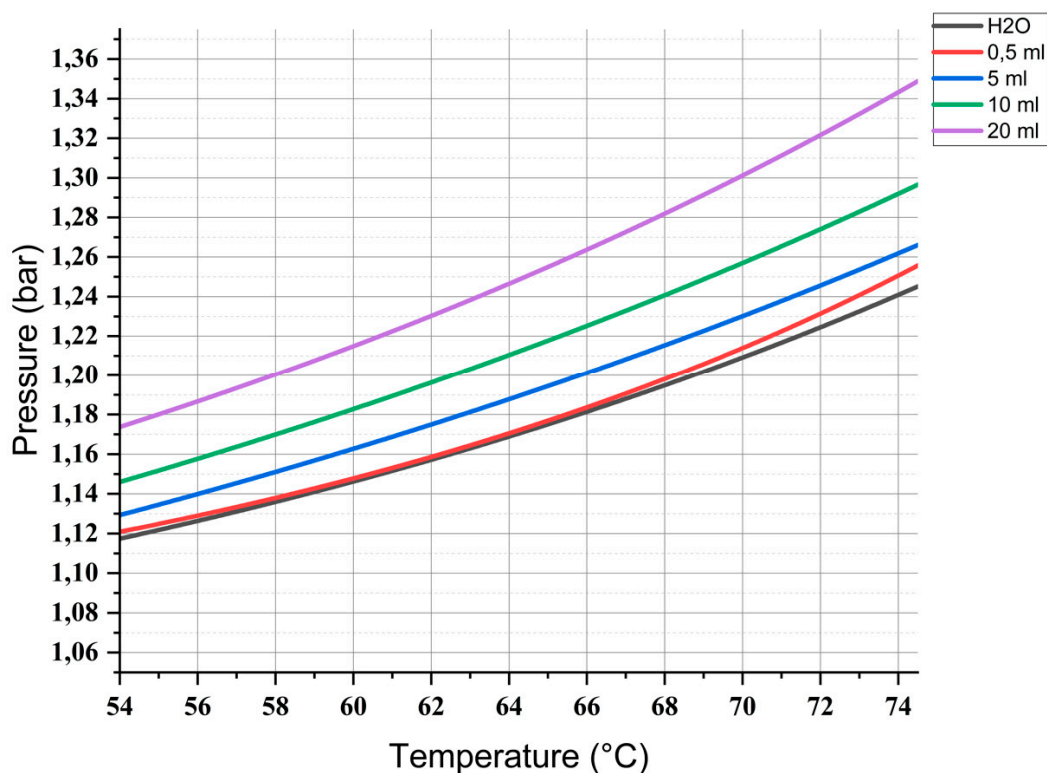


**Figure S1.** The TIC chromatogram of the miller soup volatile compounds obtained from GC-MS



**Figure S2.** Pressure in the reactor as a function of temperature for different added amounts of 35% ammonia/water solution (see insert, H<sub>2</sub>O means no ammonia added). Pressure corresponds the total pressure within the reactor in equilibrium. Temperature corresponds to the actual temperature in the middle of the reactor. ( $P_{\text{atm}} = 0.9896 \text{ Bar}$ ,  $T = 22 \pm 2 \text{ }^{\circ}\text{C}$ )

