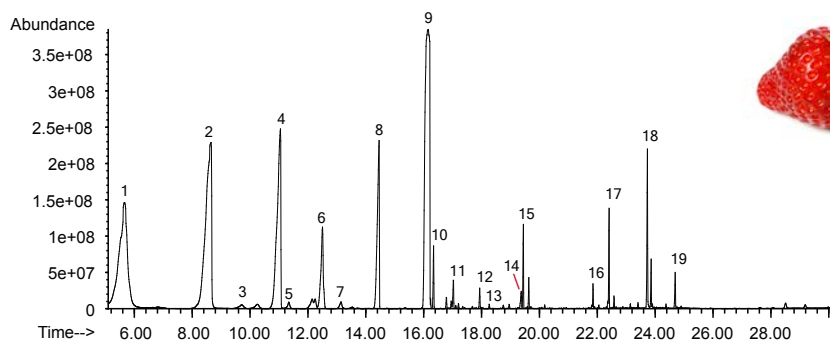
**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** August 15, 2016  
**Sample description:** Brie Cheese  
**Weight of sample (g):** 70g cheese in 140mL water, blended, 10.1025g taken  
**Sample conditions:** blended + vac(30sec) + 50°C + 3 hr equilibration  
**Desorb conditions:** 260°C for 5 min.  
**Split Mode:** Splitless  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Column:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Carrier:** He, 1.5cc/min. constant flow  
**Oven Temp:** 40°C hold 5min., 6°C/min. to 95°C, 10°C/min. to 140°C, 10°C/min. to 325 hold 5min.  
**GCMS:** Agilent 7890B/5977A  
**MS Operation:** 34-450 amu, 1.8 scans/sec

1. 4-Heptanone
2. 2-Heptanone
3. Benzaldehyde
4. 2-Octanone
5. Hexanoic acid, ethyl ester
6. Benzeneacetaldehyde
7. 8-Nonen-2-one
8. 2-Nonanone
9. Nonanal
10. Octanoic acid
11. Octanoic acid, ethyl ester
12. Decanal
13. n-Octanoic acid isopropyl ester

14. 2-Undecanone
15. n-Decanoic acid
16. Decanoic acid, ethyl ester
17. 2H-Pyran-2-one, tetrahydro-6-pentyl-
18. 2-Tridecanone
19. Dodecanoic acid
20. Dodecanoic acid, ethyl ester
21. 2H-Pyran-2-one, 6-heptyltetrahydro-
22. Tetradecanoic acid
23. n-Hexadecanoic acid
24. Hexadecanoic acid, ethyl ester

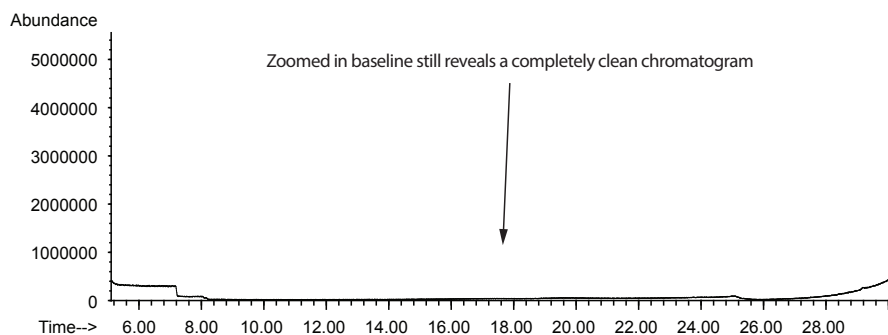
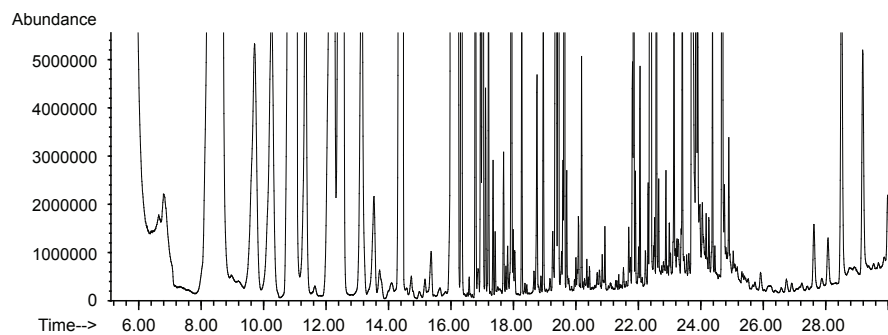
# Extremely Clean Blank After Strawberry Analysis

TIC: 16080301.D\data.ms



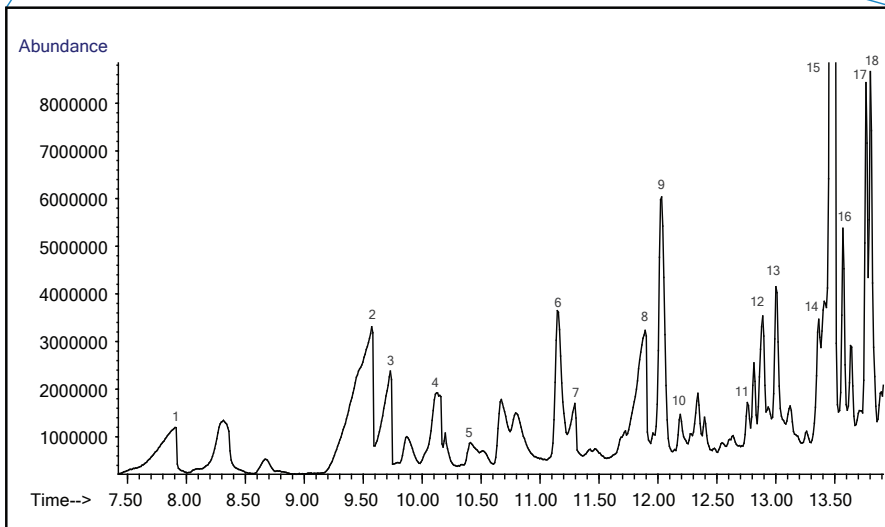
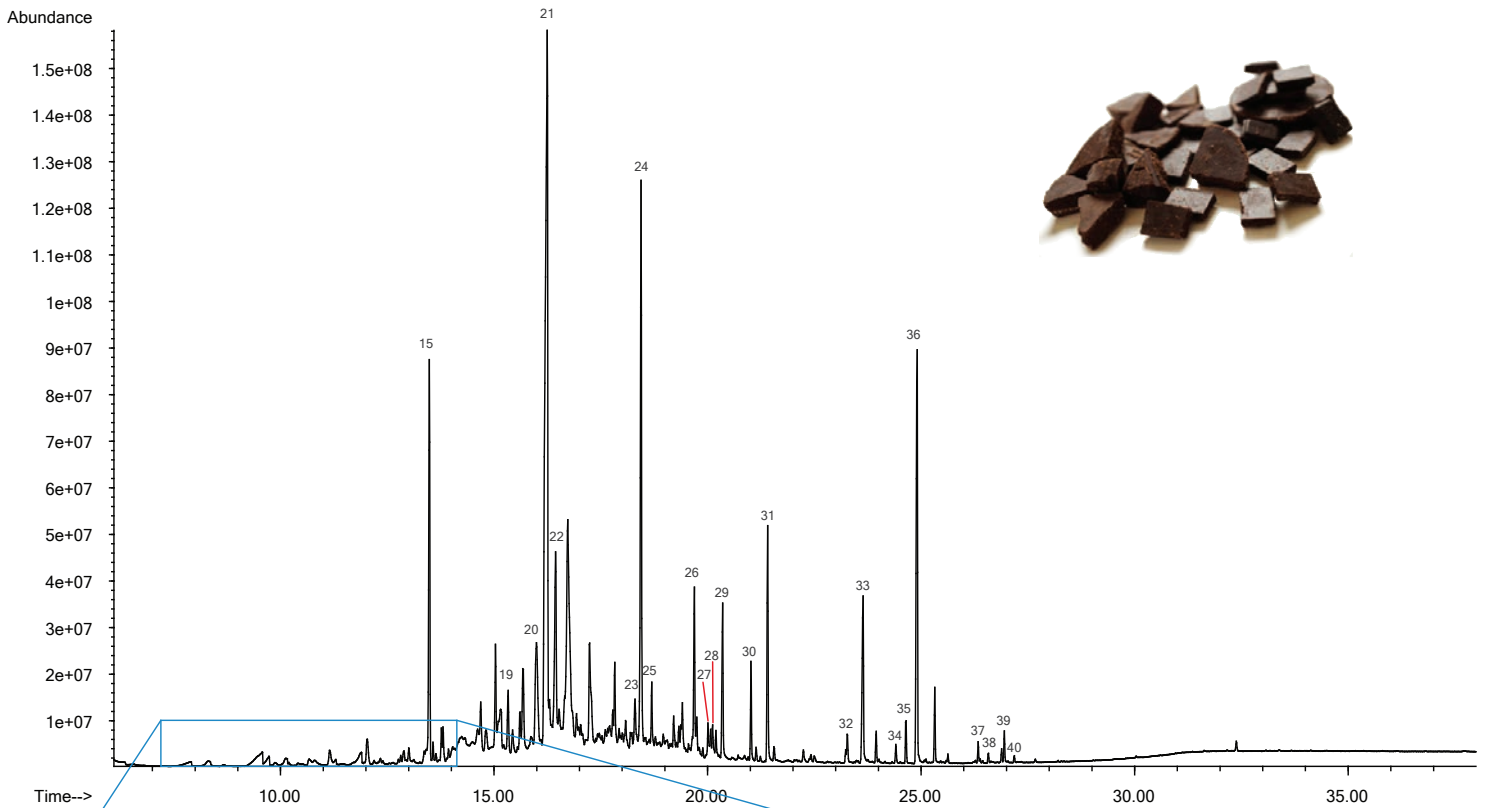
**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** August 3, 2016  
**Sample description:** Fresh Strawberries  
**Weight of sample (g):** 7.7425  
**Sample conditions:** 5 hours equilibration  
**Desorb conditions:** 260°C for 5 min.  
**Split Mode:** Splitless  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Column:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Carrier:** He, 1.5cc/min. constant flow  
**Oven Temp:** 40°C hold 5min., 6°C/min. to 95°C, 10°C/min. to 140°C, 15°C/min. to 325 hold 5 min.  
**GCMS:** Agilent 7890B/5977A  
**MS Operation:** 34-450 amu, 1.8 scans/sec

- |   |  |
|---|--|
| 1. Ethyl acetate                          | 11. 3(2H)-Furanone, 4-methoxy-2,5-dimethyl-    |
| 2. Butanoic acid methyl ester             | 12. 1,6-Octadien-3-ol, 3,7-dimethyl-           |
| 3. Propanoic acid, 2-methyl-, ethyl ester | 13. Octanoic acid, methyl ester                |
| 4. Butanoic acid, ethyl ester             | 14. Methyl salicylate                          |
| 5. Acetic acid, butyl ester               | 15. Octanoic acid, ethyl ester                 |
| 6. Butanoic acid, 2-methyl-, ethyl ester  | 16. Butanoic acid, octyl ester                 |
| 7. 1-Butanol, 3-methyl-, acetate          | 17. Pentanoic acid, octyl ester                |
| 8. Hexanoic acid, methyl ester            | 18. 1,6,10-Dodecatrien-3-ol, 3,7,11-trimethyl- |
| 9. Hexanoic acid, ethyl ester             | 19. .gamma.-Dodecalactone                      |
| 10. 2-Hexen-1-ol, acetate, (Z)-           |  |



# Dark Chocolate Analysis

TIC: 161117\_04.D\data.ms

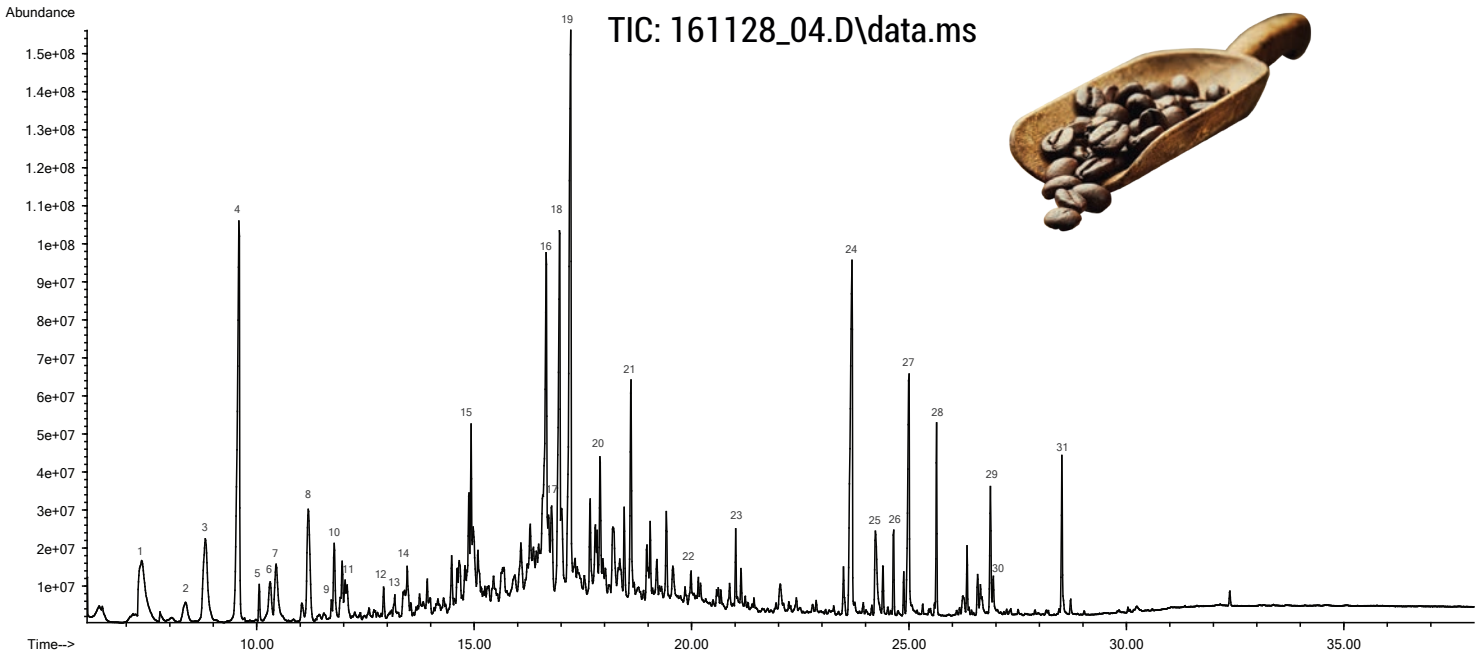


**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** November 17, 2016  
**Sample description:** Dark Chocolate  
**Amount of sample (g):** 1  
**Sample conditions:** 40 mL vial with 15 hours equilibration at 25°C  
**Desorb conditions:** 260°C for 5 min.  
**Split Mode:** Splitless  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Column:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Carrier:** He, 1.5cc/min. constant flow  
**Oven Temp:** 40°C hold 5 min., 10°C/min. to 325°C, 325 hold 5 min. (solvent delay at 6 min.)  
**GCMS:** Agilent 7890B/5977A  
**MS Operation:** 34-450 amu, 1.8 scans/sec

