Metropolitan Museum of Art
Gas Chromatography- Mass Spectrometry (GC-MS) Results from Material Analysis

This document includes (1) a mass spectrum and (2) the volatile organic compounds (VOCs) emitted from samples using GC-MS analysis. The data is not interpreted; however, several classes of chemicals are highlighted because they are potential risks for artwork in an enclosed environment. A basic key, provided below, indicates those classes. The amount of each chemical identified has not been determined; similarly, it is not known how much of each chemical is necessary to do damage to art. Finally, peaks may be present that are the result of the sample adsorbing chemicals from the air and reemitting them during testing rather than being inherent to the sample. Research is ongoing to determine specifically which chemicals and amounts are required to negatively affect artifacts.

Highlighted data:

Pink – chemicals currently known to be hazardous to art

Green – amines; can raise the pH, are suspected to react with acids and may form crystals in an enclosed environment

Yellow – chemicals of the following type, which *may* be hazardous to art:

Acids – lower the pH, corrosive to metals, degrade organic materials

Aldehydes – can convert to acids with heat or exposure to UV light

Esters – can hydrolyze into acids with heat and humidity

Sulfur-containing compounds – known to tarnish and corrode some metals

Halogenated compounds – can become reactive with exposure to heat and UV light

Nitrogen-containing, not amine – can react with other off-gassed chemicals

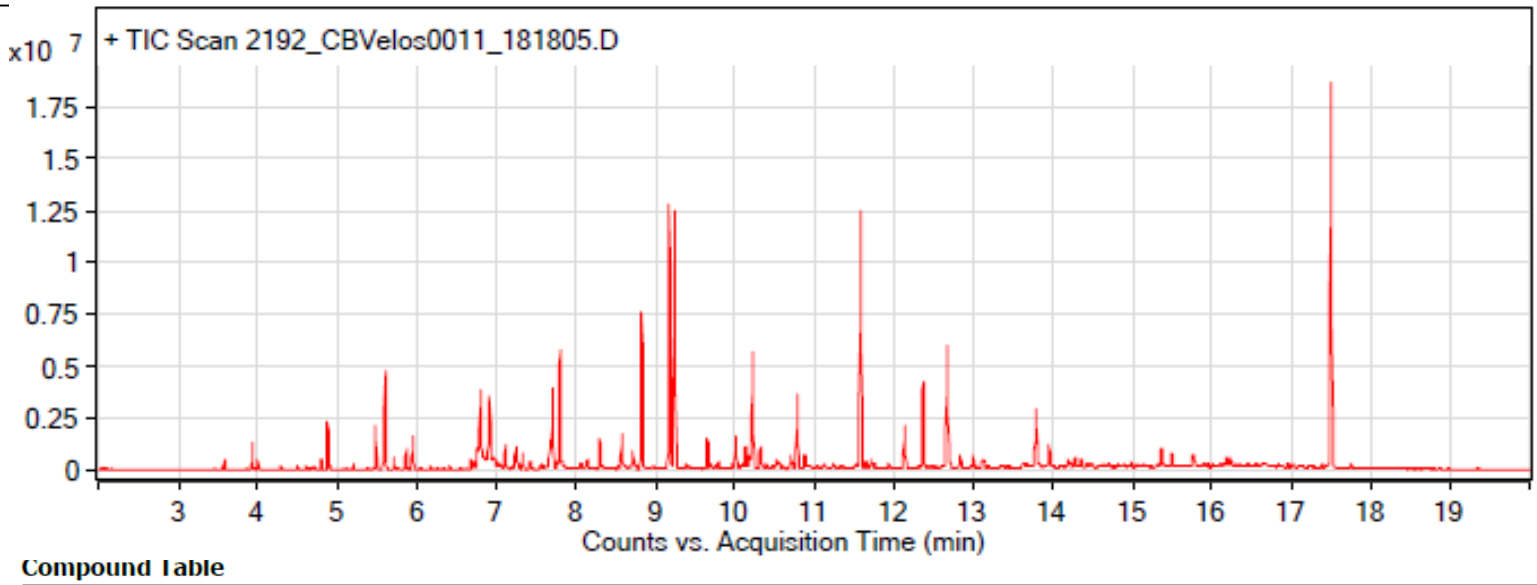
Alkynes – can become reactive when exposed to heat or UV light