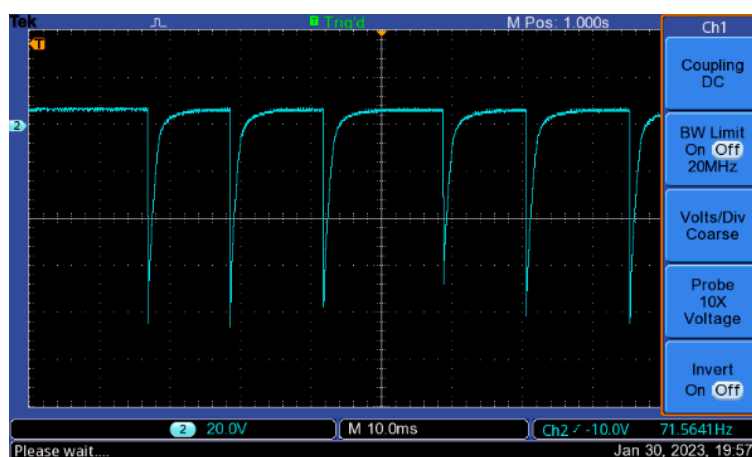


Figure S3. Voltage-time characterization of FB-1

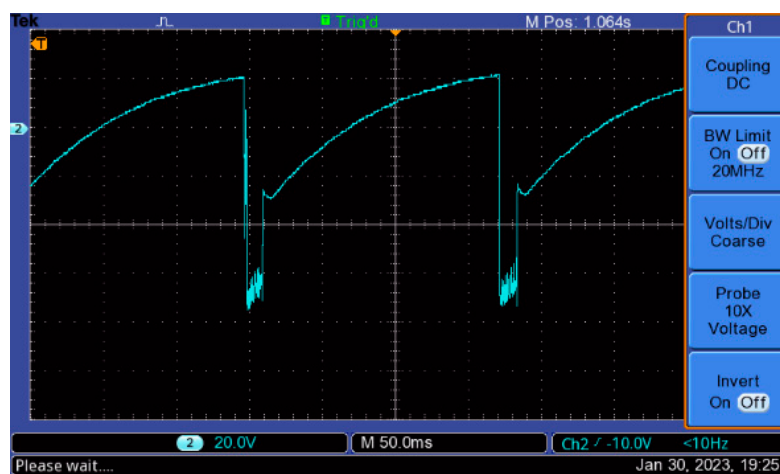