- |   |                                      |  |                                       |
|---|--------------------------------------|--|---------------------------------------|
| 1. Propanoic acid, 2-methyl-                | 11. D-Limonene                       | 21. Acetic acid, 2-phenylethyl ester                       | 31. Benzophenone                      |
| 2. Butanoic acid, 3-methyl-                 | 12. Ethanone, 1-(1H-pyrrol-2-yl)-    | 22. Benzeneacetaldehyde, .alpha.-ethylidene-               | 32. Tetradecanoic acid, ethyl ester   |
| 3. Butanoic acid, 2-methyl-                 | 13. Acetophenone                     | 23. Vanillin   | 33. Caffeine                          |
| 4. Heptanal                                 | 14. Pyrazine, 3-ethyl-2,5-dimethyl-  | 24. Benzoic acid, pent-2-yl ester                          | 34. 2-Heptadecanone                   |
| 5. Pyrazine, 2,5-dimethyl-                  | 15. Pyrazine, tetramethyl-           | 25. Tetradecane  | 35. Hexadecanoic acid, methyl ester   |
| 6. Benzaldehyde                             | 16. 2-Nonanone                       | 26. 5-Methyl-2-phenyl-2-hexenal                            | 36. Di-sec-butyl phthalate            |
| 7. Pentanoic acid, 4-methyl-                | 17. Nonanal                          | 27. Pentadecane  | 37. 9-Octadecenoic acid, methyl ester |
| 8. Hexanoic acid                            | 18. 1,6-Octadien-3-ol, 3,7-dimethyl- | 28. Butylated Hydroxytoluene                               | 38. Linoleic acid ethyl ester         |
| 9. Pyrazine, trimethyl-                     | 19. Octanoic acid, ethyl ester       | 29. 1H-2-Benzopyran-1-one, 3,4-dihydro-8-hydroxy-3-methyl- | 39. 9-Octadecenoic acid, (E)-         |
| 10. Propanoic acid, 2-hydroxy-, butyl ester | 20. Benzeneacetic acid, ethyl ester  | 30. Dodecanoic acid, ethyl ester                           | 40. Octadecanoic acid, ethyl ester    |

# Coffee Analysis

TIC: 161128\_04.D\data.ms

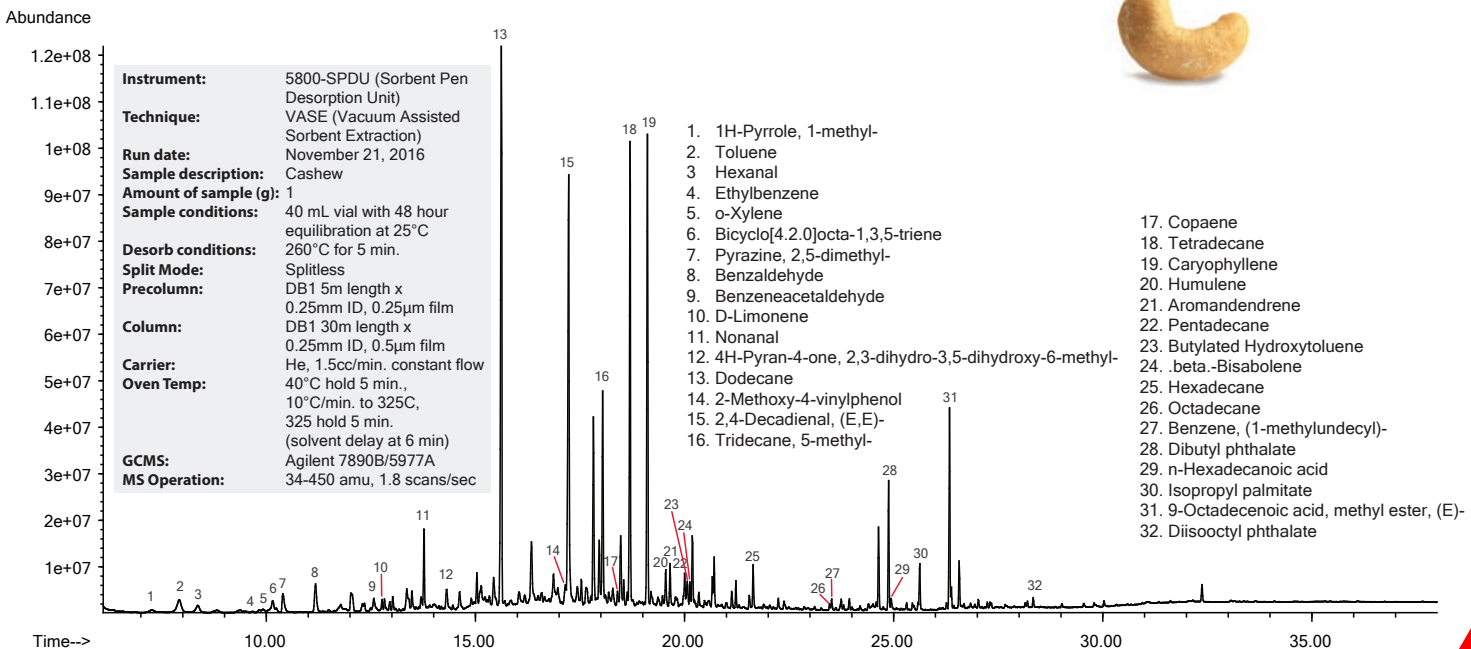


**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** November 28, 2016  
**Sample description:** Breakroom Coffee  
**Amount of sample (g):** 2  
**Sample conditions:** 20 mL vial with 3 hour equilibration at 60°C  
**Desorb conditions:** 260°C for 5 min.  
**Split Mode:** Splitless  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Column:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Carrier:** He, 1.5cc/min. constant flow  
**Oven Temp:** 40°C hold 5 min., 10°C/min. to 325C, 325 hold 5 min. (solvent delay at 6 min)  
**GCMS:** Agilent 7890B/5977A  
**MS Operation:** 34-450 amu, 1.8 scans/sec

1. Pyridine
2. 3(2H)-Furanone, dihydro-2-methyl-
3. 3-Furaldehyde
4. 2-Furanmethanol
5. Butyrolactone
6. Ethanone, 1-(2-furanyl)-
7. Pyrazine, 2,5-dimethyl-
8. 2-Furancarboxaldehyde, 5-methyl-
9. Phenol
10. 2-Furanmethanol, acetate
11. 1H-Pyrrole-2-carboxaldehyde
12. Ethanone, 1-(1H-pyrrol-2-yl)-
13. Ethanone, 1-(1-methyl-1H-pyrrol-2-yl)-
14. Phenol, 2-methoxy-
15. 1H-Pyrrole, 1-(2-furanylmethyl)-
16. Phenol, 4-ethyl-2-methoxy-
17. Indole
18. Furan, 2,2'-[oxybis(methylene)]bis-
19. 2-Methoxy-4-vinylphenol
20. Benzene, 4-ethenyl-1,2-dimethoxy-
21. 1H-Pyrrole, 1-(2-furanylmethyl)-
22. Phenol, 2,5-bis(1,1-dimethylethyl)-
23. Dodecanoic acid, ethyl ester
24. Caffeine
25. 1-Hexadecanol
26. Hexadecanoic acid, methyl ester
27. n-Hexadecanoic acid
28. Isopropyl palmitate
29. Octadecanoic acid
30. Hexadecanamide
31. 9-Octadecenamide, (Z)-

# Cashew Analysis

TIC: 161121\_03.D\data.ms

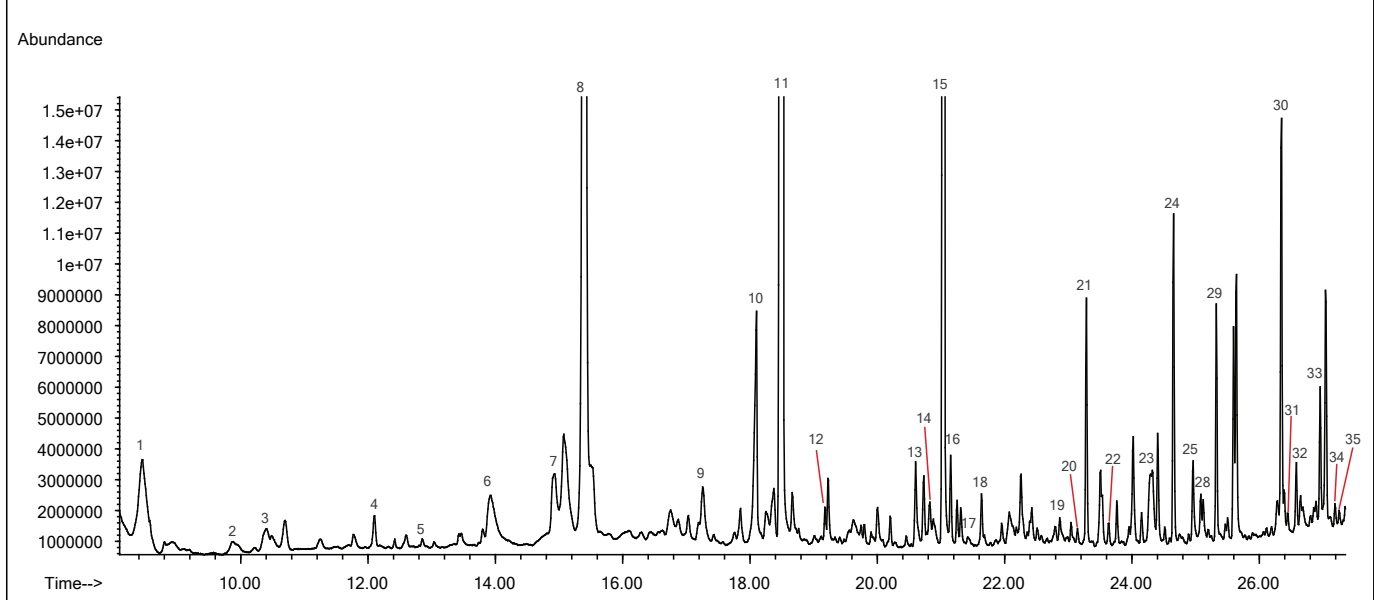
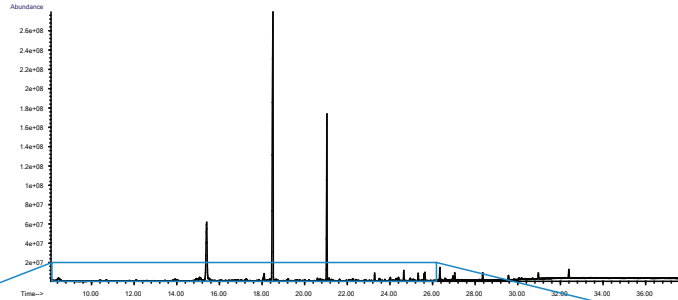


**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** November 21, 2016  
**Sample description:** Cashew  
**Amount of sample (g):** 1  
**Sample conditions:** 40 mL vial with 48 hour equilibration at 25°C  
**Desorb conditions:** 260°C for 5 min.  
**Split Mode:** Splitless  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Column:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Carrier:** He, 1.5cc/min. constant flow  
**Oven Temp:** 40°C hold 5 min., 10°C/min. to 325C, 325 hold 5 min. (solvent delay at 6 min)  
**GCMS:** Agilent 7890B/5977A  
**MS Operation:** 34-450 amu, 1.8 scans/sec

1. 1H-Pyrrole, 1-methyl-
2. Toluene
3. Hexanal
4. Ethylbenzene
5. o-Xylene
6. Bicyclo[4.2.0]octa-1,3,5-triene
7. Pyrazine, 2,5-dimethyl-
8. Benzaldehyde
9. Benzeneacetaldehyde
10. D-Limonene
11. Nonanal
12. 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-
13. Dodecane
14. 2-Methoxy-4-vinylphenol
15. 2,4-Decadienal, (E,E)-
16. Tridecane, 5-methyl-
17. Copaene
18. Tetradecane
19. Caryophyllene
20. Humulene
21. Aromandendrene
22. Pentadecane
23. Butylated Hydroxytoluene
24. beta.-Bisabolene
25. Hexadecane
26. Octadecane
27. Benzene, (1-methylundecyl)-
28. Dibutyl phthalate
29. n-Hexadecanoic acid
30. Isopropyl palmitate
31. 9-Octadecenoic acid, methyl ester, (E)-
32. Diisooctyl phthalate

