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

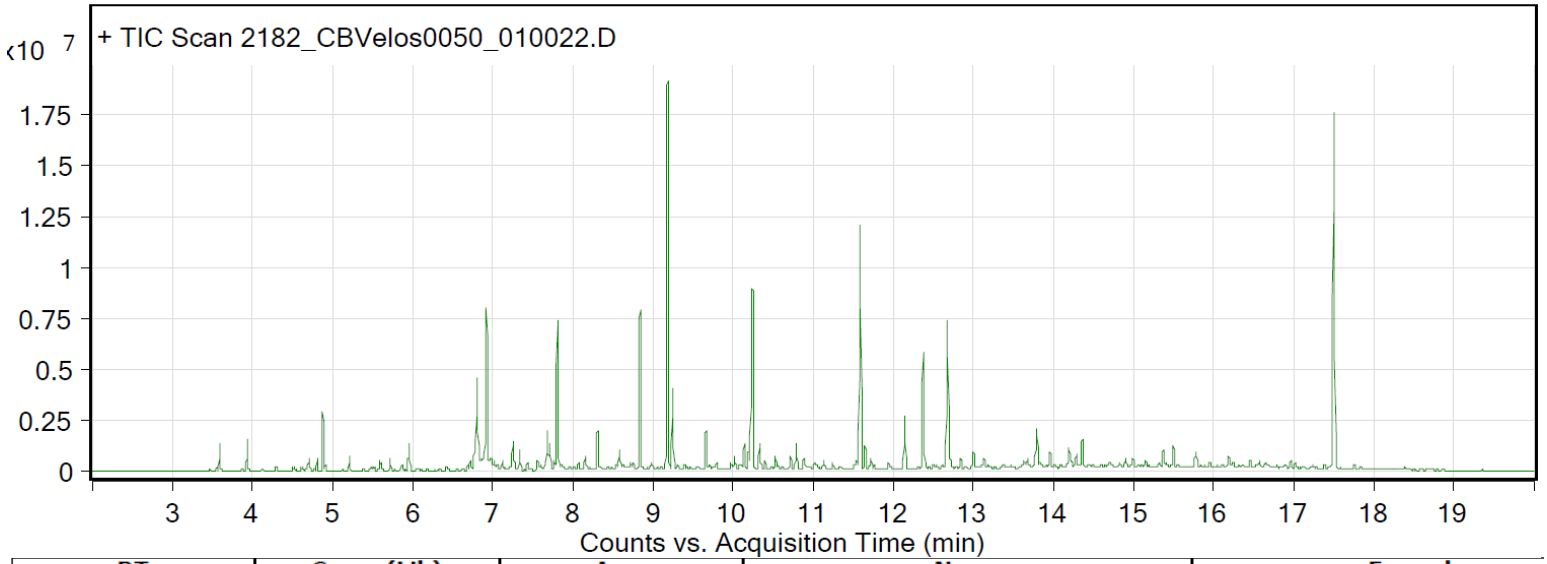
Halogenated compounds – can become reactive with exposure to heat and UV light

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 0050 fabric
Oddy test result: Unsuitable
Date collected: 5/13/2018
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