Figure S4. Voltage-time characterization of FB-2

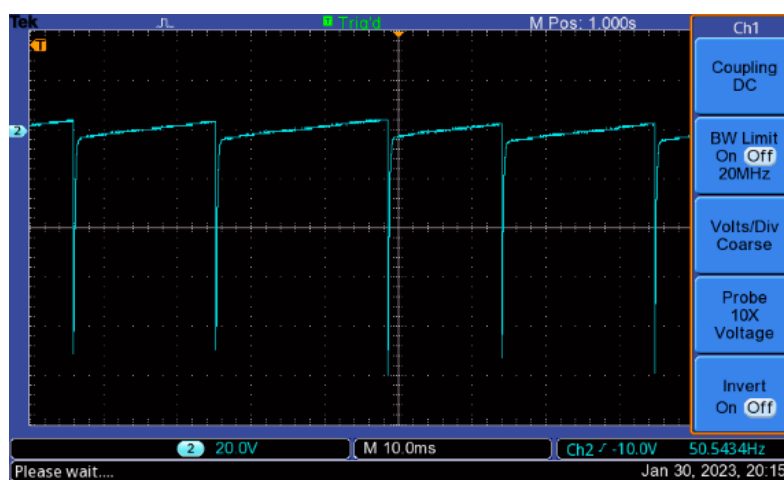
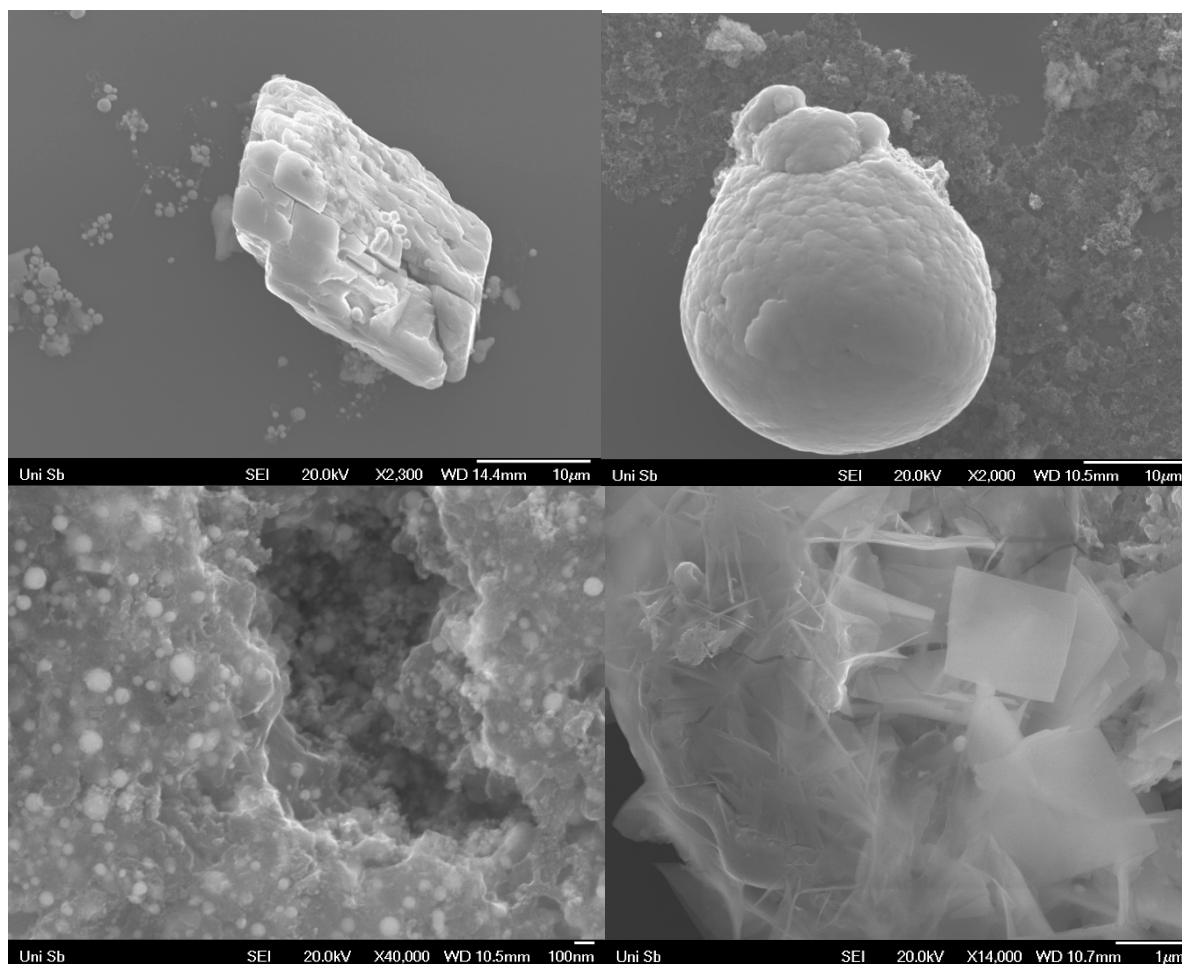
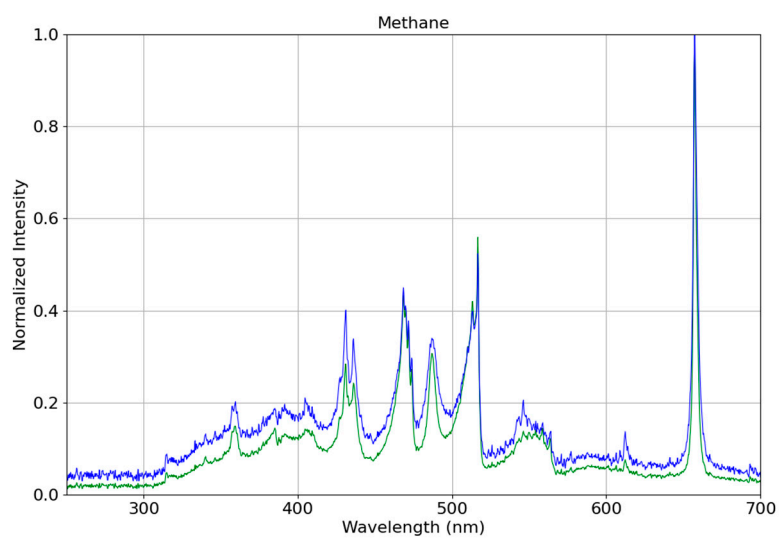