# Rum Analysis

TIC: 161116\_07.D\data.ms

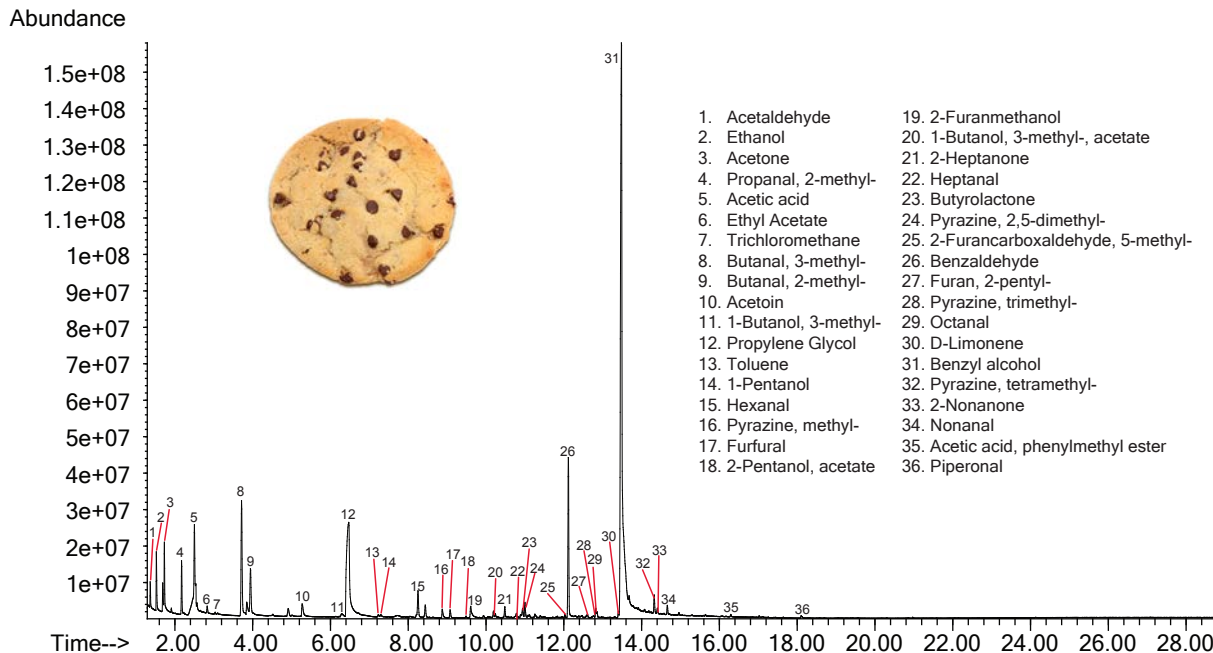


**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** November 16, 2016  
**Sample description:** 1:1 Rum (50µl Rum + 50µl Water)  
**Amount of sample (mL):** 50µl  
**Sample conditions:** 20mL vial with 15 hour equilibration at 25°C 260°C for 5 min.  
**Desorb conditions:** Splitless  
**Split Mode:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Precolumn:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Column:** He, 1.5cc/min. constant flow  
**Carrier:** 40°C hold 5 min., 10°C/min. to 300°C, hold 7 min. (solvent delay at 8 min)  
**Oven Temp:** Agilent 7890B/5977A  
**GCMS:** 34-450 amu, 1.8 scans/sec

- 3(2H)-Furanone, dihydro-2-methyl-
- 1-Hexanol
- Ethanone, 1-(2-furanyl)-
- Hexanoic acid, ethyl ester
- Pentanoic acid, 4-oxo-, ethyl ester
- Phenylethyl Alcohol
- Butanedioic acid, diethyl ester
- Octanoic acid, ethyl ester
- trans-3-Methyl-4-octanolide
- n-Decanoic acid
- Decanoic acid, ethyl ester
- Octanoic acid, 3-methylbutyl ester
- Dodecanoic acid
- Benzoic acid, 4-hydroxy-3-methoxy-, ethyl ester
- Dodecanoic acid, ethyl ester
- Pentanoic acid, 2,2,4-trimethyl-3-carboxyisopropyl, isobutyl ester
- Benzenophenone
- Pentadecanoic acid, 3-methylbutyl ester
- Tetradecanoic acid
- Ethyl 9-tetradecenoate
- Pentadecanoic acid, ethyl ester
- Isopropyl myristate
- 1-Hexadecanol
- Pentadecanoic acid, 14-methyl-, methyl ester
- n-Hexadecanoic acid
- Ethyl 9-hexadecenoate
- Hexadecanoic acid, ethyl ester
- 1-Tetradecyl acetate
- Isopropyl palmitate
- 9-Octadecenoic acid (Z)-, methyl ester
- Heneicosane
- Methyl stearate
- Ethyl 9-hexadecenoate
- Octadecanoic acid, ethyl ester
- Benzoic acid, tridecyl ester

# Fresh Cookie Analysis

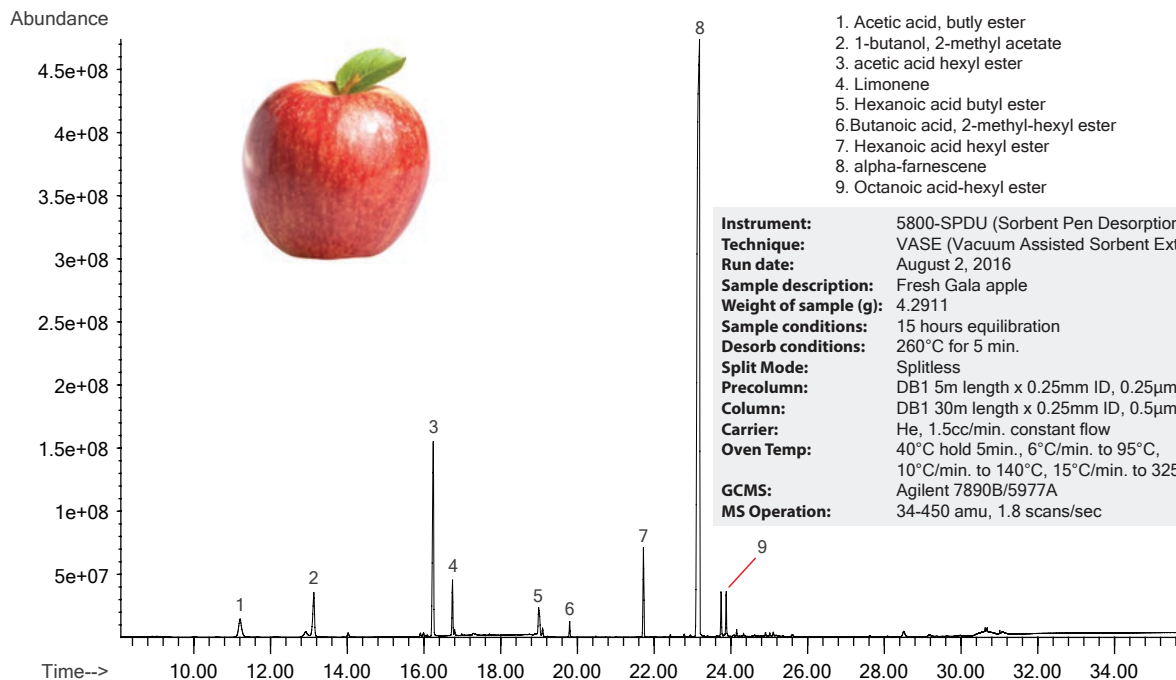
TIC: 170428\_08.D\data.ms



**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** April 28, 2017  
**Sample description:** Fresh Baked Chocolate Chip Cookie  
**Weight of sample (g):** 1.4723  
**Sample conditions:** 5hrs@25C 100rpm + preheat 2min + split 30:1  
**Split Mode:** Split 2, 30:1  
**Column:** Db-5MS UI 30 x 0.250 x 0.50  
**Carrier:** Helium 1.5mL/min  
**Oven Temp:** 35C hold 5min, 10C/min to 150, 20C/min to 300C, hold 5min (29min run time)  
**GCMS:** Agilent 7890B GC 5977A MS  
**MS Operation:** 33-450, 3 scans/sec

# Fresh Apple Analysis

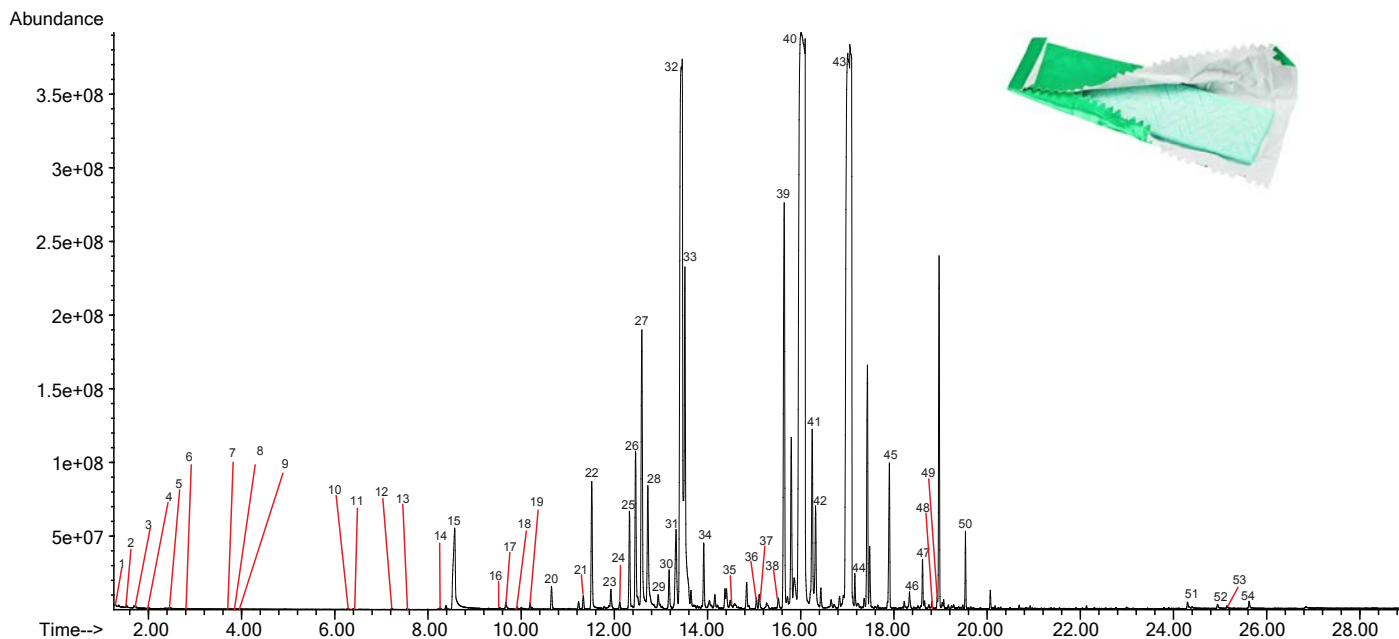
TIC: 16080202.D\data.ms



**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** August 2, 2016  
**Sample description:** Fresh Gala apple  
**Weight of sample (g):** 4.2911  
**Sample conditions:** 15 hours equilibration  
**Desorb conditions:** 260°C for 5 min.  
**Split Mode:** Splitless  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Column:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Carrier:** He, 1.5cc/min. constant flow  
**Oven Temp:** 40°C hold 5min., 6°C/min. to 95°C, 10°C/min. to 140°C, 15°C/min. to 325 hold 5min.  
**GCMS:** Agilent 7890B/5977A  
**MS Operation:** 34-450 amu, 1.8 scans/sec

# Gum Analysis

TIC: 170426\_08.D\data.ms



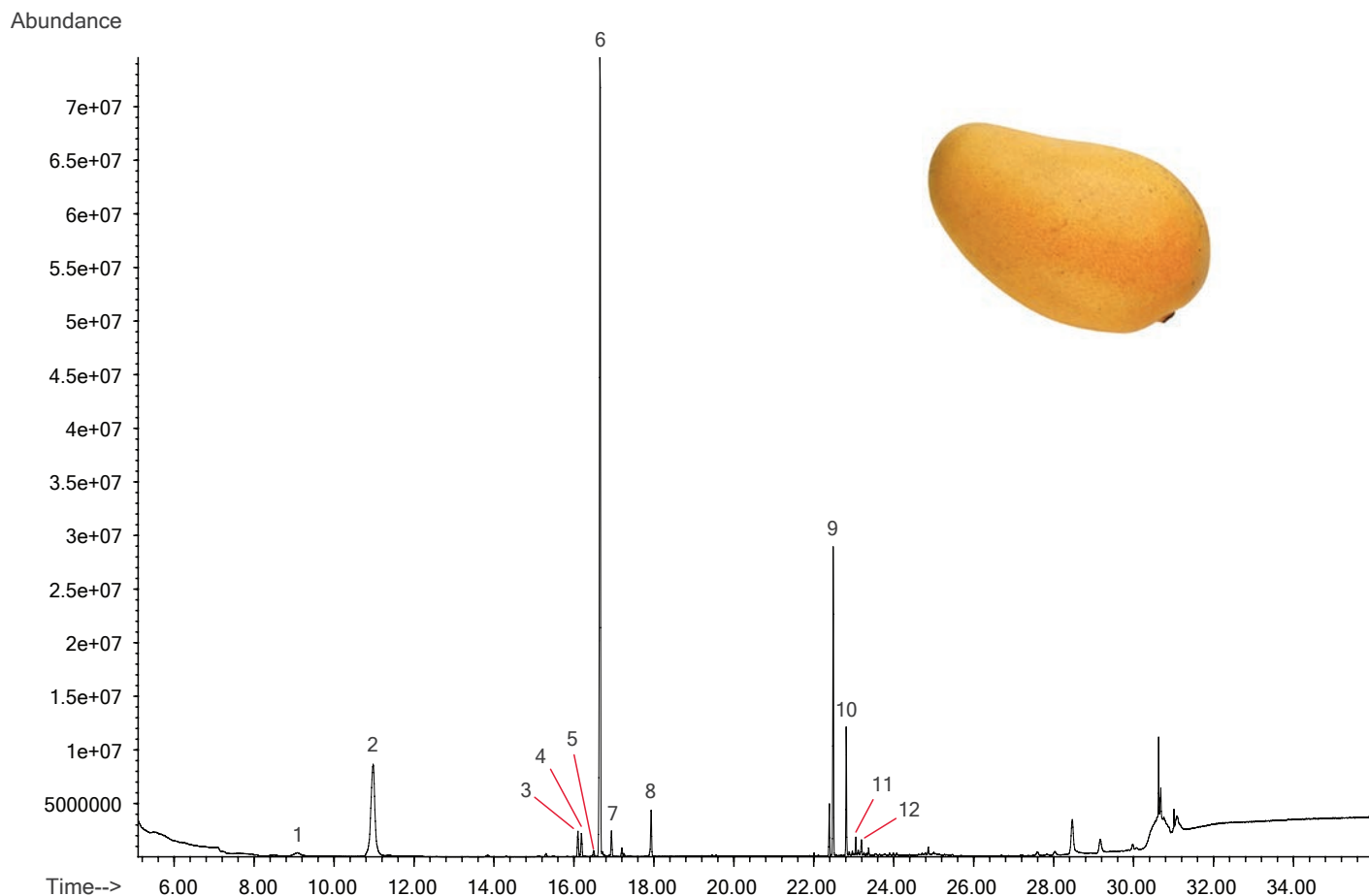
**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run Date:** April 26, 2017  
**Sample Description:** Gum  
**Weight of Sample (g):** 0.0745  
**Sample Conditions:** 20mL vial with 1 hour at 25°C 100rpm  
**Split Mode:** Split 2, 30:1  
**Column:** Db-5MS UI 30 x 0.250 x 0.50  
**Carrier:** Helium 1.5mL/min  
**Oven Temp:** 35°C hold 5 min., 10°C/min. to 150, 20°C/min to 300°C, hold 5min (29 min. run time)  
**GCMS:** Agilent 7890B GC 5977A MS  
**MS Operation:** 33-450, 3 scans/sec