RT	Score (Lib)	Area	Name	Formula
3.59	98.55	1204730	Acetic acid	C2H4O2
4.71	86.71	1028839	2-Butanol, 3,3-dimethyl-	C6H14O
4.8	97.33	490664	Hexanal	C6H12O
4.88	93.34	2179362	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
5.21	96.08	633234	2-Pentanone, 4-hydroxy-4-methyl-	C6H12O2
5.59	96.55	778386	unidentified C2-benzene	C8H10
5.72	85.56	568451	Oxime-, methoxy-phenyl-_	C8H9NO2
5.95	91.76	1353959	Ethanol, 2-butoxy-	C6H14O2
6.72	93.35	532025	Decane, 2,6,8-trimethyl-	C13H28
6.8	97.58	4900973	Benzaldehyde	C7H6O
6.92	96.1	7585057	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
7.12	97.57	400941	2-Propanone, 1-(acetyloxy)-	C5H8O3
7.25	95.58	1422157	unidentified C3-benzene	C9H12
7.34	97.38	1021328	Octanal	C8H16O
7.43	99.52	414947	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.56	86.92	600979	1,2-Propanediol, diacetate	C7H12O4
7.58	94.53	335152	Benzene, 1,2-dichloro-	C6H4Cl2
7.65	95.69	410398	unidentified C3-benzene	C9H12
7.68	97.48	2238745	1-Hexanol, 2-ethyl-	C8H18O
7.71	97.42	1375385	Butanedioic acid, dimethyl ester	C6H10O4
7.8	95.89	9175169	Benzyl Alcohol	C7H8O
8.54	92.45	304998	2-Butoxyethyl acetate	C8H16O3
8.73	96.51	317121	Benzoic acid, methyl ester	C8H8O2
8.84	97.71	9806393	Nonanal	C9H18O
9.18	95.41	22337585	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
9.25	97.49	5076738	Pentanedioic acid, dimethyl ester	C7H12O4
9.3	86.83	336005	Benzenemethanol, 4-methyl-	C8H10O
9.66	95.99	2480958	2-Nonenal, (E)-	C9H16O
9.97	95.33	408453	Cyclohexanol, 5-methyl-2-(1-methylethyl)-	C10H20O

10.02	94.36	881682	Ethanol, 2-(2-butoxyethoxy)-	C8H18O3
10.14	95.97	1519618	Azulene	C10H8
10.19	94.27	1151096	Methyl salicylate	C8H8O3
10.24	85.08	14486512	1,3-Dimethyl-4,5-imidazolidinedione	C5H8N2O2
10.33	89.28	1651580	Decanal	C10H20O
10.52	92.85	840236	Ethanol, 2-phenoxy-	C8H10O2
10.72	91.49	793789	Benzothiazole	C7H5NS
10.79	97.73	1680214	Hexanedioic acid, dimethyl ester	C8H14O4
11.13	87.08	583794	2-Decenal, (E)-	C10H18O
11.24	95.03	393277	1-Decanol	C10H22O
11.52	86.79	276643	Phenol, p-tert-butyl-	C10H14O
11.59	95.9	14966636	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.65	95.43	1505479	Tridecane	C13H28
11.72	96.43	746942	Naphthalene, 2-methyl-	C11H10
11.76	95.79	349201	Undecanal	C11H22O
11.94	92.54	340204	Naphthalene, 2-methyl-	C11H10
12.14	94.23	3228001	1,3-Diacetin	C7H12O5
12.37	90.06	7777516	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
12.68	93.53	10043514	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	C12H24O3
12.84	92.94	714512	1,1'-Biphenyl	C12H10
13	94.16	1250276	Tetradecane	C14H30
13.13	95.36	702234	Dodecanal	C12H24O
13.68	87.12	672150	Cyclopentane, nonyl-	C14H28
13.95	96.46	1156411	1-Dodecanol	C12H26O
14.19	95.09	1491205	1-Pentadecene	C15H30
14.28	93.11	956695	pentadecane	C15H32
14.9	86.21	644871	Sulfurous acid, hexyl tetradecyl ester	C20H42O3S
14.99	94.57	679087	n-Nonylcyclohexane	C15H30
15.15	92.36	503262	Pentadecane, 3-methyl-	C16H34
15.5	89.1	1434229	2,6,10-Trimethyltridecane	C16H34
15.76	89.72	505475	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
15.78	92.77	963283	Dodecanoic acid, 1-methylethyl ester	C15H30O2
15.95	96.62	355317	Methanone, diphenyl-	C13H10O
16.19	92.48	756303	Cyclopentane, undecyl-	C16H32
16.89	89.92	288785	2,6-Diisopropylnaphthalene	C16H20
16.97	91.8	517034	2,6-Diisopropylnaphthalene	C16H20
17.02	92.02	405070	2,6-Diisopropylnaphthalene	C16H20
17.5	97.9	24601653	Benzyl benzoate	C14H12O2