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

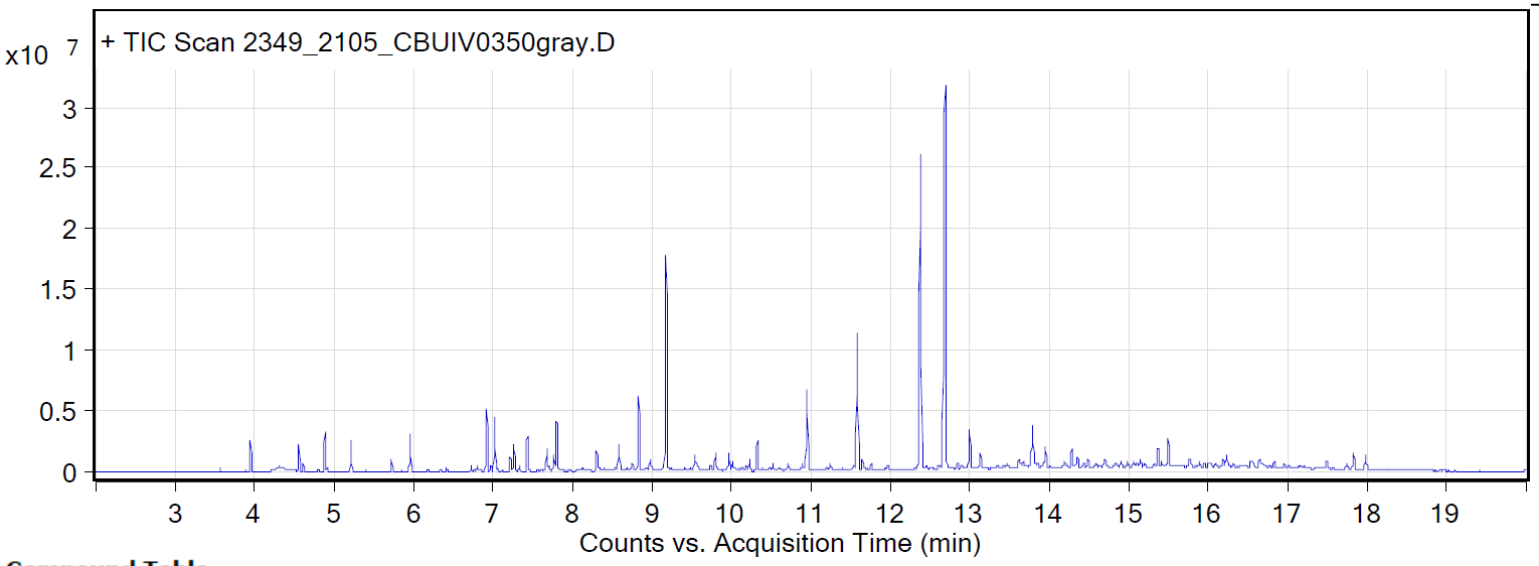
Halogenated compounds – can become reactive with exposure to heat and UV light

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 Unisono IV 0350 gray cotton fabric
Oddy test result: Temporary
Date collected: 3/19/2018
Technique used: SPME with a PDMS/Carbon WR 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
3.95	93.68	1607260	Silanediol, dimethyl-	C2H8O2Si
4.55	95	1953368	Benzene, methyl-	C7H8
4.88	92.43	2315622	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
5.21	95.63	2459663	2-Pentanone, 4-hydroxy-4-methyl-	C6H12O2
5.72	85.37	908669	Oxime-, methoxy-phenyl-_	C8H9NO2
5.95	96.96	3274161	Ethanol, 2-butoxy-	C6H14O2
6.92	95.94	4710386	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
7.02	95.74	4899098	Propanoic acid, 3-ethoxy-, ethyl ester	C7H14O3
7.21	96.22	1326095	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.26	89.1	2641635	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.33	93.13	594528	Octanal	C8H16O
7.43	98.39	3568881	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.68	97.39	2315626	1-Hexanol, 2-ethyl-	C8H18O
7.76	91.5	1347313	dl-Limonene	C10H16
7.8	95.89	4948811	Benzyl Alcohol	C7H8O
8.83	96.71	7770361	Nonanal	C9H18O
8.98	95.08	952322	Benzeneethanol	C8H10O
9.18	95.81	20869747	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
9.54	93.62	1836392	1,3-Pentanediol, 2,2,4-trimethyl-	C8H18O2
9.8	89.81	1407227	1-(1-Methoxypropan-2-yloxy)propan-2-yl acetate	C9H18O4
9.96	97.78	1937388	Cyclohexanol, 5-methyl-2-(1-methylethyl)-, (1.alpha.,2.beta.,5.alpha.)-(.+/-.)-	C10H20O
10.01	95.45	1137385	Ethanol, 2-(2-butoxyethoxy)-	C8H18O3
10.32	92.78	3067162	Decanal	C10H20O
10.52	92.94	737295	Ethanol, 2-phenoxy-	C8H10O2
10.89	91.56	699146	1-Phenoxypropan-2-ol	C9H12O2
10.95	96.93	8084722	Hexanoic acid, 2-ethyl-, 2-methylpropyl ester	C12H24O2

11.24	97.71	911460	1-Decanol	C10H22O
11.58	96.04	13997908	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.64	94.5	1191435	Tridecane	C13H28
11.76	96.17	658934	Undecanal	C11H22O
12.38	87.85	38744284	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
12.69	93.87	53123813	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	C12H24O3
13	95.06	4488338	Tetradecane	C14H30
13.13	96.86	1779180	Dodecanal	C12H24O
13.62	85.82	1022241	5,9-Undecadien-2-one, 6,10-dimethyl-, (E)-	C13H22O
13.95	96.09	2616188	1-Dodecanol	C12H26O
14.19	90.51	629111	1-Pentadecene	C15H30
14.28	93.76	2011903	pentadecane	C15H32
14.43	93.72	559951	Tridecanal	C13H26O
14.48	88.91	837722	Tetradecane, 2,2-dimethyl-	C16H34
14.99	87.72	728224	n-Nonylcyclohexane	C15H30
15.06	89.96	684939	Hexadecane, 2,6,10,14-tetramethyl-	C20H42
15.14	93.57	985071	Pentadecane, 3-methyl-	C16H34
15.2	85.89	594914	1-Tridecanol	C13H28O
15.41	85.47	695127	1-Decanol	C10H22O
15.49	91.4	3365915	Hexadecane	C16H34
15.76	89.76	895136	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
15.78	86.43	708305	Dodecanoic acid, 1-methylethyl ester	C15H30O2
15.94	95.67	539215	Methanone, diphenyl-	C13H10O
16.03	86.48	775032	Pentadecane, 2,6,10-trimethyl-	C18H38
16.18	88.33	829917	Cyclopentane, undecyl-	C16H32
16.23	91.27	1586338	Decyl octyl ether	C18H38O
16.65	90.55	1456189	Heptadecane	C17H36
17.49	98.05	810860	Benzyl benzoate	C14H12O2
17.74	87.72	567612	Octadecane	C18H38
17.83	97.8	1965149	2-Ethylhexyl salicylate	C15H22O3
17.98	95.03	1667034	Isopropyl myristate	C17H34O2