Figure S5. Voltage-time characterization of CA-1

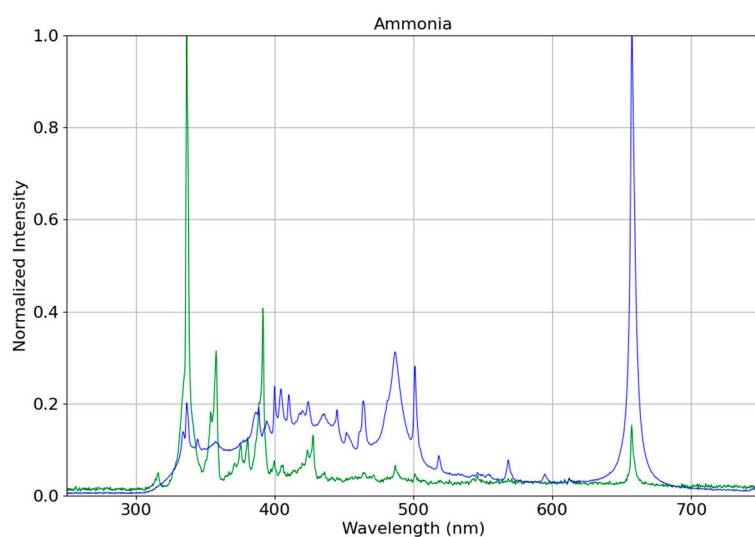
Figures S.3-S5. Voltage as a function of time for spark generators FB-1, FB-2 and CA-1. The sudden breakdowns in tension correspond to spark generation.



**Figure S6.** SEM pictures of Black material



**Figure S7.** The methane excitation spectrum of spark generators FB-1 (blue) and FB-2 (green).



**Figure S8.** The ammonia excitation spectrum of spark generators FB-1 (blue) and FB-2 (green).

**Table S1.** The 20 most abundance fragments as observed by GC/MS

Experiment #	Fragments abundance decrease (m/z) →																			
Sample 1	73	117	75	132	313	129	57	221	43	145	147	71	341	355	85	55	281	131	41	69
Sample 2	117	73	75	132	313	129	57	43	145	71	341	55	85	41	131	69	185	314	133	118
Sample 3	117	73	75	132	313	129	57	43	145	71	341	85	55	41	131	69	314	133	118	201
Sample 4	73	221	75	117	222	263	57	43	147	132	71	129	313	223	74	133	85	145	205	131
Sample 5	73	165	75	147	180	117	221	330	175	45	129	43	74	114	128	166	132	257	100	243
Sample 6	165	73	180	75	166	149	175	117	147	43	57	45	221	74	71	132	98	181	129	167
Sample 7	117	73	341	75	132	129	145	57	43	55	342	131	71	226	69	133	41	85	201	118
Sample 8	73	165	147	75	117	180	43	45	149	166	131	74	129	59	330	221	116	57	71	103

