

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

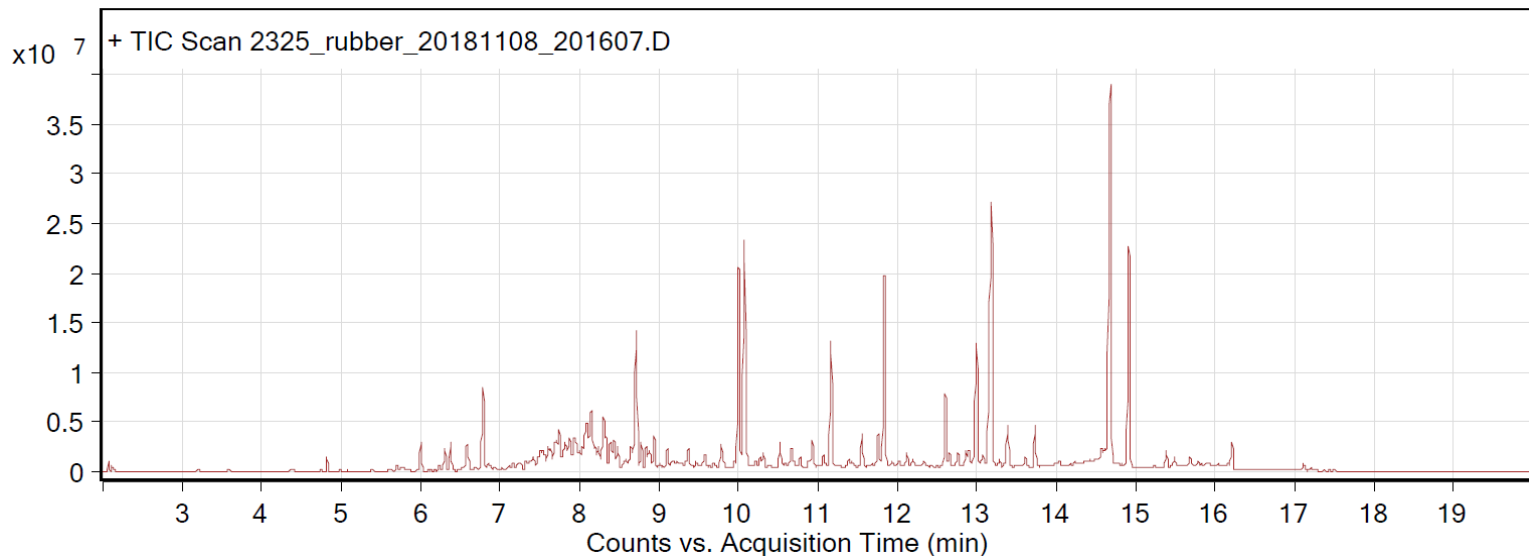
Sample: Capri Collections: rubber cork flooring; Skylight AD1007

Oddy test result: Temporary

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	93.65	935834	Silanediol, dimethyl-	C2H8O2Si
2.11	95.78	819953	Triethylamine	C6H15N
4.37	85.17	694809	Styrene	C8H8
4.82	96.79	1863343	Ethanol, 2-butoxy-	C6H14O2
5.7	95.47	920662	Benzaldehyde	C7H6O
6	87.88	3567148	Phenol	C6H6O
6.23	90.07	683778	unidentified C3-benzene	C9H12
6.3	95.86	2935884	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
6.37	92.25	4307414	Ethanol, 2-(2-ethoxyethoxy)-	C6H14O3
6.77	88.3	4231459	1-Hexanol, 2-ethyl-	C8H18O
6.85	92.63	781041	Benzyl Alcohol	C7H8O
7.33	89.02	1968844	Dodecane, 2,6,11-trimethyl-	C15H32
7.42	86.71	2823876	Pentatriacontane	C35H72
7.51	91.53	6005244	Undecane, 4,6-dimethyl-	C13H28
7.6	90.82	3665854	Undecane, 5-methyl-	C12H26
7.82	88.53	6664313	Undecane, 4-methyl-	C12H26
7.87	89.12	6634202	Hexadecane, 2,6,10,14-tetramethyl-	C20H42
7.93	85.95	6203265	Dodecane	C12H26
8.15	87.37	14119641	Undecane, 4,6-dimethyl-	C13H28
8.24	92.11	3829920	Dodecane, 2,7,10-trimethyl-	C15H32
8.3	90.53	13916955	Undecane, 4-methyl-	C12H26
8.39	90.21	5610232	Undecane, 4,6-dimethyl-	C13H28
8.43	88.5	4532047	Undecane, 5,6-dimethyl-	C13H28
8.47	88.81	3458700	Octane, 2,3-dimethyl-	C10H22
8.71	94.75	19091292	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
8.78	92.32	3750538	2,3-Dimethyldecane	C12H26
8.84	92.79	3918449	Undecane, 2-methyl-	C12H26
8.94	94.26	5159236	Undecane, 3-methyl-	C12H26
9.01	88.84	847865	.ALPHA.-NEO-ISO-MENTHOL	C10H20O
9.1	86.95	2898664	1-(1-Methoxypropan-2-yloxy)propan-2-yl acetate	C9H18O4

9.16	89.11	1374822	2-Undecene, 3-methyl-, (E)-	C12H24
9.37	95.17	3528382	Dodecane	C12H26
9.46	91.53	1164619	Decanal	C10H20O
9.78	95.48	3445027	Benzothiazole	C7H5NS
10	86.94	32822016	2-Propanol, 1,1'-oxybis-	C6H14O3
10.07	87.26	39592653	2-Propanol, 1,1'-oxybis-	C6H14O3
10.52	93.2	3459826	Benzene, 1,3-bis(1-methylethenyl)-	C12H14
10.67	93.75	3921607	1-Tridecene	C13H26
10.78	94.73	1703857	Tridecane	C13H28
11.08	90.55	1288334	Ethanone, 1-[4-(1-methylethyl)phenyl]-	C11H14O
11.17	96.19	20647937	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.55	89.02	5520781	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
11.76	92.09	5062775	Ethanone, 1-(2,3-dihydro-1H-inden-5-yl)-	C11H12O
12.12	95.02	2377920	Tetradecane	C14H30
12.61	96.45	11007725	Ethanone, 1,1'-(1,4-phenylene)bis-	C10H10O2
12.66	96.35	2327582	Ethanone, 1,1'-(1,4-phenylene)bis-	C10H10O2
12.76	89.67	2553725	Cyclopentane, nonyl-	C14H28
13	89.61	26186288	.alpha.,.alpha.'-Dihydroxy-m-diisopropylbenzene	C12H18O2
13.19	86.16	59554135	Ethanone, 1-[4-(1-hydroxy-1-methylethyl)phenyl]-	C11H14O2
13.29	91.99	1106069	1-Pentadecene	C15H30
13.61	97.99	1384913	Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-	C15H24O
14.03	88.62	742579	n-Nonylcyclohexane	C15H30
15.38	88.83	2615254	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
17.11	85.31	1083935	Cyclononasiloxane, octadecamethyl-	C18H54O9Si9