

**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

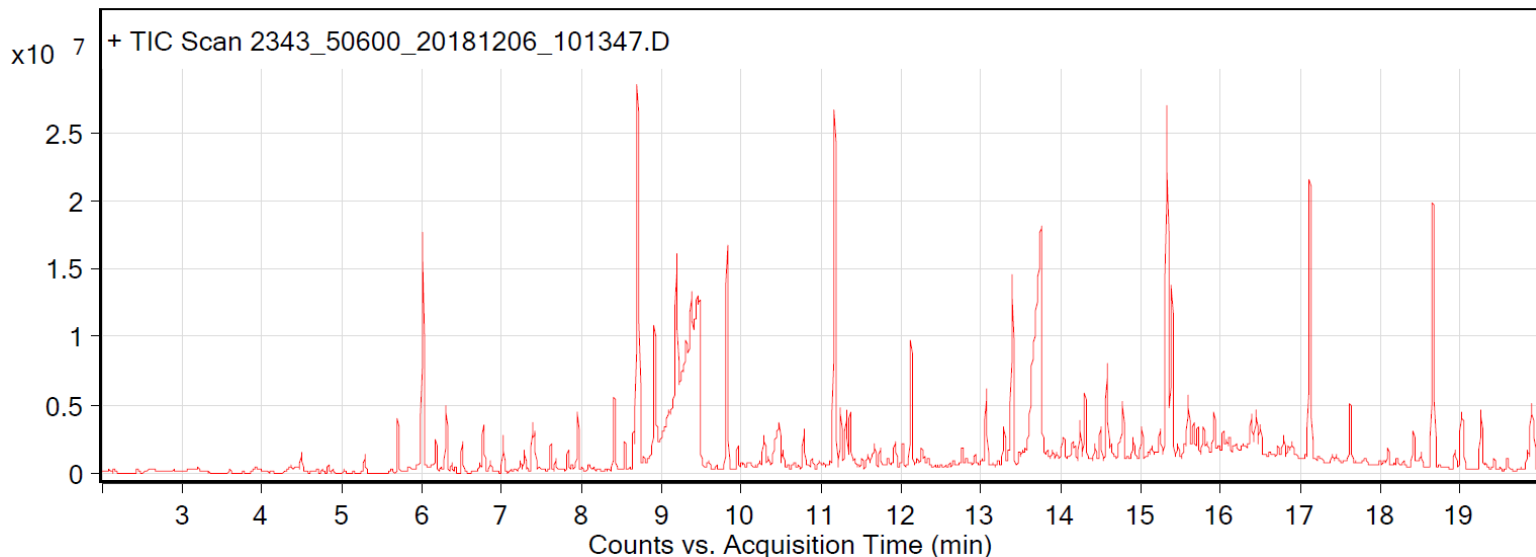
Sample: tesa: 50600 polyester silicone masking tape

Odd test result: Temporary

Date collected: 12/5/2018

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) 11.5 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (2) 11.8 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



#### Compound Table

RT	Score (Lib)	Area	Name	Formula
1.76	87.03	5041014	Benzene, methyl-	C7H8
3.1	92.93	2483882	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
3.93	96.95	2112881	unidentified C2-benzene	C8H10
4.49	87.86	2212282	Trisiloxane, octamethyl-	C8H24O2Si3
5.29	96.92	2080651	.ALPHA.-PINENE, (-)-	C10H16
5.7	98.14	5227791	Benzaldehyde	C7H6O
6.01	89.02	26412448	Phenol	C6H6O
6.17	94.47	3853734	Heptane, 2,2,4,6,6-pentamethyl-	C12H26
6.3	96.42	6666013	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
6.5	96.68	3146947	.DELTA.3-Carene	C10H16
6.77	95.99	4932571	1-Hexanol, 2-ethyl-	C8H18O
7.02	95.53	3587359	Benzaldehyde, 2-hydroxy-	C7H6O2
7.29	93.84	2343406	Benzenemethanol, .alpha.-methyl-	C8H10O
7.38	96.51	4111781	Ethanone, 1-phenyl-	C8H8O
7.41	87.43	5198369	Benzaldehyde, 2-methyl-	C8H8O
7.62	97.33	2827918	Benzaldehyde, 4-methyl-	C8H8O
7.83	97.17	2080852	Benzoic acid, methyl ester	C8H8O2
7.95	96.35	6695300	Nonanal	C9H18O
8.41	97.08	8667042	Benzenemethanol, 4-methyl-	C8H10O
8.54	95.1	3000812	Benzenemethanol, 2-methyl-	C8H10O
8.65	94.56	4445956	Acetic acid, 2-ethylhexyl ester	C10H20O2
8.7	87.35	33486683	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
8.72	93.28	26496514	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
8.91	97.34	13387080	Phenol, 2,4-dichloro-	C6H4Cl2O
8.95	85.23	9131911	Phenylglyoxylic acid, neopentyl ester	C13H16O3
9.19	91.46	18733737	Pentasiloxane, dodecamethyl-	C12H36O4Si5
9.31	92.42	2465211	1,2-Benzenediol	C6H6O2
9.37	95.38	6280027	Dodecane	C12H26
9.48	97.4	181511563	TETRAMETHYL 1-BENZOYLOXY-4,5-DIHYDROPYRIDO(1,2-A)AZEPINE-2,3,4,5-TETRACARBOX...	C25H23NO10