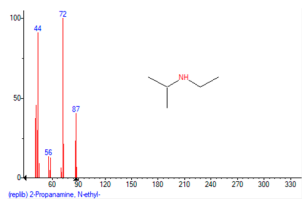
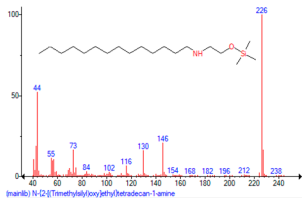
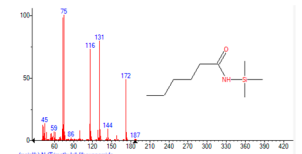
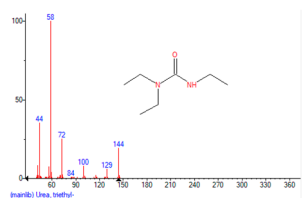
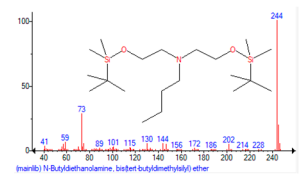
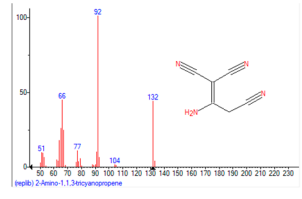
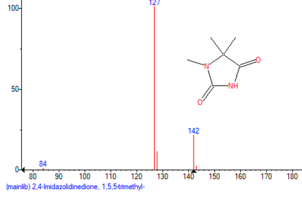
**Table S2.** Spark generator electrical characteristics

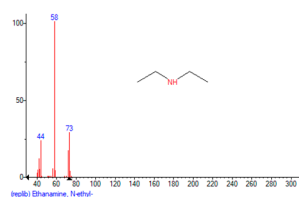
Spark generators	FB-1	FB-2	CA-1
V input	19.00 V	15.00 V	11.50 kV
I input	0.100 A	0.500 A	0.107 mA
V Output (kV)	9	10	11
Sparking frequency (Hz)	71	10	50

**Table S3.** Number of assigned compounds by GC/MS

Experiment #	Number of assigned compounds
Sample 1	140
Sample 2	154
Sample 3	351
Sample 4	261
Sample 5	330
Sample 6	124
Sample 7	305
Sample 8	160

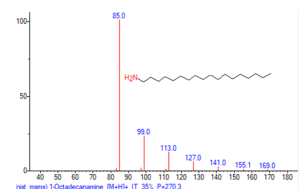
Table S4. Assigned compounds by GC/MS

Sub-molecular class affiliation examples	Assigned structure	Prob.	NIST N.
Amines	 <p>(mz44) 2-Propanamine, N-ethyl</p>	70.0	77935
	 <p>(mz226) N-(2,2,6,6-tetramethyl-1,3-oxybis(4-phenyl)butanediol)-1-amine</p>	10.4	350495
	 <p>(mz172) N-(3-methylbutyl)hexanamide</p>	83.7	408867
	 <p>(mz144) Urea, N-ethyl</p>	82.9	96499
	 <p>(mz244) N-Butyl-2,4-dihydroxy-1,3-bis(tert-butyl) ether</p>	54.9	53512
	 <p>(mz132) 2-Nitro-1,1,3,3-tetraphenylpropane</p>	68.5	112363
	 <p>(mz127) 2,4-imidazolidinedione, 1,5,5-trimethyl</p>	37.6	62814



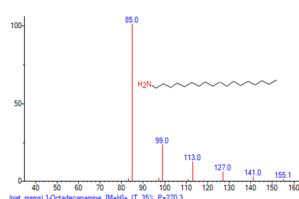
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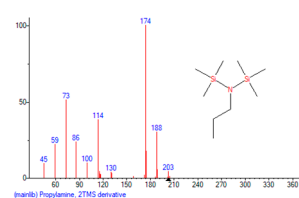
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51.7

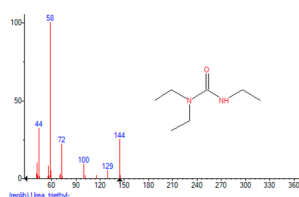
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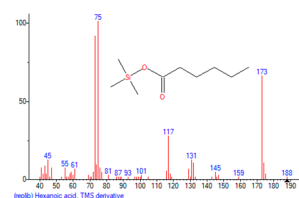
Urea



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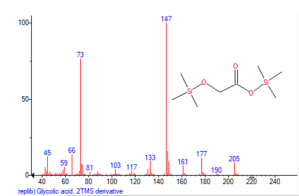
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Fatty acids



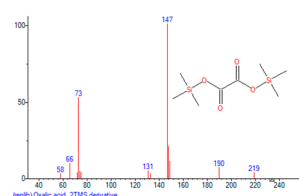
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86.6