Sample: creation baumann Velos 0011 black fabric

Oddy test result: Unsuitable

Date collected: 6/26/2018

Technique used: SPME with a PDMS/DVB fiber; Agilent 7890B GC and 5977B MS fitted with a GL Sciences OPTIC-4 multimode inlet and LEAP PAL RTC autosampler; Pre-heated at 60°C for 20 minutes; fiber exposure at 60°C for 20 minutes; sample injected into 220°C inlet and cryo-trapped for 2 min at -15°C; GC ramped from 35°C to 250 °C at 10°C/min. Data analyzed in Masshunter Qualitative Analysis. Deconvoluted data with > 85% match with a NIST 17.0 or Wiley 9 library are reported.
VOCs not highlighted are because they were also observed in blanks: (1) 5.7 min: methoxyphenyl oxime; (2) 12.4 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (3) 12.7 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name	Formula
3.58	98.35	402690	Acetic acid	C2H4O2
3.93	95.29	1046753	Silanediol, dimethyl-	C2H8O2Si
4	95.81	370502	Triethylamine	C6H15N
4.8	96.67	477460	Hexanal	C6H12O
4.88	92.48	1715861	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
5.21	95.82	303528	2-Pentanone, 4-hydroxy-4-methyl-	C6H12O2
5.48	98.79	1925999	Ethylbenzene	C8H10
5.6	97.37	6349809	unidentified C2-benzene	C8H10
5.72	85.18	547413	Oxime-, methoxy-phenyl-_	C8H9NO2
5.87	91.11	944952	Benzene, 1,2-dimethyl-	C8H10
5.95	93.37	1644451	Ethanol, 2-butoxy-	C6H14O2
6.8	96.59	4104186	Benzaldehyde	C7H6O
6.92	96.14	2534346	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
7.05	91.95	296683	6-Methyl-5-hepten-2-one	C8H14O
7.12	97.39	1133508	2-Propanone, 1-(acetyloxy)-	C5H8O3
7.25	92.31	790043	unidentified C3-benzene	C9H12
7.26	92.54	859691	Ethanol, 2-(2-ethoxyethoxy)-	C6H14O3
7.33	96.94	802110	Octanal	C8H16O
7.43	97.77	458398	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.57	96.36	297874	Benzene, 1,3-dichloro-	C6H4Cl2
7.68	92.06	1735266	1-Hexanol, 2-ethyl-	C8H18O
7.71	97.49	4438209	Butanedioic acid, dimethyl ester	C6H10O4
7.8	95.87	7064508	Benzyl Alcohol	C7H8O
7.83	88.34	465818	2-Pyrrolidinone, 1-methyl-	C5H9NO
8.72	96.52	969971	Benzoic acid, methyl ester	C8H8O2
8.75	85.02	268069	Undecane	C11H24
8.83	97.62	9176133	Nonanal	C9H18O
9.18	95.53	13916227	Cyclopentasiloxane, decamethyl-	C10H30O5Si5

9.25	97.09	15275659	Pentanedioic acid, dimethyl ester	C7H12O4
9.66	96.04	1797911	2-Nonenal, (E)-	C9H16O
9.96	95.57	321313	Cyclohexanol, 5-methyl-2-(1-methylethyl)-	C10H20O
10.01	96.23	1979290	Ethanol, 2-(2-butoxyethoxy)-	C8H18O3
10.13	96.03	1343062	Azulene	C10H8
10.18	96.59	889446	Methyl salicylate	C8H8O3
10.23	85.89	7540498	Hydrouracil, 1-methyl-	C5H8N2O2
10.32	96.16	1386739	Decanal	C10H20O
10.52	92.89	564148	Ethanol, 2-phenoxy-	C8H10O2
10.71	92.37	821695	Benzothiazole	C7H5NS
10.79	97.75	4653891	Hexanedioic acid, dimethyl ester	C8H14O4
10.88	85.3	879891	Quinoline	C9H7N
11.13	85.74	342365	2-Decenal, (E)-	C10H18O
11.24	96.91	373810	1-Decanol	C10H22O
11.58	95.9	15593858	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.71	96.75	598177	Naphthalene, 2-methyl-	C11H10
11.76	95.52	322263	Undecanal	C11H22O
12.14	94.29	2678914	1,3-Diacetin	C7H12O5
12.37	90.09	5463440	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
12.67	93.62	8063181	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	C12H24O3
12.84	96.4	785256	1,1'-Biphenyl	C12H10
13	94.57	811465	Tetradecane	C14H30
13.11	96.28	371251	Benzene, 1,1'-oxybis-	C12H10O
13.13	97.39	563287	Dodecanal	C12H24O
13.95	96.88	1561144	1-Dodecanol	C12H26O
14.19	94.01	469481	1-Pentadecene	C15H30
14.28	93.17	732879	pentadecane	C15H32
14.36	86.67	427905	Phenol, 2,4-bis(1,1-dimethylethyl)-	C14H22O
14.99	91.15	306063	n-Nonylcyclohexane	C15H30
15.49	88.34	915589	Dodecane, 2,6,10-trimethyl-	C15H32
15.76	90.3	608839	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
15.78	93.06	642433	Dodecanoic acid, 1-methylethyl ester	C15H30O2
16.19	93.06	561587	Cyclohexadecane	C16H32
16.23	93.25	631788	Octane, 1,1'-oxybis-	C16H34O
17.5	97.92	25738116	Benzyl benzoate	C14H12O2