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

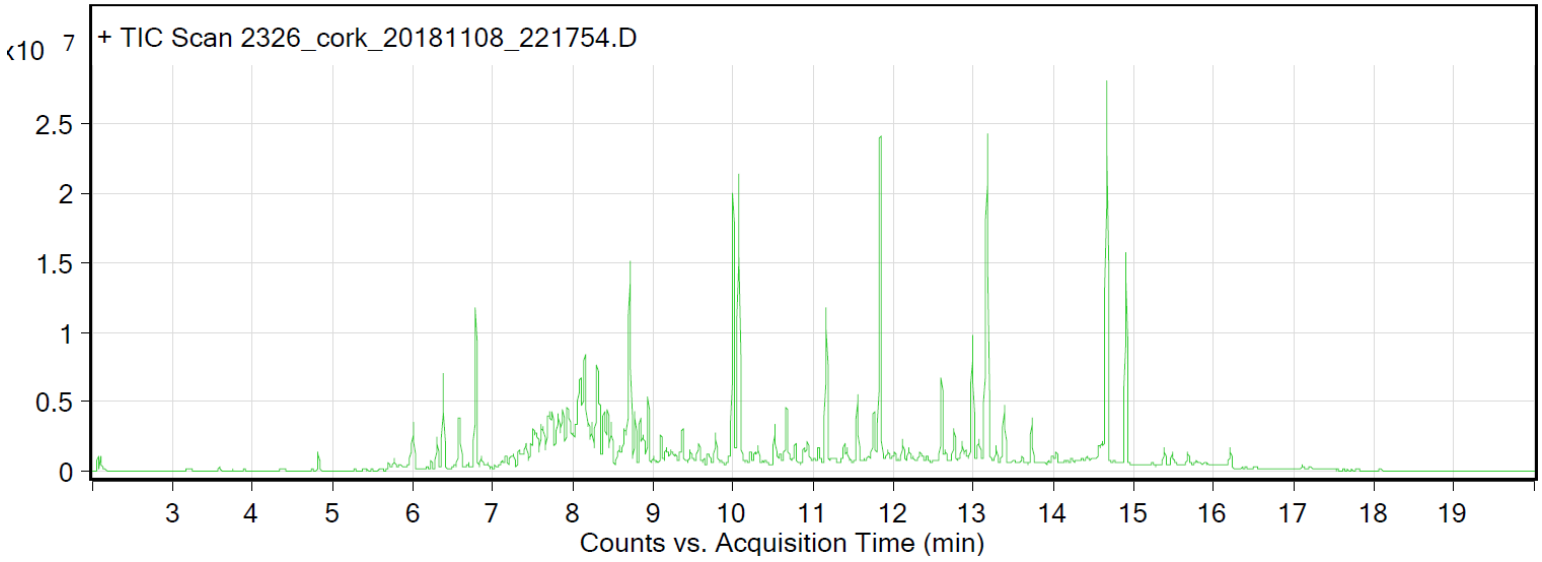
Halogenated compounds – can become reactive with exposure to heat and UV light

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

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

Sample: Capri Collections: rubber cork flooring; Gold AD2004
Oddy test result: Unsuitable
Date collected: 11/8/2018
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: VOCs not highlighted are because they were also observed in blanks: (1) 11.6 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid;



Compound Table

RT	Score (Lib)	Area	Name	Formula
2.07	93.64	818436	Silanediol, dimethyl-	C2H8O2Si
2.09	95.76	1305375	Triethylamine	C6H15N
4.82	96.75	1799132	Ethanol, 2-butoxy-	C6H14O2
5.7	96.03	893276	Benzaldehyde	C7H6O
6.01	85.23	4592333	Phenol	C6H6O
6.23	89.42	761907	unidentified C3-benzene	C9H12
6.3	95.74	2907091	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
6.38	96.36	10297024	Ethanol, 2-(2-ethoxyethoxy)-	C6H14O3
6.58	88.22	8698267	1-Propanol, 2-(2-methoxypropoxy)-	C7H16O3
6.85	90.75	924937	Benzyl Alcohol	C7H8O
7.16	85.89	1660173	Nonane, 3-methyl-	C10H22
7.32	91.69	3547452	Dodecane, 2,6,11-trimethyl-	C15H32
7.51	90.76	8173393	Undecane, 4,6-dimethyl-	C13H28
7.6	91.04	4719052	Undecane, 5-methyl-	C12H26
7.63	88.05	4518533	Undecane, 5,7-dimethyl-	C13H28
7.74	86.61	6639270	Oxalic acid, butyl isohexyl ester	C12H22O4
7.81	89.54	9589657	Undecane, 4-methyl-	C12H26
7.87	88.09	9040709	Octane, 2,3,6-trimethyl-	C11H24
8.15	89.42	19194366	Undecane, 4,6-dimethyl-	C13H28
8.24	91.52	5159485	Undecane, 4,7-dimethyl-	C13H28
8.3	93	20386459	Nonane, 4,5-dimethyl-	C11H24
8.38	86.43	6219056	Ether, hexyl pentyl	C11H24O
8.43	89.06	6757383	Undecane, 5,6-dimethyl-	C13H28
8.47	89.25	4802963	Octane, 2,3-dimethyl-	C10H22
8.71	90.99	21574877	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
8.78	92.36	5443204	Nonane, 5-butyl-	C13H28
8.84	92.9	6031624	Undecane, 2-methyl-	C12H26
8.94	94.4	7499006	Undecane, 3-methyl-	C12H26
9.16	90.27	2306299	5-Undecene, 3-methyl-, (E)-	C12H24
9.37	95.67	4664544	Dodecane	C12H26
9.46	92.82	2251239	Decanal	C10H20O
9.78	96.88	2908644	Benzothiazole	C7H5NS

10	86.97	30136939	2-Propanol, 1,1'-oxybis-	C6H14O3
10.07	87.6	36061239	2-Propanol, 1,1'-oxybis-	C6H14O3
10.21	86.14	1548264	2-Ethyl-1-dodecanol	C14H30O
10.52	93.83	3995334	Benzene, 1,3-bis(1-methylethenyl)-	C12H14
10.78	90.76	2338783	Tridecane	C13H28
11.07	88.62	932667	Ethanone, 1-[4-(1-methylethyl)phenyl]-	C11H14O
11.16	96.19	18636299	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.39	86.42	2276404	Heptylcyclohexane	C13H26
11.55	88.71	8114116	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
11.76	91.86	5623858	Ethanone, 1-(2,3-dihydro-1H-inden-5-yl)-	C11H12O
12.12	93.9	2767951	Tetradecane	C14H30
12.6	96.09	8836016	Ethanone, 1,1'-(1,4-phenylene)bis-	C10H10O2
12.65	94.99	1497479	Ethanone, 1,1'-(1,4-phenylene)bis-	C10H10O2
12.76	89.87	4528499	1-Tetradecanol	C14H30O
12.99	89.45	16694874	.alpha.,.alpha.'-Dihydroxy-m-diisopropylbenzene	C12H18O2
13.18	85.74	49060768	Ethanone, 1-[4-(1-hydroxy-1-methylethyl)phenyl]-	C11H14O2
13.29	93.69	1965111	1-Pentadecene	C15H30
13.61	96.68	849809	Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-	C15H24O
14.03	88.38	1191954	n-Nonylcyclohexane	C15H30
15.38	88.72	2035620	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
15.48	85.51	1882082	4a(2H)-Naphthalenemethanol, octahydro-	C11H20O