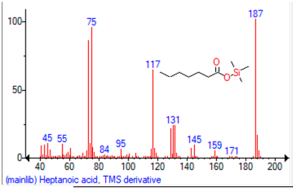
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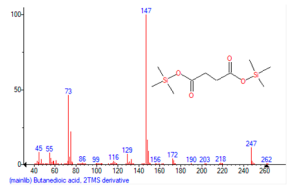
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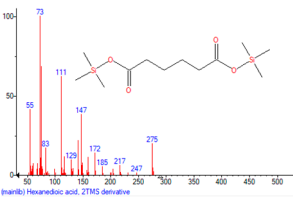
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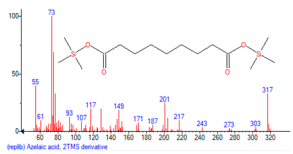
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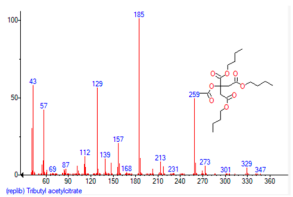
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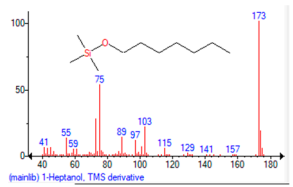
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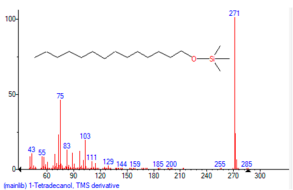
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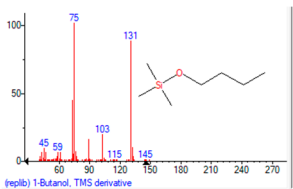
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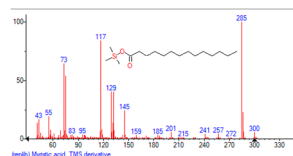


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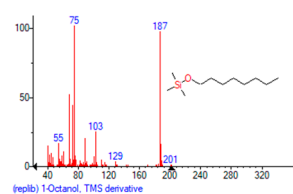
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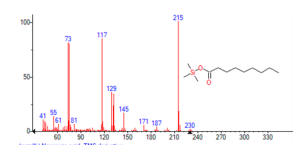
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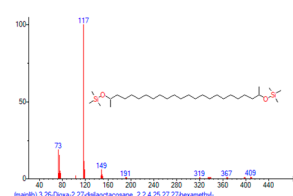
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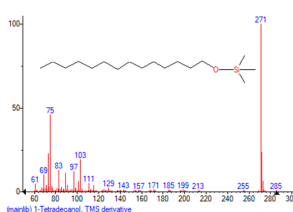
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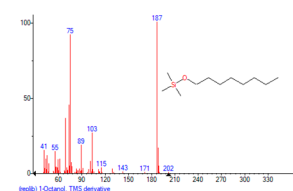
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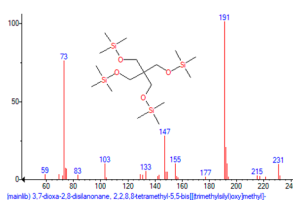
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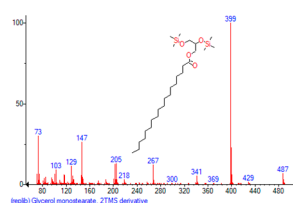
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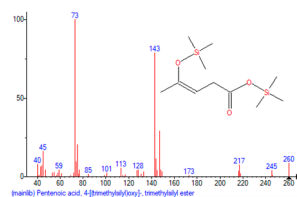
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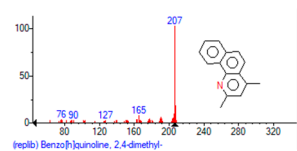
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## Aromatics