- |   |  |
|---|--|
| 1. Acetaldehyde                             | 28. 3-Octanol  |
| 2. Ethanol                                  | 29. 1,3,8-p-Menthatriene                                 |
| 3. Acetone                                  | 30. 1,3-Cyclohexadiene, 1-methyl-4-(1-methylethyl)-      |
| 4. Carbon disulfide                         | 31. o-Cymene   |
| 5. Methyl vinyl ketone                      | 32. D-Limonene   |
| 6. Ethyl Acetate                            | 33. Eucalyptol   |
| 7. Butanal, 3-methyl-                       | 34. .gamma.-Terpinene                                    |
| 8. 1-Butanol                                | 35. Benzene, 1-methyl-4-(1-methylethenyl)-               |
| 9. Butanal, 2-methyl-                       | 36. 2,4,6-Octatriene, 2,6-dimethyl-, (E,Z)-              |
| 10. 1-Butanol, 3-methyl-                    | 37. Pentanedioic acid, dimethyl ester                    |
| 11. 1-Butanol, 2-methyl-                    | 38. dl-Isopulegol  |
| 12. Toluene                                 | 39. l-Menthone   |
| 13. Butanoic acid, 2-methyl-, methyl ester  | 40. Levomenthol  |
| 14. Butanoic acid, ethyl ester              | 41. Methyl salicylate                                    |
| 15. Propanoic acid, 2-hydroxy-, ethyl ester | 42. Cyclohexanone, 2-methyl-5-(1-methylethenyl)-, trans- |
| 16. Butanoic acid, 2-methyl-, ethyl ester   | 43. D-Carvone  |
| 17. 3-Hexen-1-ol, (Z)-                      | 44. 2-Cyclohexen-1-one, 3-methyl-6-(1-methylethyl)-      |
| 18. 2-Hexen-1-ol, (E)-                      | 45. Triacetin  |
| 19. 1-Butanol, 3-methyl-, acetate           | 46. 2-Allyl-4-methylphenol                               |
| 20. Furan, 2,5-diethyltetrahydro-           | 47. (-).beta.-Bourbonene                                 |
| 21. .alpha.-Phellandrene                    | 48. Isocaryophyllene                                     |
| 22. .alpha.-Pinene                          | 49. .beta.-ylangene                                      |
| 23. Cyclohexanone, 3-methyl-                | 50. Butylated Hydroxytoluene                             |
| 24. Benzaldehyde                            | 51. 9-Octadecenamide, (Z)-                               |
| 25. .beta.-Phellandrene                     | 52. Erucic acid  |
| 26. .beta.-Pinene                           | 53. Diisooctyl phthalate                                 |
| 27. .beta.-Myrcene                          | 54. 13-Docosenamide, (Z)-                                |



# Mango Analysis

TIC: 16080303.D\data.ms

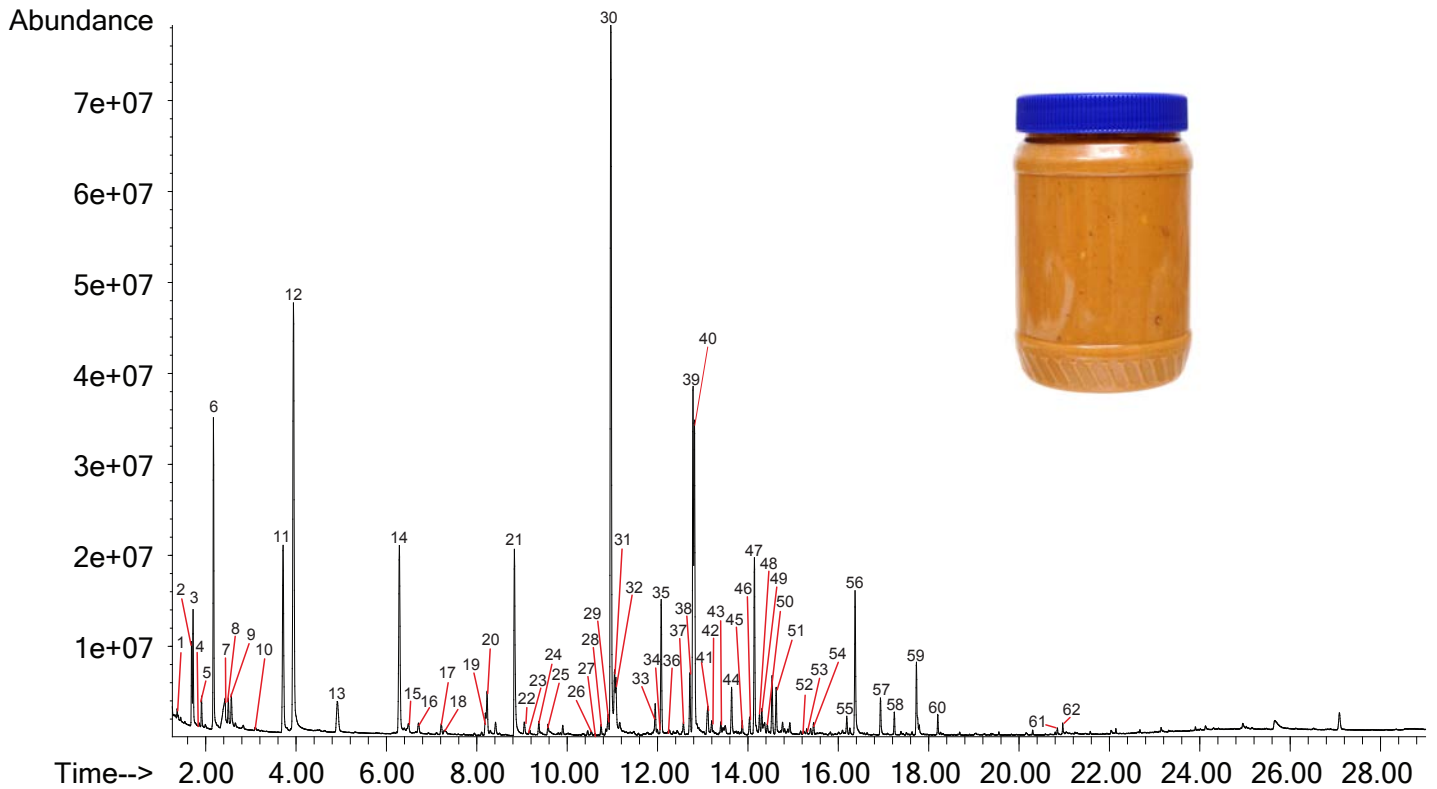


**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run Date:** August 3, 2016  
**Sample Description:** Fresh Mango  
**Weight of Sample (g):** 7.7366  
**Sample Conditions:** 40mL vial with 15 hours equilibration  
**Desorb conditions:** 260°C for 5 min.  
**Split Mode:** Splitless  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Column:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Carrier:** He, 1.5cc/min. constant flow  
**Oven Temp:** 40°C hold 5min., 6°C/min. to 95°C, 10°C/min. to 140°C, 10°C/min. to 325 hold 5min.  
**GCMS:** Agilent 7890B/5977A  
**MS Operation:** 34-450 amu, 1.8 scans/sec

1. Disulfide, dimethyl
2. Butanoic acid, ethyl ester
3. Butanoic acid, butyl ester
4. .beta.-Myrcene
5. .alpha.-Phellandrene
6. 3-Carene
7. Limonene
8. Terpinolene
9. Caryophyllene
10. Humulene
11. .beta.-copaene
12. Naphthalene, 1,2,3,5,6,7,8,8a-octahydro-1,8a-dimethyl-7-(1-methylethenyl)-, [1R-(1.alpha.,7.beta.,8a.alpha.)]-

# Peanut Butter Analysis

TIC: 170503\_04.D\data.ms



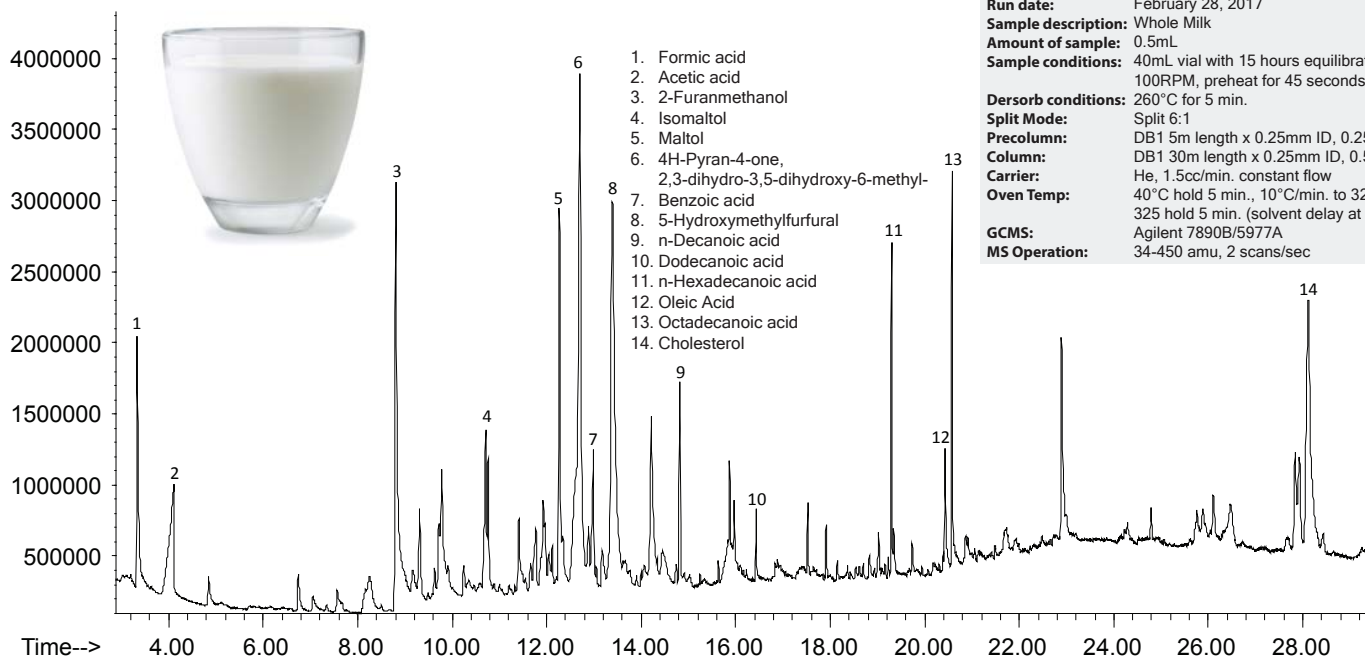
**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run Date:** May 3, 2017  
**Sample Description:** Peanut Butter, creamy, 16oz., lot # 69504004  
**Weight of Sample (g):** 0.5386  
**Sample Conditions:** 40mL vial with 15 hours at 25°C 100rpm  
+ split 30:1 + preheat 2 min  
**Split Mode:** Agilent Splitter, 30:1  
**Column:** DB-5MS UI 30 x 0.250 x 0.50  
**Carrier:** Helium 1.5mL/min  
**Oven Temp:** 35°C hold 5min, 10°C/min to 150,  
20°C/min to 300°C, hold 5 min (29 min run time)  
**GCMS:** Agilent 7890B GC 5977A MS  
**MS Operation:** 33-450, 3 scans/sec

