

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

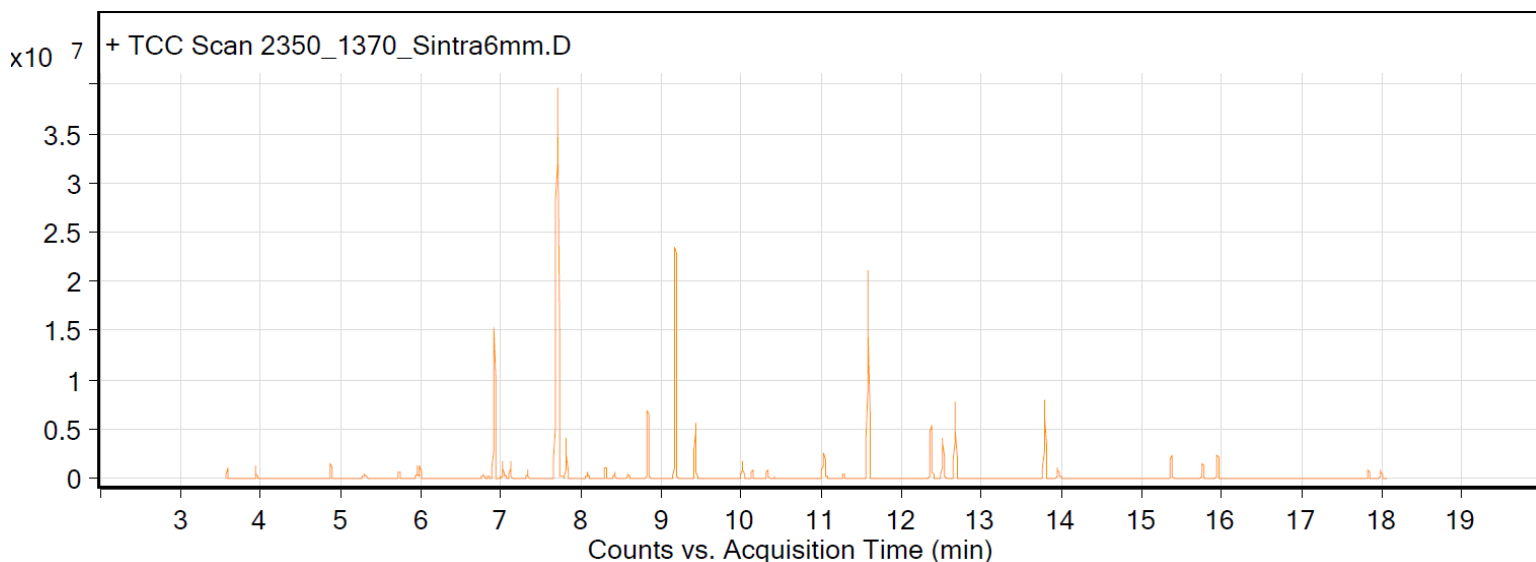
Sample: 3A Composites 6mm Sintra PVC board

Oddy test result: temporary

Date collected: 3/16/2018

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) 12.4 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester propanoic acid; (2) 12.7 min: 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester propanoic acid.



Compound Table

RT	Score (Lib)	Area	Name	Formula
3.58	97.97	1033372	Acetic acid	C2H4O2
3.94	93.68	1029607	Silanediol, dimethyl-	C2H8O2Si
4.88	92.44	1331488	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
5.3	87.7	805336	1-Heptene, 2,6-dimethyl-	C9H18
5.95	93.94	1425755	Ethanol, 2-butoxy-	C6H14O2
5.99	96.05	666508	Propanoic acid, butyl ester	C7H14O2
7.02	95.56	1888657	Propanoic acid, 3-ethoxy-, ethyl ester	C7H14O3
7.12	98.94	1983458	1,2-Ethandiol, diacetate	C6H10O4
7.33	97.46	882989	Octanal	C8H16O
7.71	86.5	66471955	1-Decanol	C10H22O
7.82	95.65	4732778	Benzyl Alcohol	C7H8O
8.08	90.94	849021	Undecane, 4,7-dimethyl-	C13H28
8.42	94.49	742891	Formic acid, 2-ethylhexyl ester	C9H18O2
8.84	97.78	8587988	Nonanal	C9H18O
9.18	95.88	32390638	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
9.43	96.47	6666920	Acetic acid, 2-ethylhexyl ester	C10H20O2
10.01	95.97	2472529	Ethanol, 2-(2-butoxyethoxy)-	C8H18O3
10.14	96.46	1119848	Azulene	C10H8
10.32	96.28	1061063	Decanal	C10H20O
11.04	95.12	4974895	Caprolactam	C6H11NO
11.28	85.54	732110	Dodecane, 2,6,11-trimethyl-	C15H32
11.59	96.6	30817730	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
12.37	89.16	7957171	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
12.67	93.89	11464651	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	C12H24O3
13.95	91.04	1406062	1-Dodecanol	C12H26O
15.37	89.57	3326436	1,2-Benzenedicarboxylic acid, diethyl ester	C12H14O4
15.76	90.16	2117840	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
15.95	97.9	3435249	Methanone, diphenyl-	C13H10O
17.83	97.85	1229551	2-Ethylhexyl salicylate	C15H22O3
17.98	94.51	1083529	Isopropyl myristate	C17H34O2