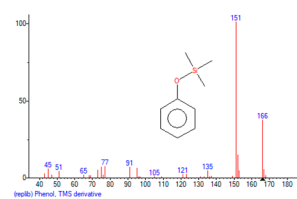
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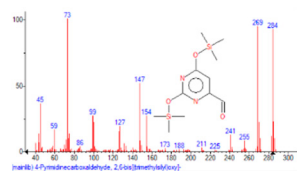
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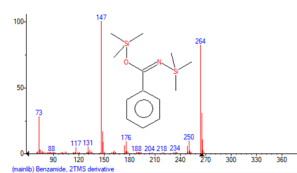
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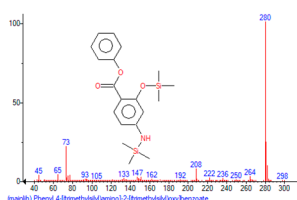
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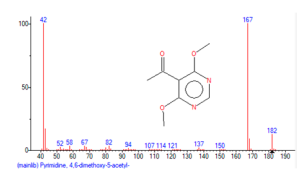
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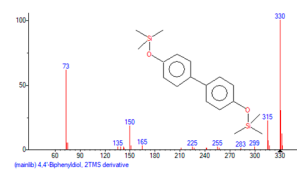
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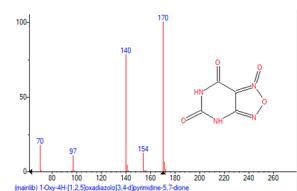
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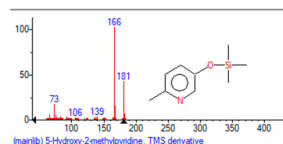
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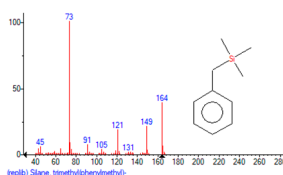
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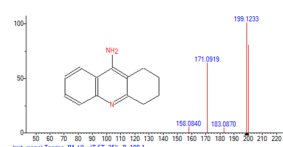
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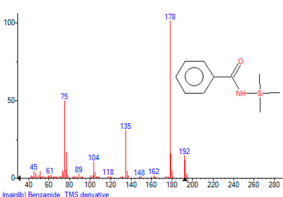
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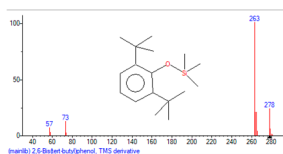
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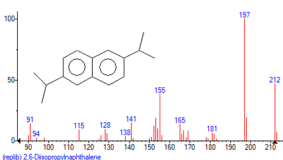
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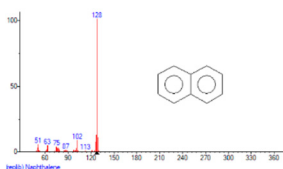
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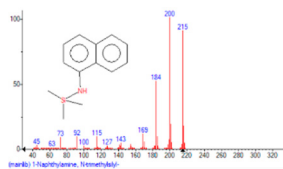
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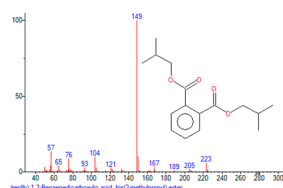
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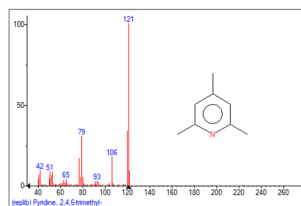
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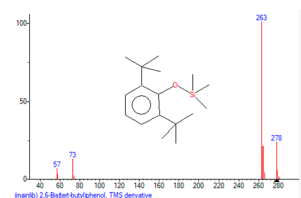
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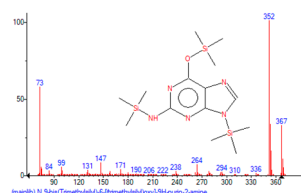
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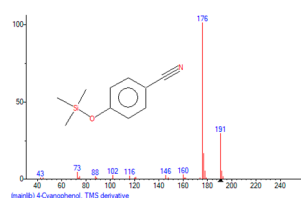
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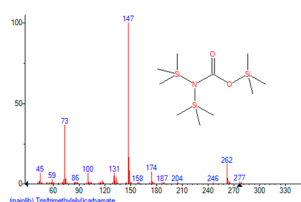
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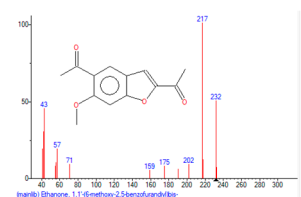
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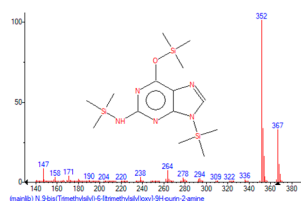
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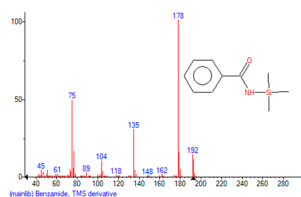
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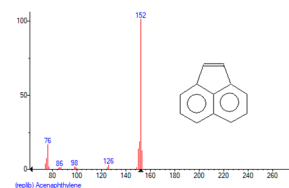
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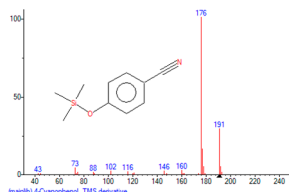
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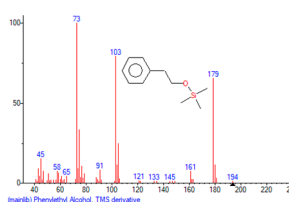
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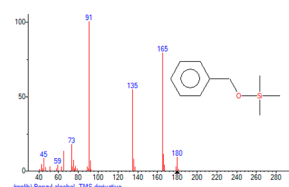
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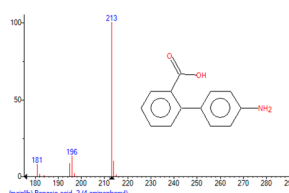
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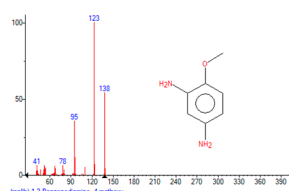
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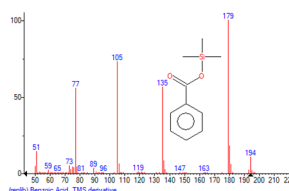
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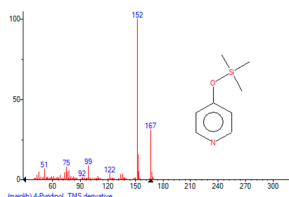
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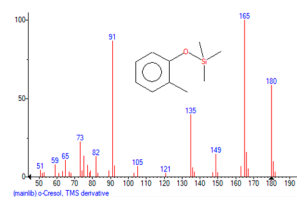
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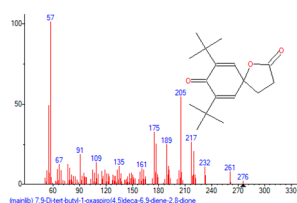
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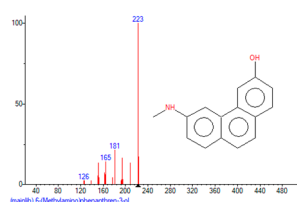
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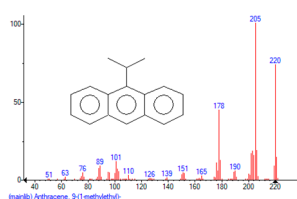
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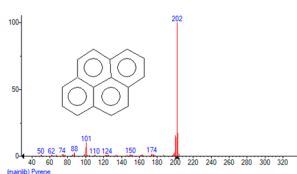
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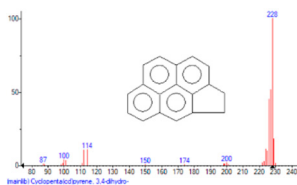
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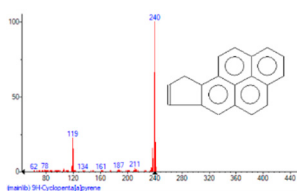
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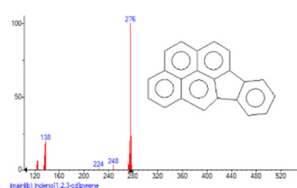
71.9

