

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

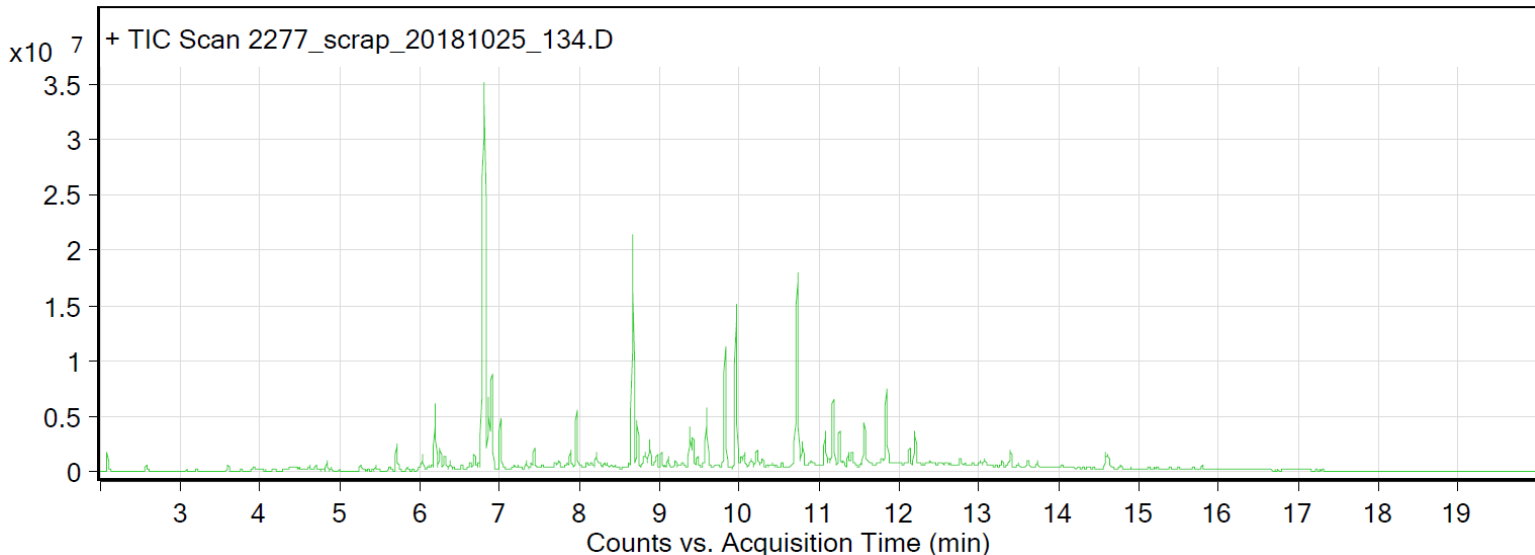
Sample: Scotch® Scrapbooking Tape, 3/4 in x 400 in, S-16634

Oddy test result: Unsuitable

Date collected: 10/24/2018

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) 11.6 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
1.72	94.6	3440528	Benzene, methyl-	C7H8
2.09	93.66	1894533	Silanediol, dimethyl-	C2H8O2Si
4.39	89.31	1943623	Styrene	C8H8
4.7	94.15	1119274	2-Propenoic acid, butyl ester	C7H12O2
4.84	97	1322166	Ethanol, 2-butoxy-	C6H14O2
5.26	91.93	872932	1-Pentanol, 3,4-dimethyl-	C7H16O
5.45	94.6	800100	1-Hexanol, 4-methyl-, (S)-	C7H16O
5.71	93.2	3638854	Benzaldehyde	C7H6O
6.03	88.68	1984248	Phenol	C6H6O
6.19	92.91	8722647	Isooctanol	C8H18O
6.25	91.33	2580370	Isooctanols	C8H18O
6.31	96.1	1034999	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
6.38	97.27	1086314	Octanal	C8H16O
6.68	96.39	2928488	(S)-3-Ethyl-4-methylpentanol	C8H18O
6.74	92.02	815887	Benzene, methyl(1-methylethyl)-	C10H14
6.8	85.2	8882303	dl-Limonene	C10H16
6.81	93.08	79018849	1-Hexanol, 2-ethyl-	C8H18O
6.82	87.58	5393981	(3S,4S)-3-Methyl-4-octanol	C9H20O
6.86	89.28	9665904	1-Heptanol, 3-methyl-	C8H18O
6.9	88.63	13744710	1-Heptanol, 4-methyl-	C8H18O
7.01	96.06	6513986	(S)-(+)-5-Methyl-1-heptanol	C8H18O
7.33	87.79	1147407	Sulfurous acid, 2-ethylhexyl hexyl ester	C14H30O3S
7.4	94.97	796710	Ethanone, 1-phenyl-	C8H8O
7.43	95.98	2636906	1-Octanol	C8H18O
7.89	97.24	2658187	Undecane	C11H24
7.96	97.83	8128995	Nonanal	C9H18O
8.21	89.02	2522850	1-Heptanol, 6-methyl-	C8H18O
8.66	96.72	33452585	Acetic acid, 2-ethylhexyl ester	C10H20O2
8.73	93.58	6338094	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
9.03	91.25	2182590	Cyclohexanol, 5-methyl-2-(1-methylethyl)-, [1R-(1.alpha.,2.beta.,5.alpha.)]-	C10H20O

9.11	89.77	1707008	Acetic acid, octyl ester	C10H20O2
9.38	94.4	5581246	Dodecane	C12H26
9.47	96.23	1579038	Decanal	C10H20O
9.59	94.78	8913077	Cyclohexanol, 4-(1,1-dimethylethyl)-, trans-	C10H20O
9.82	95.55	16441451	2-Ethylhexyl acrylate	C11H20O2
9.96	91.58	21911936	2-Ethyl-1-hexyl propionate	C11H22O2
10.28	85.35	1562328	2-Ethylhexyl acrylate	C11H20O2
10.42	87.48	980564	Octane, 1,1'-oxybis-	C16H34O
10.73	95.44	34555113	N-tert-Octylacrylamide	C11H21NO
10.79	93.49	3599038	Tridecane	C13H28
11.18	92.7	9382436	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.37	85.13	2021906	Naphthalene, 1,2,3,4-tetrahydro-2,7-dimethyl-	C12H16
11.56	90.53	7444562	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
11.78	90.76	934243	3-PHENYL-1-PROPANOL ACETATE	C11H14O2
11.84	93.36	11876796	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	C12H24O3
12.13	93.73	2394790	Tetradecane	C14H30
12.2	94.34	4831751	1,1'-Biphenyl, 2-methyl-	C13H12
12.77	87.71	1409105	Nonyl tetradecyl ether	C23H48O
13.62	94.49	1015226	Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-	C15H24O
13.73	92.2	851249	Benzene, 1,1'-(1,2-ethanediyl)bis-	C14H14
14.59	92.66	2125734	1,2-Benzenedicarboxylic acid, diethyl ester	C12H14O4
14.62	90.83	2312396	PENTAN-1,3-DIOLDIISOBUTYRATE, 2,2,4-TRIMETHYL-	C16H30O4