- |                              |                                      |   |
|------------------------------|--------------------------------------|---|
| 1. Acetaldehyde              | 21. Pyrazine, methyl-                | 41. Pyrazinamide                              |
| 2. Acetone                   | 22. Furfural                         | 42. Pyrazine, 2-ethenyl-5-methyl-             |
| 3. Pentane                   | 23. 1H-Pyrrole, 3-methyl-            | 43. Ethanone, 1-(2-pyridinyl)-                |
| 4. Dimethyl sulfide          | 24. 1H-Pyrrole, 2-methyl-            | 44. Benzeneacetaldehyde                       |
| 5. Acetic acid, methyl ester | 25. 2-Furanmethanol                  | 45. Ethanone, 1-(1H-pyrrol-2-yl)-             |
| 6. Propanal, 2-methyl-       | 26. 2-Heptanone                      | 46. Acetophenone                              |
| 7. Acetic acid               | 27. Heptanal                         | 47. Pyrazine, 3-ethyl-2,5-dimethyl-           |
| 8. 2,3-Butanedione           | 28. 2(5H)-Furanone                   | 48. Pyrazine, 2-ethyl-3,5-dimethyl-           |
| 9. 2-Butanone                | 29. Butyrolactone                    | 49. 2,3-Dimethyl-5-ethylpyrazine              |
| 10. 1-Propanol, 2-methyl-    | 30. Pyrazine, 2,5-dimethyl-          | 50. Pyrazine, 2,5-diethyl-                    |
| 11. Butanal, 3-methyl-       | 31. Pyrazine, ethyl-                 | 51. Nonanal                                   |
| 12. Butanal, 2-methyl-       | 32. Pyrazine, 2,3-dimethyl-          | 52. Methyl nicotinate                         |
| 13. 2,3-Pentanedione         | 33. 2H-Pyran-2-one, tetrahydro-      | 53. 5H-5-Methyl-6,7-dihydrocyclopentapyrazine |
| 14. 1H-Pyrrole, 1-methyl-    | 34. 2-Furancarboxaldehyde, 5-methyl- | 54. Pyrazine, 3,5-diethyl-2-methyl-           |
| 15. Disulfide, dimethyl      | 35. Benzaldehyde                     | 55. 6-Aminoindoline                           |
| 16. Pyrrole                  | 36. Dimethyl trisulfide              | 56. Benzofuran, 2,3-dihydro-                  |
| 17. Pentanal, 2-methyl-      | 37. Furan, 2-pentyl-                 | 57. (-)-Carvone                               |
| 18. Toluene                  | 38. Pyrazine, 2-ethyl-6-methyl-      | 58. Benzeneacetaldehyde, .alpha.-ethylidene-  |
| 19. Octane                   | 39. Pyrazine, trimethyl-             | 59. 2-Methoxy-4-vinylphenol                   |
| 20. Hexanal                  | 40. Pyrazine, 2-ethyl-5-methyl-      | 60. 2,4-Decadienal                            |
|                              |                                      | 61. 2-Pentadecanone                           |
|                              |                                      | 62. Pentadecanal-                             |

# Milk Analysis

TIC: 170228\_18.D\data.ms

Abundance

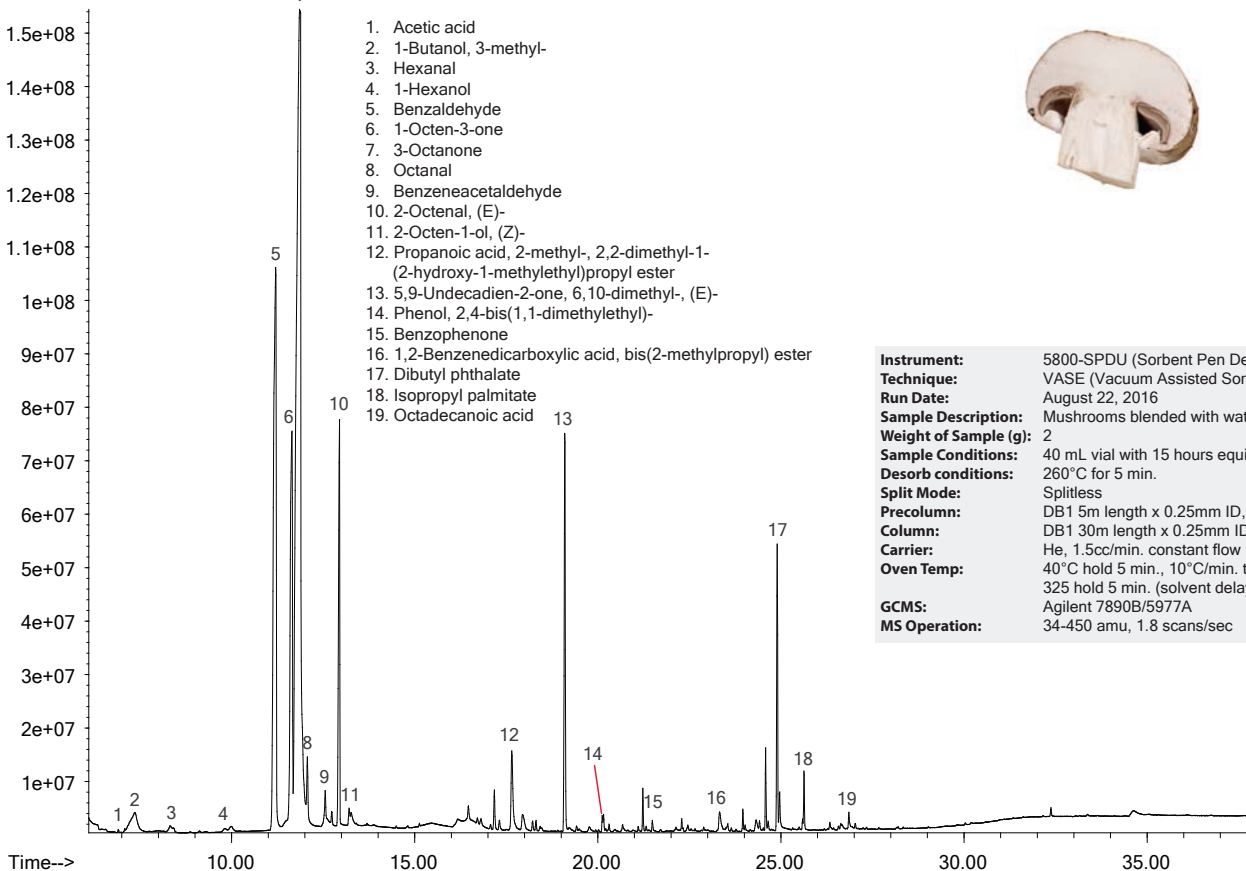


**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** February 28, 2017  
**Sample description:** Whole Milk  
**Amount of sample:** 0.5mL  
**Sample conditions:** 40mL vial with 15 hours equilibration at 25°C 100RPM, preheat for 45 seconds  
**Desorb conditions:** 260°C for 5 min.  
**Split Mode:** Split 6:1  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Column:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Carrier:** He, 1.5cc/min. constant flow  
**Oven Temp:** 40°C hold 5 min., 10°C/min. to 325°C, 325 hold 5 min. (solvent delay at 6 min.)  
**GCMS:** Agilent 7890B/5977A  
**MS Operation:** 34-450 amu, 2 scans/sec

# Mushroom Analysis

TIC: 161122\_02.D\data.ms

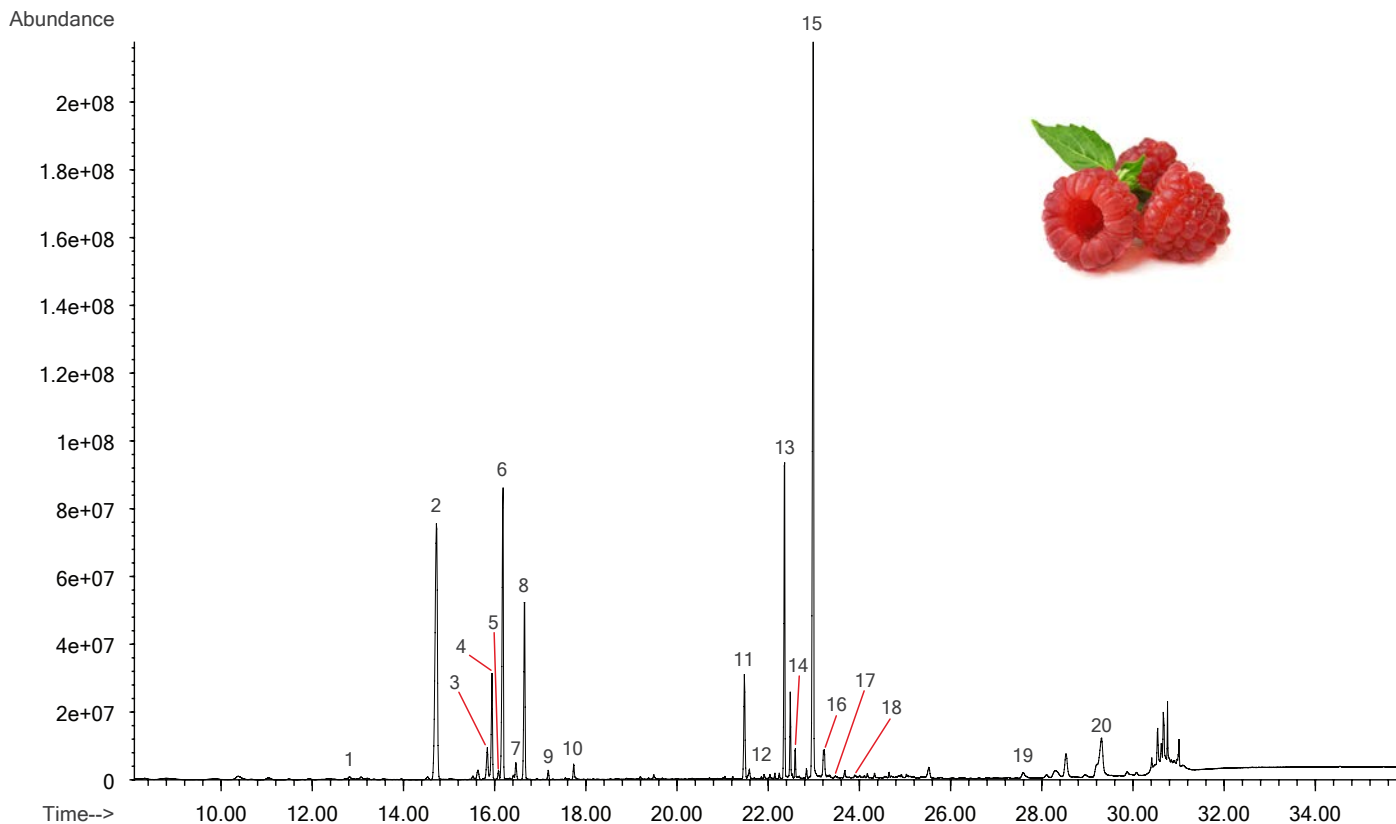
Abundance



**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run Date:** August 22, 2016  
**Sample Description:** Mushrooms blended with water (1:2 ratio)  
**Weight of Sample (g):** 2  
**Sample Conditions:** 40 mL vial with 15 hours equilibration at 25°C 260°C for 5 min.  
**Desorb conditions:** Splitless  
**Split Mode:** Splitless  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Column:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Carrier:** He, 1.5cc/min. constant flow  
**Oven Temp:** 40°C hold 5 min., 10°C/min. to 325°C, 325 hold 5 min. (solvent delay at 6 min.)  
**GCMS:** Agilent 7890B/5977A  
**MS Operation:** 34-450 amu, 1.8 scans/sec

# Raspberry Analysis

TIC: 16080201.D\data.ms



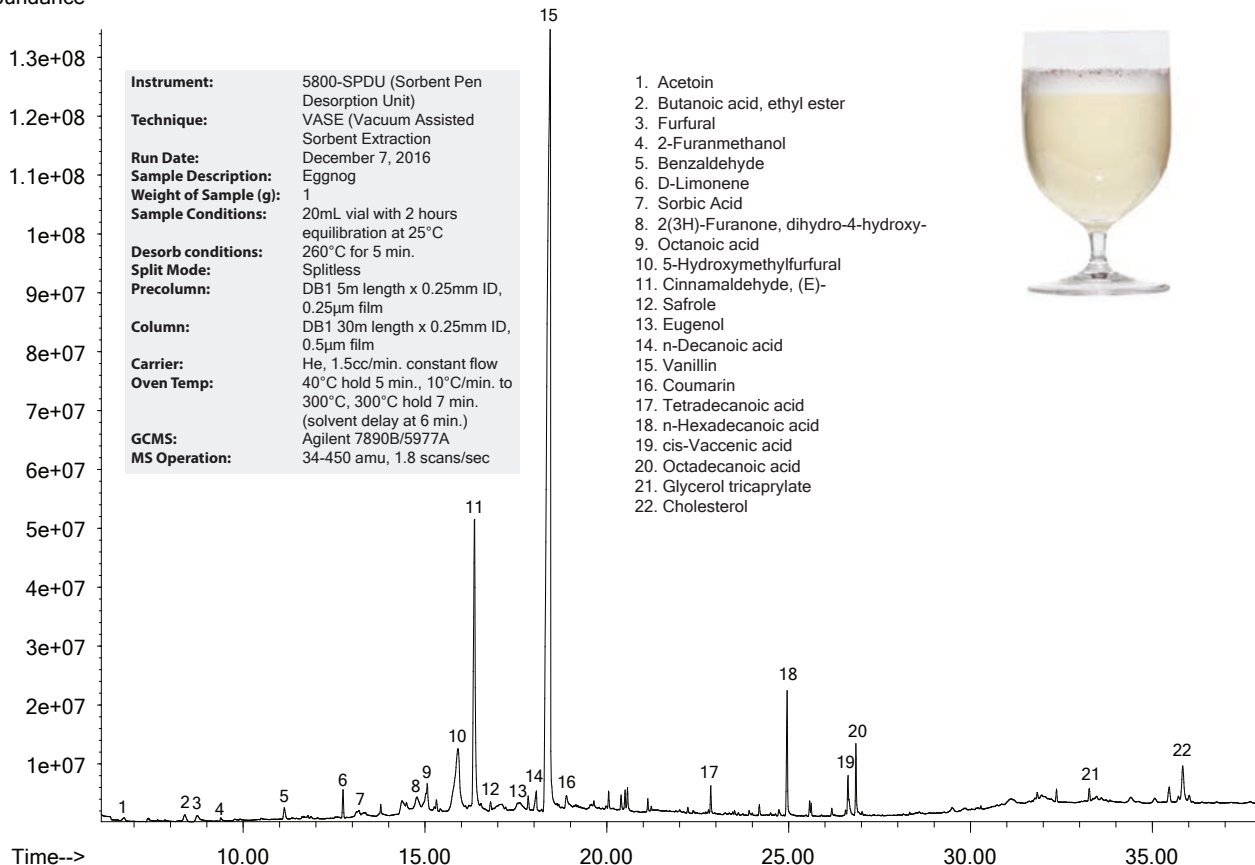
**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run Date:** August 2, 2016  
**Sample Description:** Fresh Raspberries  
**Weight of Sample (g):** 6.9049  
**Sample Conditions:** vac(30sec) + 15hr equilibration  
**Desorb conditions:** 260°C for 5 min.  
**Split Mode:** Splitless  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25µm film  
**Column:** DB1 30m length x 0.25mm ID, 0.5µm film  
**Carrier:** He, 1.5cc/min. constant flow  
**Oven Temp:** 40°C hold 5min., 6°C/min. to 95°C,  
10°C/min. to 140°C, 15°C/min. to  
325 hold 5min.  
**GCMS:** Agilent 7890B/5977A  
**MS Operation:** 34-450 amu, 1.8 scans/sec