74738



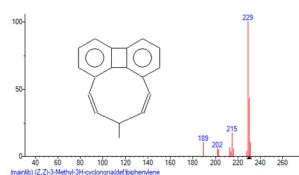
97.3

326095



60.7

114983



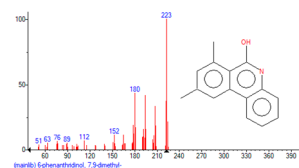
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147978



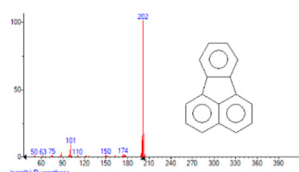
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74739



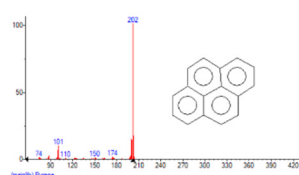
95.4

396294



72.5

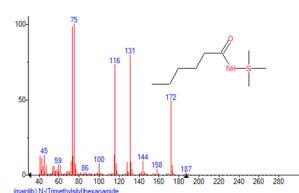
228362



41.4

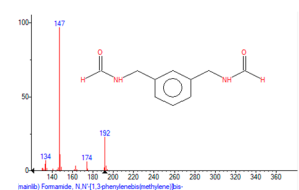
227992

## Amides



48.3

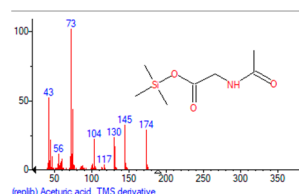
289197



43.5

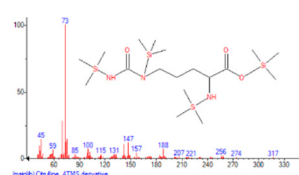
202417

## Amino acids



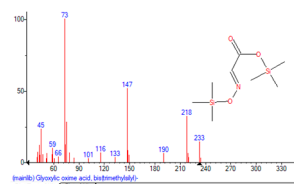
40.5

275909



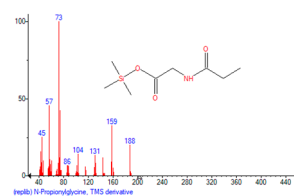
31.4

17846



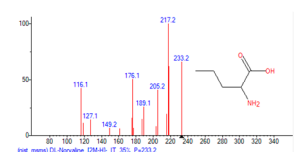
29.7

78864



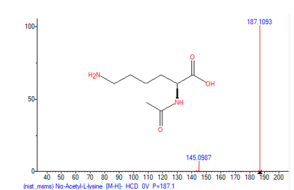
31.0

960881



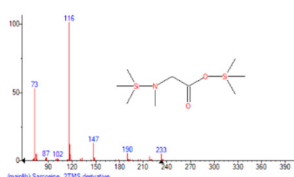
20.0

21164



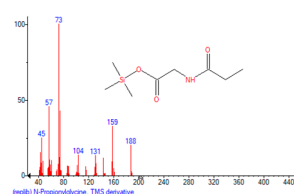
71.1

186737



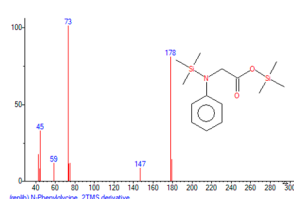
26.1

153975



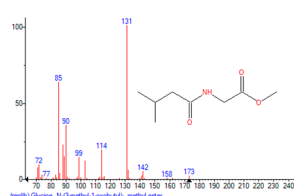
40.3

835375



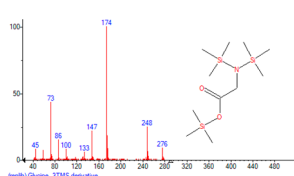
30.1

484429



35.4

111238

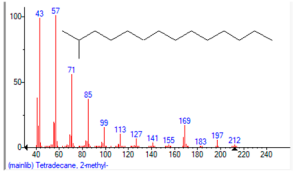


35.2

158658

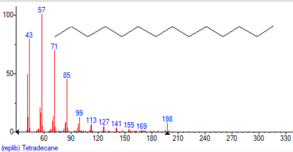


Saturated hydrocarbons



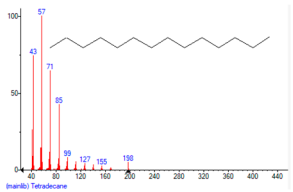
19.3

707968



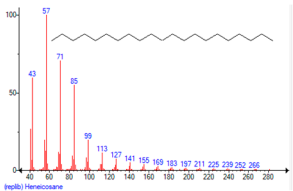
35.5

1589508



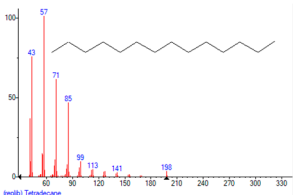
30.3

1950172



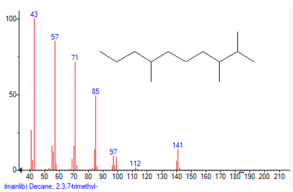
8.14

4520627



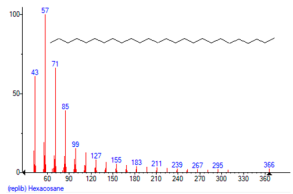
43.1

1527630



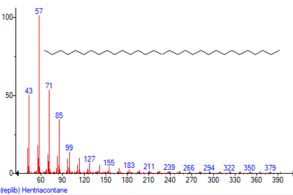
62.4

17267



21.8

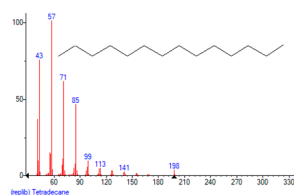
304116



15.0

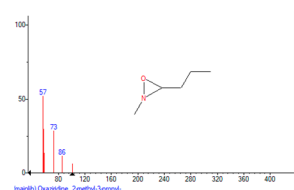
654619

## Others



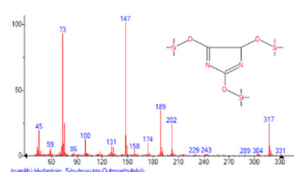
41.9

1506272



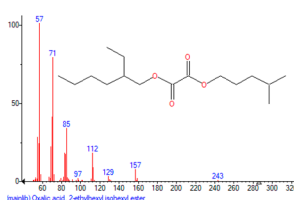
31.1

18533



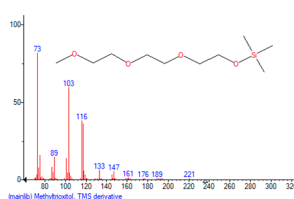
80.9

149425



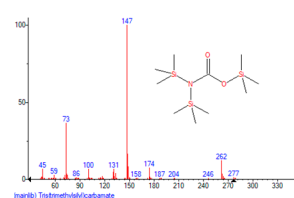
12.5

85426



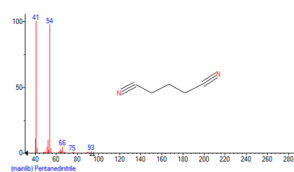
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11325



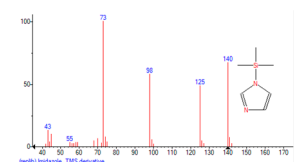
86.4

8057243



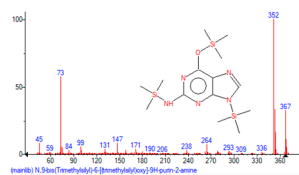
87.1

2330325



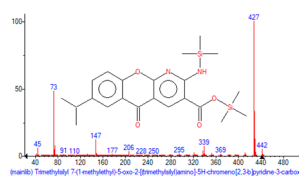
94.0

161540



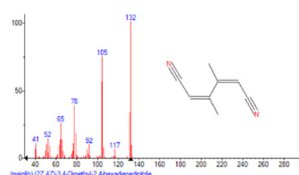
77.7

333943



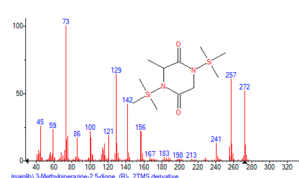
54.3

408271



69.5

210603



80.0

333700

Note: PAHs refer to polycyclic Aromatic Hydrocarbons.