

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

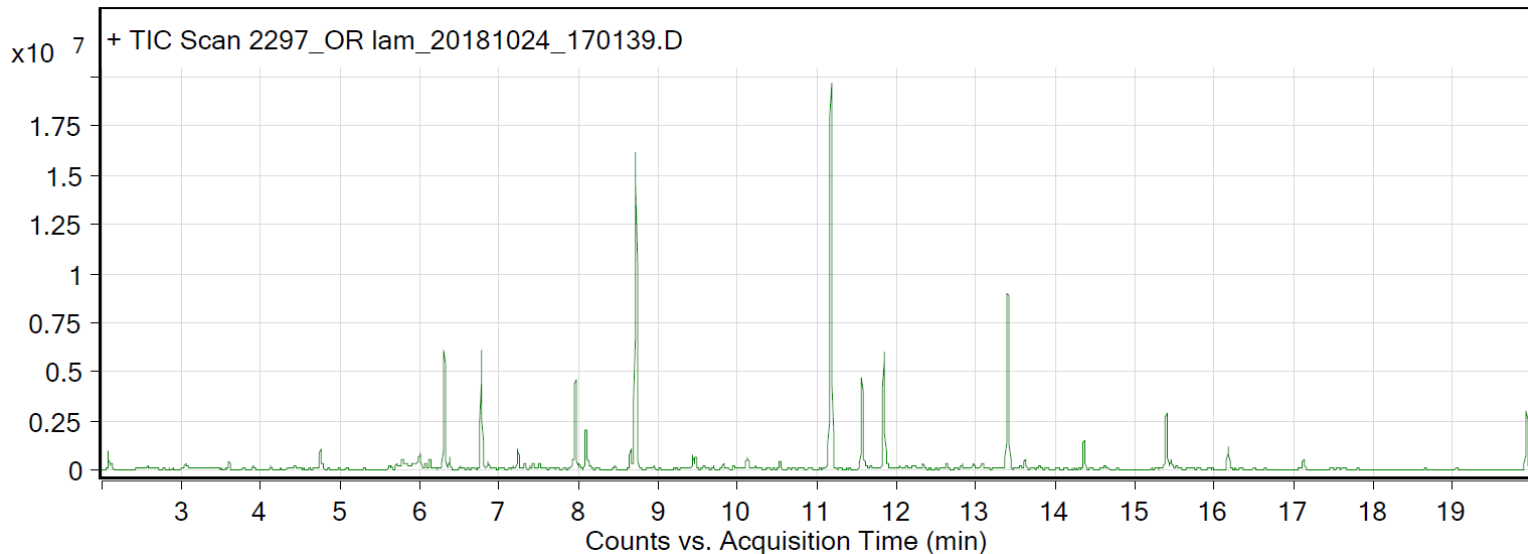
Sample: Oregon Laminations Company: PVC crystal clear glossy binding covers

Odd test result: Temporary

Date collected: 10/23/2018

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) 4.8 min: methoxyphenyl oxime; (2) 12.6 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (3) 12.8 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Compound table

RT	Score (Lib)	Area	Name	Formula
1.44	91.06	545400	Acetic acid	C2H4O2
1.51	98.04	2526218	Acetic acid	C2H4O2
1.69	93.13	449647	Benzene, methyl-	C7H8
2.08	93.7	840656	Silanediol, dimethyl-	C2H8O2Si
2.12	89.81	516075	Propanoic acid	C3H6O2
3.6	93.4	631816	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
4.75	85.67	1140105	Oxime-, methoxy-phenyl-	C8H9NO2
5.71	95.57	409802	Benzaldehyde	C7H6O
6.13	94.92	661199	6-Methyl-5-hepten-2-one	C8H14O
6.31	96.3	8204038	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
6.38	97.7	765269	Octanal	C8H16O
6.78	96.68	8517142	1-Hexanol, 2-ethyl-	C8H18O
6.8	92.37	569656	dl-Limonene	C10H16
6.86	87.83	554574	Benzyl alcohol	C7H8O
7.24	93.69	1529186	Undecane, 4,7-dimethyl-	C13H28
7.32	93.59	411309	Dodecane, 2,6,11-trimethyl-	C15H32
7.43	91.71	425082	1-Octanol	C8H18O
7.51	91.43	329487	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
7.96	97.99	6915638	Nonanal	C9H18O
8.66	96.04	1496154	Acetic acid, 2-ethylhexyl ester	C10H20O2
8.72	94.53	24611296	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
9.44	85.69	1143559	1,3-Dimethyl-4,5-imidazolidinedione	C5H8N2O2
9.47	94.38	870696	Decanal	C10H20O
9.82	95.06	343050	2-Ethylhexyl acrylate	C11H20O2
10.53	91.51	692035	Dodecane, 4,6-dimethyl-	C14H30
11.15	88.39	1115761	Nonane, 2,2,4,4,6,8,8-heptamethyl-	C16H34
11.18	95.59	32070116	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.57	92.19	7761474	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
11.84	92.36	9520570	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	C12H24O3
12.33	91.07	395667	Hexasiloxane, tetradecamethyl-	C14H42O5Si6

13.62	95.21	692833	Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-	C15H24O
14.36	87.6	2220187	Heptasiloxane, hexadecamethyl-	C16H48O6Si7
15.39	90.88	4356028	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
15.45	89.22	937112	1-(4-ISOPROPYLPHENYL)-2-METHYLPROPYL ACETATE	C15H22O2
17.12	85.26	757965	OCTADECAMETHYLCYCLONONASILOXAN E	C18H54O9Si9