1. 2-Heptanone
2. alpha-pinene
3. beta-myrcene
4. 3-hexen-1-ol, acetate (Z)
5. acetic acid, hexyl ester
6. alpha- phellandrene
7. p-cymene
8. .beta.-Phellandrene
9. gamma terpinene
10. Cyclohexene, 1-methyl-4(1methylethylidene)
11. 3-buten-2-one, 4-(2,6,6 trimethyl 1-cyclohexen-1-yl)
12. 1,1,5-trimethyl-1, 2-hydronaphthalene
13. alpha-Ionone
14. 1,3,6,10-Dodecatetraene, 3,7,11-trimethyl (Z,E)
15. trans-beta-Ionone
16. alpha farnesene
17. Naphthalene, 1,2,3,5,6,7,8,8a-octahydro-1,8a-dimethyl-7-(1-methylethenyl)-, [1R-(1.alpha.,7.beta.,8a.alpha.)]-
18. Dodecanoic acid
19. Pentadecanoic acid
20. n-Hexadecanoic acid

# Eggnog Analysis

TIC: 161207\_08.D\data.ms

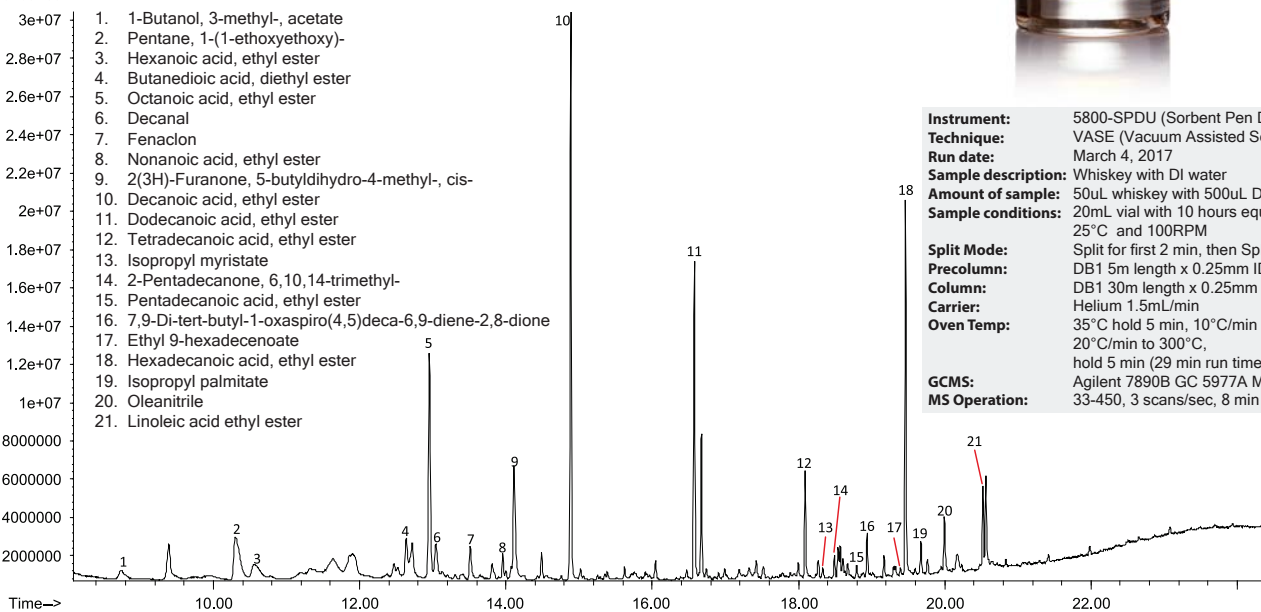
Abundance



# Whiskey Analysis

TIC: 170304\_04.D\data.ms

Abundance



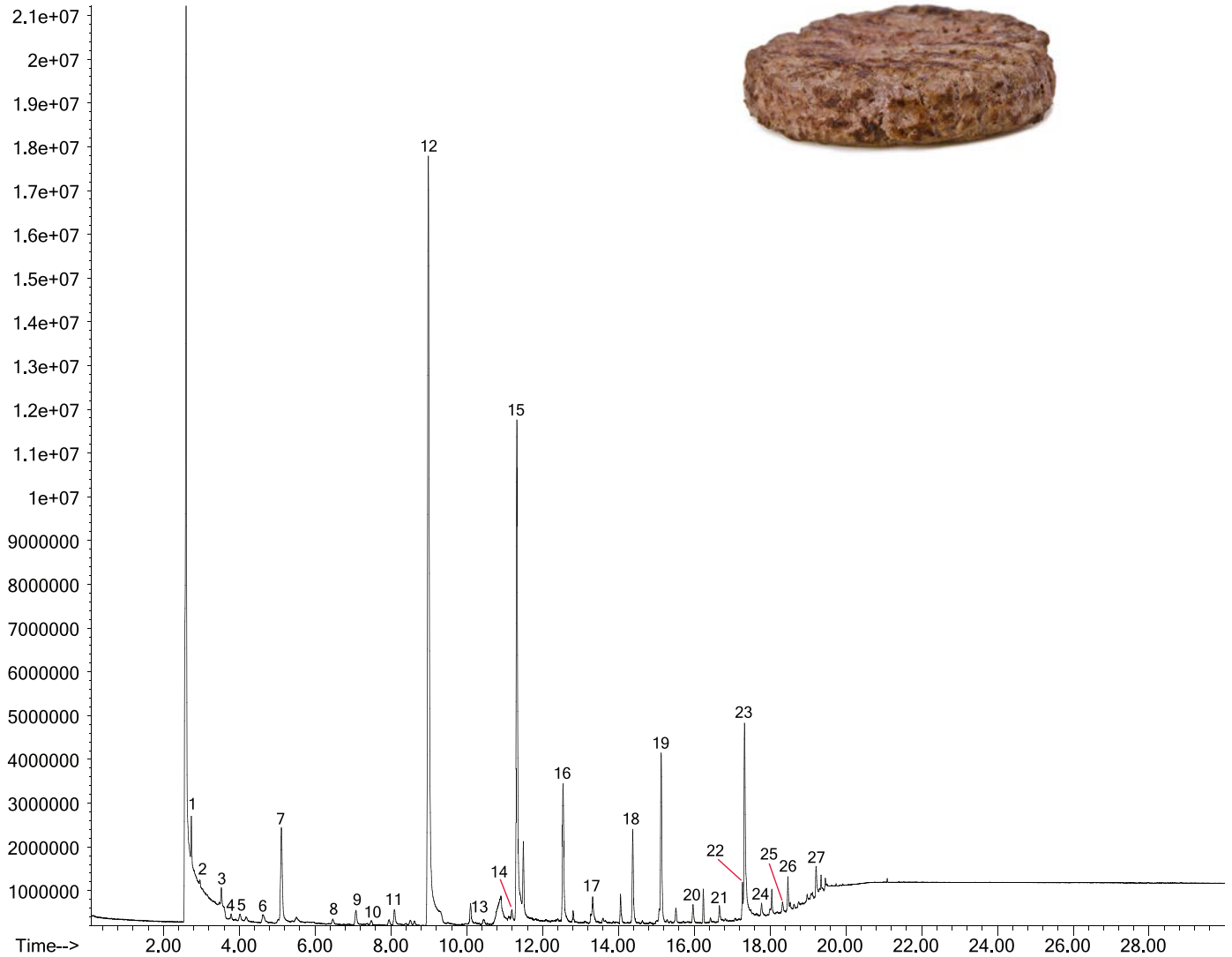
**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** March 4, 2017  
**Sample description:** Whiskey with DI water  
**Amount of sample:** 50uL whiskey with 500uL DI water  
**Sample conditions:** 20mL vial with 10 hours equilibration at 25°C and 100RPM  
**Split Mode:** Split for first 2 min, then Splitless  
**Precolumn:** DB1 5m length x 0.25mm ID, 0.25um film  
**Column:** DB1 30m length x 0.25mm ID, 0.5um film  
**Carrier:** Helium 1.5mL/min  
**Oven Temp:** 35°C hold 5 min, 10°C/min to 150°C, 20°C/min to 300°C, hold 5 min (29 min run time)  
**GCMS:** Agilent 7890B GC 5977A MS  
**MS Operation:** 33-450, 3 scans/sec, 8 min solvent delay



# Cooked Ground Beef Analysis

TIC: 1171121\_14.D\data.ms

Abundance

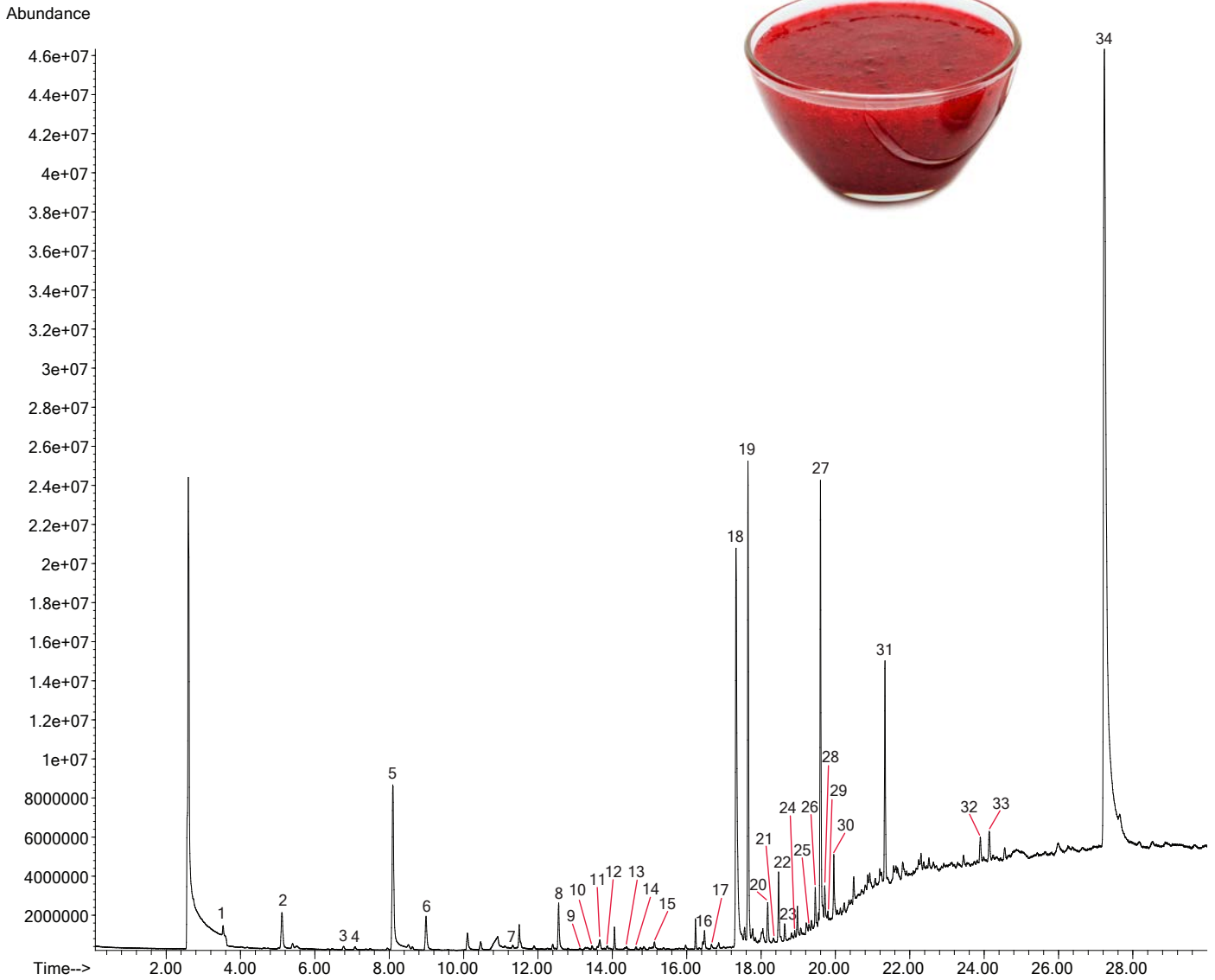


**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** November 28, 2017  
**Sample description:** Cooked ground beef 80% lean  
**Weight of sample (g):** 0.50  
**Sample conditions:** 5hrs@25C 300 rpm + cold tray  
**Split Mode:** Agilent 30:1 split  
**Preheat:** 2min at 260°C  
**Precolumn:** 0.6m Silonite Coated Tubing  
**Column:** DB-5MS UI 30m x 0.250mm ID x 0.50um film thickness  
**Carrier:** Helium 1.5mL/min  
**Oven Temp:** 35°C hold 5min, 10°C/min to 150, 20°C/min to 230°C, hold 9.5min (30min run time)  
**GCMS:** Agilent 7890B GC 5977A MS  
**MS Operation:** Full Scan, 33-450, 3 scans/sec

- |                         |                         |
|-------------------------|-------------------------|
| 1. Pentane              | 15. Hexanal             |
| 2. n-Hexane             | 16. p-Xylene            |
| 3. Acetaldehyde         | 17. Heptanal            |
| 4. Carbon disulfide     | 18. 1-Pentanol          |
| 5. Dimethyl sulfide     | 19. Acetoin             |
| 6. Propanal             | 20. 1-Hexanol           |
| 7. Acetone              | 21. Nonanal             |
| 8. Butanal              | 22. 1-Octen-3-ol        |
| 9. 2-Butanone           | 23. Acetic acid         |
| 10. Butanal, 3-methyl-  | 24. 1-Hexanol, 2-ethyl- |
| 11. Ethanol             | 25. Propanoic acid      |
| 12. Toluene             | 26. Benzaldehyde        |
| 13. 2,3-Butanedione     | 27. Butanoic Acid       |
| 14. Disulfide, dimethyl |                         |