9.82	96.13	25250839	2-Ethylhexyl acrylate	C11H20O2
9.95	91.36	2502148	2-Ethyl-1-hexyl propionate	C11H22O2
10.27	93.98	2928576	2-Decenal, (E)-	C10H18O
10.47	95.03	12218713	Nonanoic acid	C9H18O2
10.78	86.82	4579486	Decane	C10H22
11.15	85.64	1966383	Dodecane, 2,6,11-trimethyl-	C15H32
11.17	94.95	44546574	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.24	86.07	6853495	Naphthalene, 1,2,3,4-tetrahydro-2,7-dimethyl-	C12H16
11.32	96.43	7540522	Benzamide	C7H7NO
11.36	85.95	6672481	Naphthalene, 1,2,3,4-tetrahydro-2,7-dimethyl-	C12H16
11.67	89.02	2760516	2-Undecenal	C11H20O
11.74	90.74	2347413	Tridecane, 3-methyl-	C14H30
11.92	96.95	2577545	1,1'-Biphenyl	C12H10
12.02	94.85	2858517	1-Heptadecene	C17H34
12.12	95	14414263	Tetradecane	C14H30
12.25	85.73	2273064	Dodecanal	C12H24O
13.07	85.59	8908716	1-Dodecanol	C12H26O
13.38	86.62	5443036	Pentadecane	C15H32
13.75	95.82	94076635	Benzoic acid, 3,4-dichloro-	C7H4Cl2O2
14.02	85.58	2983793	Pentadecane, 5-methyl-	C16H34
14.24	90.1	4438301	Pentadecane, 3-methyl-	C16H34
14.42	86.96	1940237	Cyclopropane, 1-methyl-1-(1-methylethyl)-2-nonyl-	C16H32
14.49	95.83	4168917	1-Hexadecanol	C16H34O
14.58	88.53	11945593	Hexadecane	C16H34
14.78	94.66	6281745	2,4-Dichlorobenzamide	C7H5Cl2NO
15.01	98	3852368	Methanone, diphenyl-	C13H10O
15.32	93.18	18262760	Benzoic acid, phenyl ester	C13H10O2
15.39	86.21	19474103	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
15.59	87.47	6315513	1,1'-Biphenyl, 2,2',5,5'-tetramethyl-	C16H18
15.63	90.58	2157739	1-Nonadecene	C19H38
15.66	87.16	3511860	1,1-Bis(p-tolyl)ethane	C16H18
15.71	92.28	3773849	Heptadecane	C17H36
16.11	89.03	1866444	2,6-Diisopropyl-naphthalene	C16H20
16.5	91.98	3411904	2-Biphenylcarboxylic acid	C13H10O2
16.79	88	2647030	Octadecane	C18H38
16.89	91.8	2784623	Hexadecane, 2,6,10,14-tetramethyl-	C20H42
17.12	87.19	37165408	Cyclononasiloxane, octadecamethyl-	C18H54O9Si9
17.62	97.41	7275854	1-Hexadecanol	C16H34O
18.09	93.57	2124916	7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione	C17H24O3
18.41	93.55	4935123	n-Hexadecanoic acid	C16H32O2
19.04	91.49	3871231	Isopropyl palmitate	C19H38O2
19.26	85.08	7594829	SILICATE ANION TETRAMER	C24H72O12Si12
19.89	86.29	9178287	SILICATE ANION TETRAMER	C24H72O12Si12
21.02	90.21	2325576	SILICATE ANION TETRAMER	C24H72O12Si12
21.7	94.07	4268324	1,3-Dimethyl-5-pylazolyl-2,4-dichlorobenzoate	C12H10Cl2N2O2