# Canned Cranberry Sauce Analysis

TIC: 161207\_08.D\data.ms

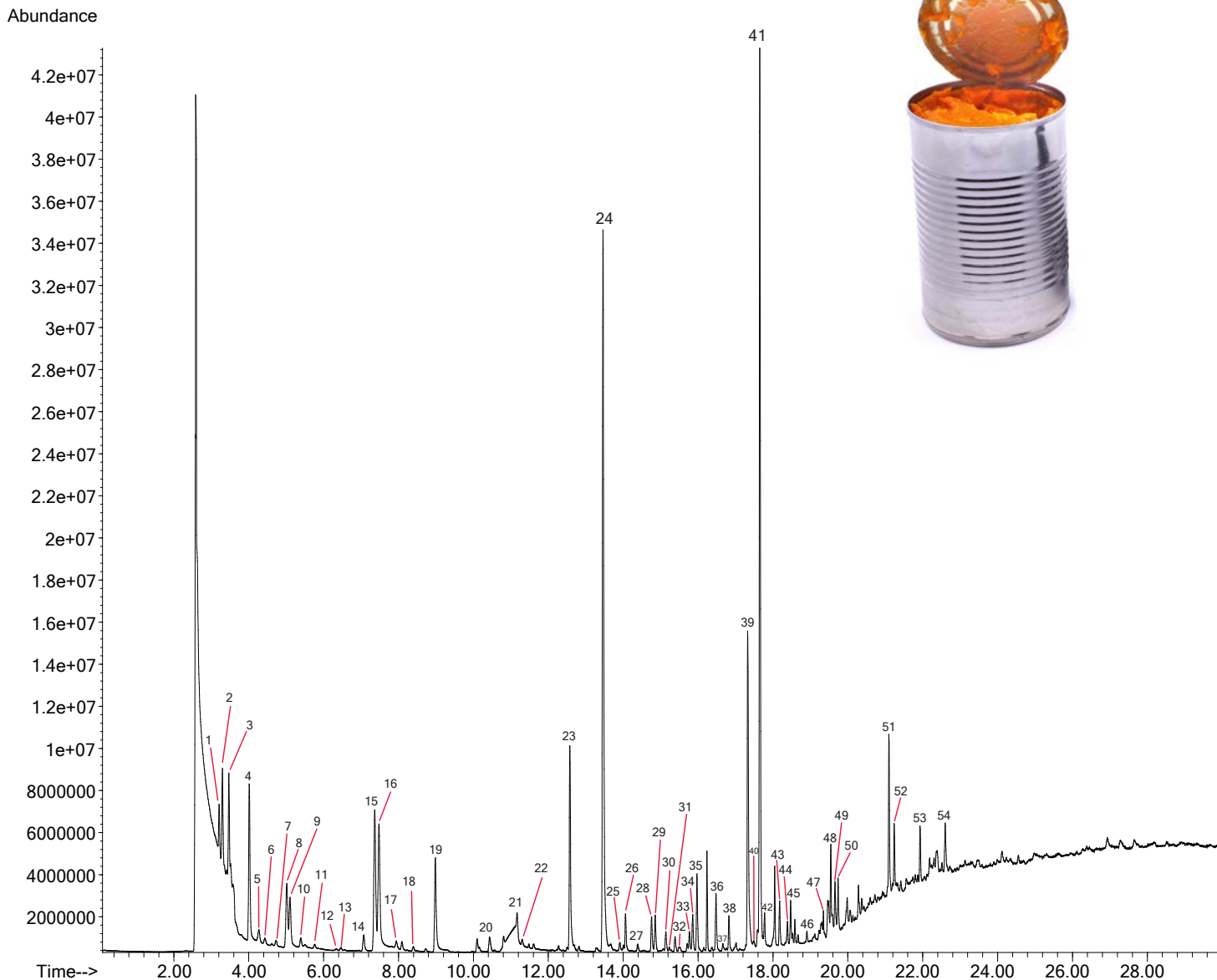


**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** November 28, 2017  
**Sample description:** Canned whole cranberry sauce  
**Weight of sample (g):** 0.49  
**Sample conditions:** 15hrs@25C 300 rpm + cold tray  
**Split Mode:** 30:1 split  
**Preheat:** 2min at 260°C  
**Precolumn:** 0.6m Silonite Coated Tubing  
**Column:** DB-5MS UI 30m x 0.250mm ID x 0.50um film thickness  
**Carrier:** Helium 1.5mL/min  
**Oven Temp:** 35°C hold 5min, 10°C/min to 150, 20°C/min to 230°C, hold 9.5min (30min run time)  
**GCMS:** Agilent 7890B GC 5977A MS  
**MS Operation:** Full Scan, 33-450, 3 scans/scan

- |                          |                                       |
|--------------------------|---------------------------------------|
| 1. Acetaldehyde          | 18. Acetic acid                       |
| 2. Acetone               | 19. Furfural                          |
| 3. Ethyl Acetate         | 20. Ethanone, 1-(2-furanyl)-          |
| 4. 2-Butanone            | 21. Propanoic acid                    |
| 5. Ethanol               | 22. Benzaldehyde                      |
| 6. 2,3-Butanedione       | 23. Propanoic acid, 2-methyl-         |
| 7. Hexanal               | 24. 2-Furancarboxaldehyde, 5-methyl-  |
| 8. 1-Butanol             | 25. Butanoic acid                     |
| 9. Pyridine              | 26. Octadecane                        |
| 10. D-Limonene           | 27. Butanoic acid, 2-methyl-          |
| 11. 1-Butanol, 3-methyl- | 28. Heptadecane                       |
| 12. Eucalyptol           | 29. Benzoic acid, ethyl ester         |
| 13. 1-Pentanol           | 30. .alpha.-Terpineol                 |
| 14. Styrene              | 31. Benzyl alcohol                    |
| 15. Acetoin              | 32. Benzoic acid, 2-ethylhexyl ester  |
| 16. 3-Hexen-1-ol, (Z)-   | 33. i-Propyl 14-methyl-pentadecanoate |
| 17. Nonanal              | 34. Benzoic acid                      |

# Canned Pumpkin Analysis

TIC: 171121\_06.D\data.ms



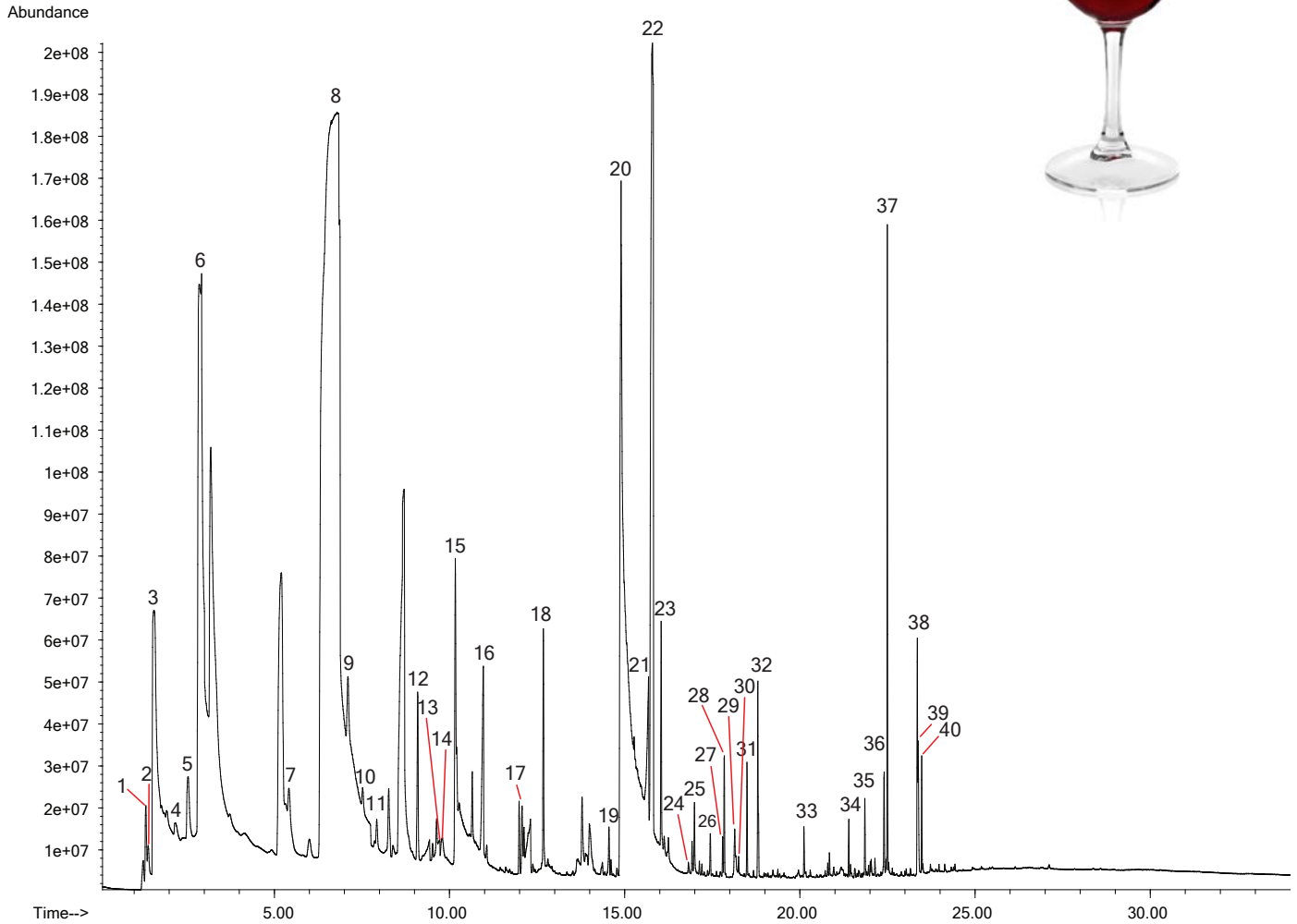
**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** November 28, 2017  
**Sample description:** Canned Pumpkin  
**Weight of sample (g):** 0.88  
**Sample conditions:** 15hrs@25C 300 rpm + cold tray  
**Split Mode:** 30:1 split  
**Preheat:** 2min at 260°C  
**Precolumn:** 0.6m Silonite Coated Tubing  
**Column:** DB-5MS UI 30m x 0.250mm ID x 0.50um film thickness  
**Carrier:** Helium 1.5mL/min  
**Oven Temp:** 35°C hold 5min, 10°C/min to 150, 20°C/min to 230°C, hold 9.5min (30min run time)  
**GCMS:** Agilent 7890B GC 5977A MS  
**MS Operation:** Full Scan, 33-450, 3 scans/sec

- |                                      |   |
|--------------------------------------|---|
| 1. Acetaldehyde                      | 28. Heptadecane                                 |
| 2. Acetone                           | 29. Benzoic acid, ethyl ester                   |
| 3. Ethyl Acetate                     | 30. alpha-Terpineol                             |
| 4. 2-Butanone                        | 31. Benzyl alcohol                              |
| 5. Ethanol                           | 32. Benzoic acid, 2-ethylhexyl ester            |
| 6. 2,3-Butanedione                   | 33. i-Propyl 14-methyl-pentadecanoate           |
| 7. Hexanal                           | 34. Benzoic acid                                |
| 8. 1-Butanol                         | 35. 1-Hexanol                                   |
| 9. Pyridine                          | 36. 3-Hexen-1-ol, (Z)-                          |
| 10. D-Limonene                       | 37. Nonanal                                     |
| 11. 1-Butanol, 3-methyl-             | 38. Ethanol, 2-butoxy-                          |
| 12. Eucalyptol                       | 39. Acetic acid                                 |
| 13. 1-Pentanol                       | 40. Methional                                   |
| 14. Styrene                          | 41. Furfural                                    |
| 15. Acetoin                          | 42. 1-Hexanol, 2-ethyl-                         |
| 16. 3-Hexen-1-ol, (Z)-               | 43. Ethanone, 1-(2-furanyl)-                    |
| 17. Nonanal                          | 44. 1,6-Octadien-3-ol, 3,7-dimethyl-            |
| 18. Acetic acid                      | 45. Benzaldehyde                                |
| 19. Furfural                         | 46. 2-Furancarboxaldehyde, 5-methyl-            |
| 20. Ethanone, 1-(2-furanyl)-         | 47. 1H-Pyrazole-4-carboxaldehyde, 1,5-dimethyl- |
| 21. Propanoic acid                   | 48. 2-Furanmethanol                             |
| 22. Benzaldehyde                     | 49. 1H-Indene, 1,1,3-trimethyl-                 |
| 23. Propanoic acid, 2-methyl-        | 50. 3-Nonen-1-ol, (Z)-                          |
| 24. 2-Furancarboxaldehyde, 5-methyl- | 51. 5,9-Undecadien-2-one, 6,10-dimethyl-, (E)-  |
| 25. Butanoic acid                    | 52. alpha-Ionone                                |
| 26. Octadecane                       | 53. trans-beta-Ionone                           |
| 27. Butanoic acid, 2-methyl-         | 54. 1H-Pyrole-2-carboxaldehyde                  |



# Wine Analysis

TIC: 170601\_03.D\data.ms

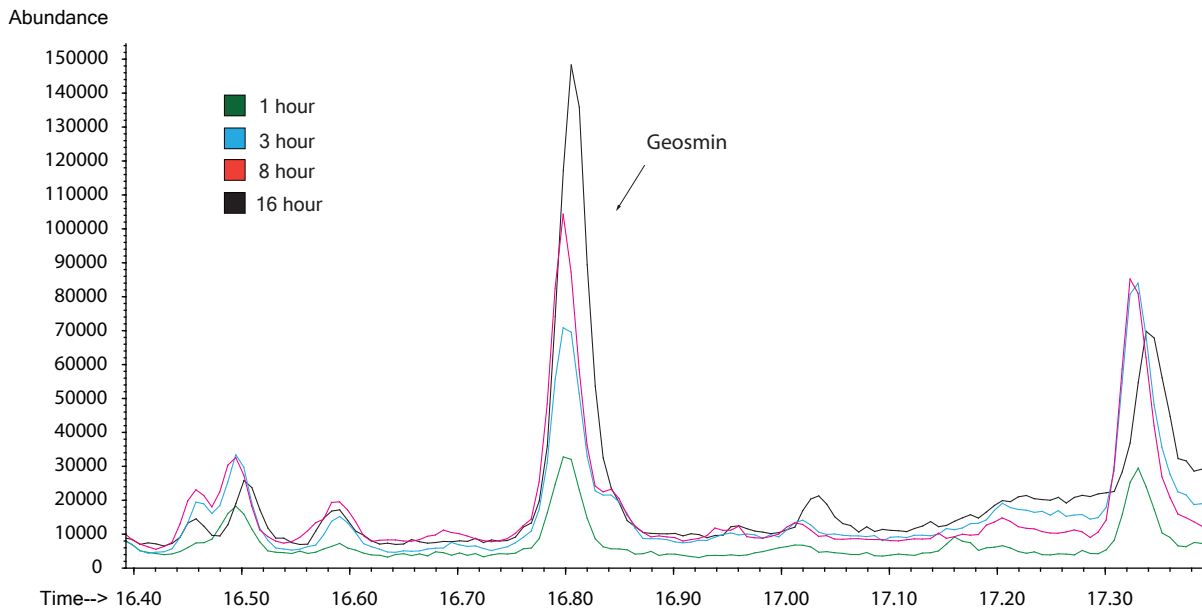
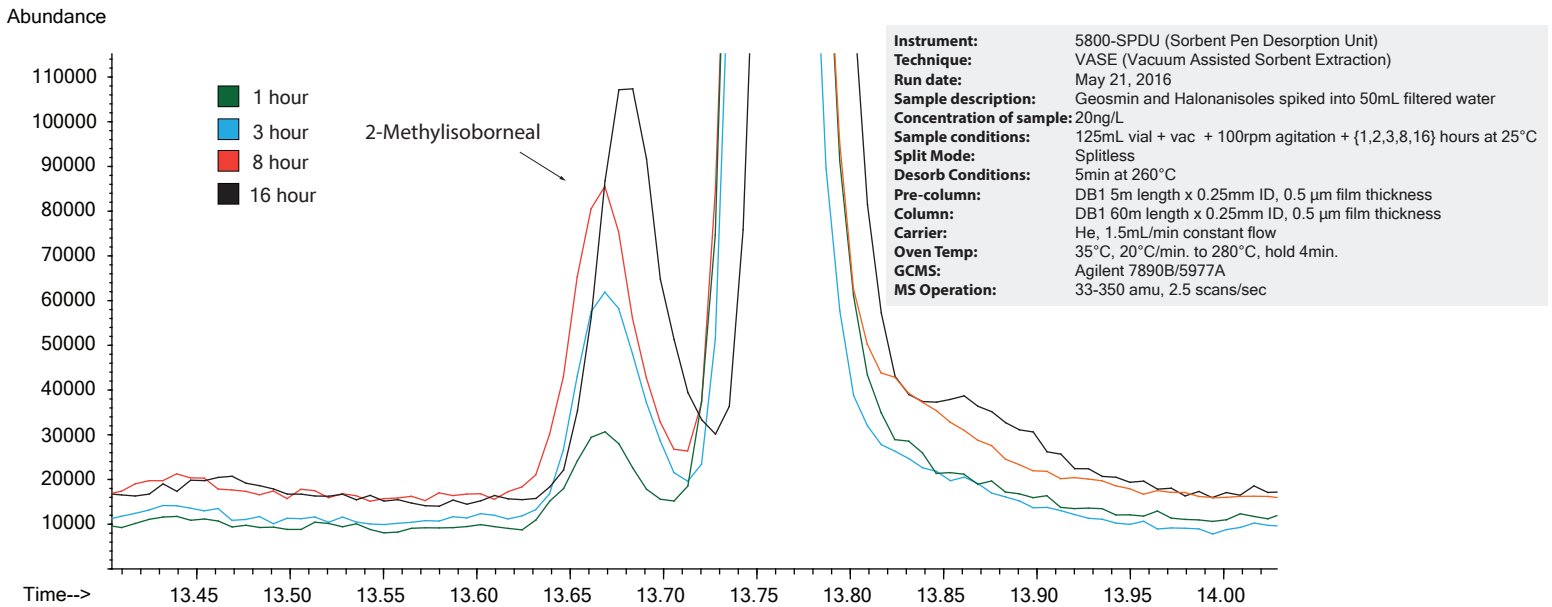


**Instrument:** 5800-SPDU (Sorbent Pen Desorption Unit)  
**Technique:** VASE (Vacuum Assisted Sorbent Extraction)  
**Run date:** June 1, 2017  
**Sample description:** Red Wine  
**Amount of sample:** 0.5mL  
**Sample conditions:** 40mL vial with 15 hours equilibration at 25°C, preheat to 260°C for 1.5min  
**Split Mode:** Agilent Splitter, 10:1  
**Precolumn:** 0.6m Silonite Coated filmless column  
**Column:** DB-5MS UI 30 x 0.250 x 0.50  
**Carrier:** Helium 1.5mL/min  
**Oven Temp:** 35°C hold 5min, 10°C/min to 150, 20°C/min to 300°C, hold 5min (29min run time)  
**GCMS:** Agilent 7890B GC 5977A MS  
**MS Operation:** 33-450, 3 scans/sec

1. Sulfur dioxide
2. Acetaldehyde
3. Ethanol
4. 1-Propanol
5. 2,3-Butanedione
6. Ethyl Acetate
7. Propanoic acid, ethyl ester
8. 1-Butanol, 3-methyl-
9. Propanoic acid, 2-methyl-, ethyl ester
10. Isobutyl acetate
11. Butanoic acid, ethyl ester
12. Furfural
13. Butanoic acid, 2-methyl-, ethyl ester
14. Butanoic acid, 3-methyl-, ethyl ester
15. 1-Butanol, 3-methyl-, acetate
16. Butyrolactone
17. 2-Furancarboxaldehyde, 5-methyl-
18. Hexanoic acid, ethyl ester
19. Butanedioic acid, ethyl methyl ester
20. Phenylethyl Alcohol
21. Octanoic acid
22. Butanedioic acid, diethyl ester
23. Octanoic acid, ethyl ester
24. Benzeneacetic acid, ethyl ester
25. Acetic acid, 2-phenylethyl ester
26. 2(3H)-Furanone, 5-butylidihydro-4-methyl-, cis-
27. Succinic acid, butyl ethyl ester
28. 2(3H)-Furanone, 5-butylidihydro-4-methyl-
29. n-Decanoic acid
30. 2(3H)-Furanone, dihydro-5-pentyl-
31. Decanoic acid, ethyl ester
32. Butanedioic acid, ethyl 3-methylbutyl ester
33. Dodecanoic acid, ethyl ester
34. Tetradecanoic acid, ethyl ester
35. 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester
36. Ethyl 9-hexadecenoate
37. Hexadecanoic acid, ethyl ester
38. Linoleic acid ethyl ester
39. Ethyl Oleate
40. Octadecanoic acid, ethyl ester

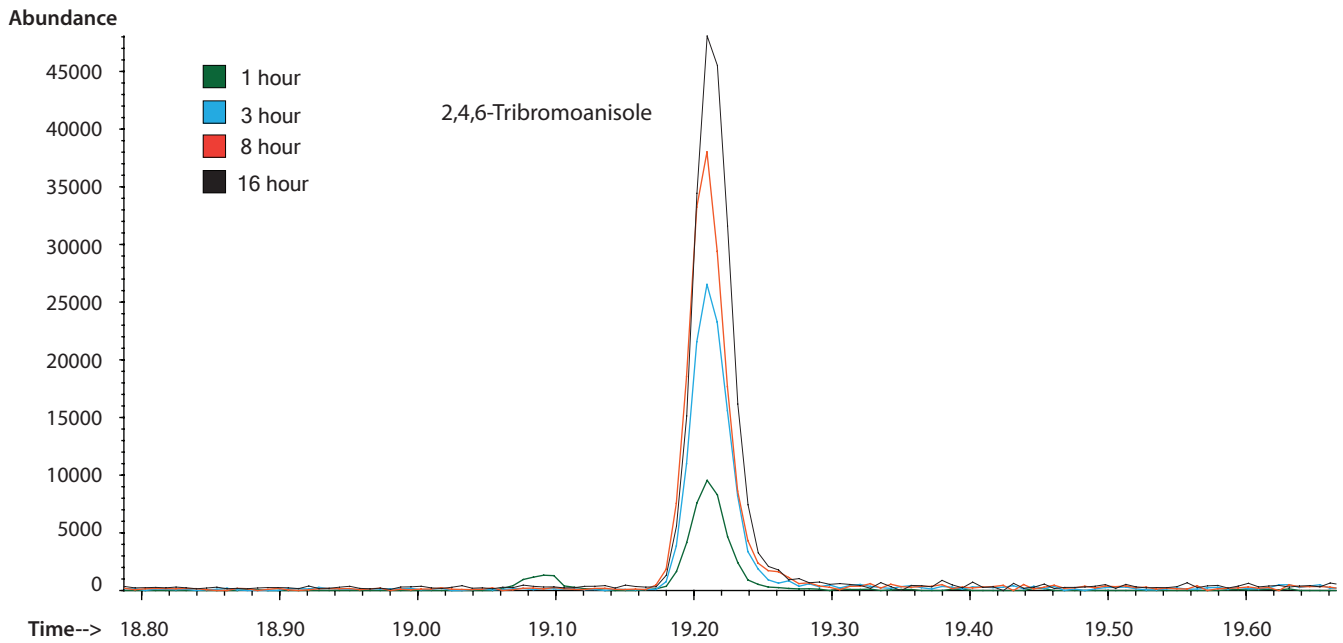
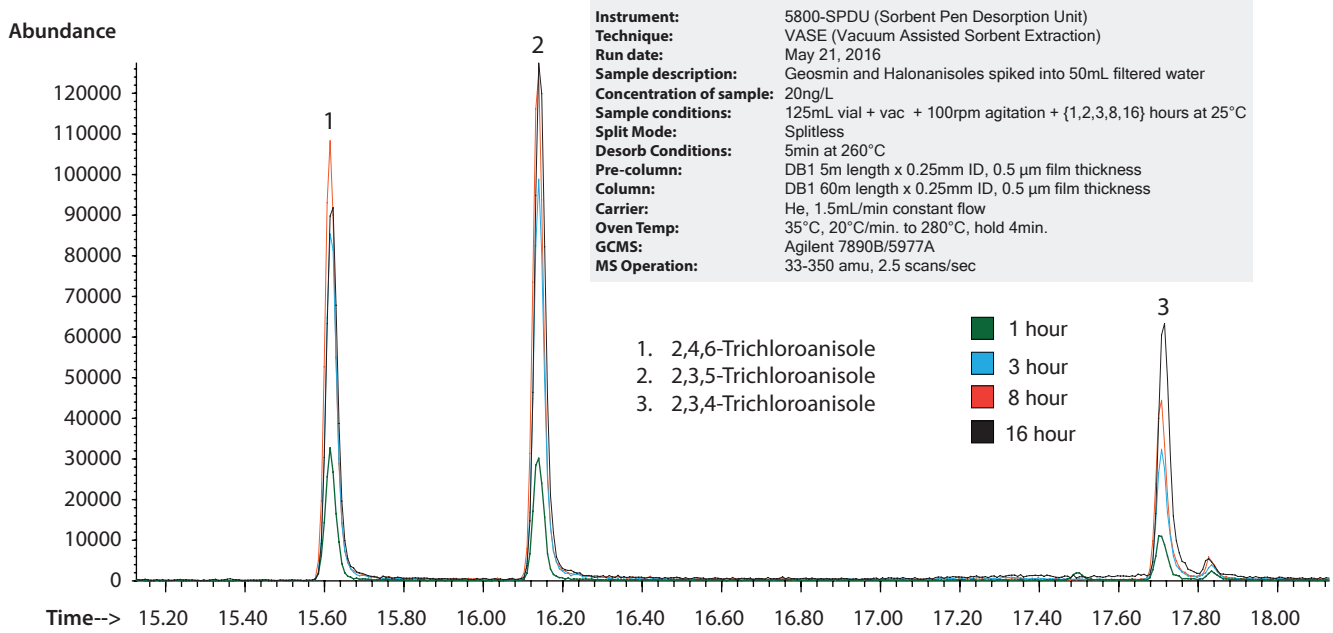
# Sorbent Pen™ Vacuum Extraction of Odors Kinetics Study Comparing Recoveries of a 20 Ppt Standard in Water After 1, 3, 8, 16 Hour Extraction Times

- Extractions performed without salting to prevent adsorbent damage via aerosol transport
- Temp = 25°C. Sorbent Pens™ heated to 30°C to prevent water condensation
- An overnight extraction appears to bring the Pens to near equilibrium with the sample



**Figures 1,2 (above)** – Relative responses for target compounds extracted from 20ng/L standards in 50cc filtered water at 25°C, no salt added, 100 rpm agitation, 1/30th atm vacuum, for 1,3,8, and 16 hours. A final extraction time of 20 hours was selected for this method with an extraction efficiency between 60-80%.

# Sorbent Pen™ Kinetic Study



**Figures 3,4 (above)** – Relative responses for target compounds extracted from 20ng/L standards in 50cc filtered water at 25°C, no salt added, 100 rpm agitation, 1/30th atm vacuum, for 1,3,8, and 16 hours. A final extraction time of 20 hours was selected for this method with an extraction efficiency between 60-80%.



## *Sorbent Pens™ - A Revolutionary Extraction Technology That Is Quantitative By Design.*

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Sorbent Pens™ Chromatography –180102.2.1