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

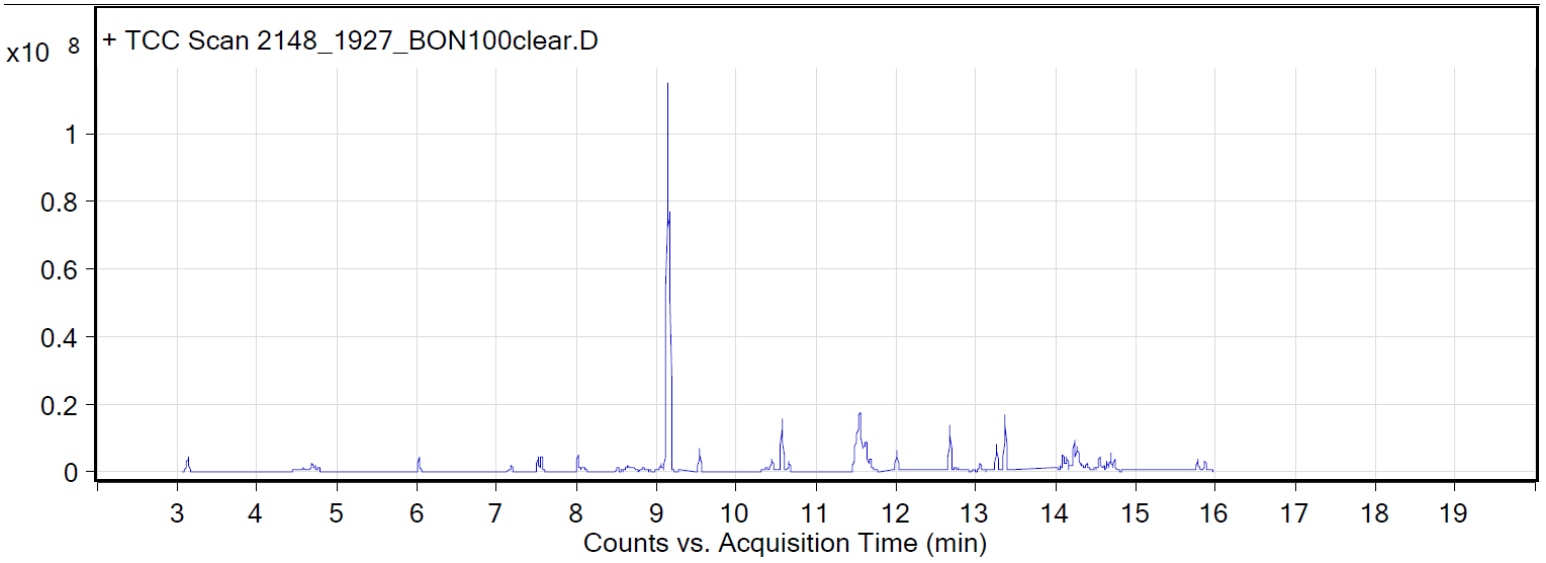
Nitrogen-containing, not amine – can react with other off-gassed chemicals

Alkynes – can become reactive when exposed to heat or UV light

Sample: Heritage Packaging Bon 100 clear

Oddy test result: Unsuitable
Date collected: 1/31/2018
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) 12.7 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name	Formula
3.14	98.11	9957958	Acetic acid	C2H4O2
4.58	94.63	3248349	Cyclopropane, pentyl-	C8H16
4.68	89.2	2935511	Hexanal	C6H12O
4.78	87.13	4754056	Propanoic acid, 2,2-dimethyl-	C5H10O2
6.03	95.63	7285981	Heptanal	C7H14O
7.18	86.52	5024803	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
7.52	95.26	3355734	Decane	C10H22
7.56	97.98	7403293	Octanal	C8H16O
8.02	97.75	9122278	dl-Limonene	C10H16
8.08	88.08	2429803	Benzyl alcohol	C7H8O
8.51	88.95	2477724	Dodecane, 2,6,11-trimethyl-	C15H32
8.64	88.74	6989603	1-Octanol	C8H18O
9.06	95.61	4272259	Undecane	C11H24
9.17	97.18	240622753	Nonanal	C9H18O
9.54	94.3	11271509	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
10.33	86.59	2669602	Octanoic acid	C8H16O2
10.44	92.25	3955656	1-Dodecene	C12H24
10.57	96.23	17218430	Dodecane	C12H26
10.66	97.7	5565673	Decanal	C10H20O
11.55	93.56	47881249	Caprolactam	C6H11NO
11.63	92.88	23332903	Nonanoic acid	C9H18O2
12.01	94.65	10930990	Tridecane	C13H28
12.78	86.27	3037741	2,2-Dimethyl-1-(2-hydroxy-1-isopropyl)propyl ester of isobutanoic acid	C12H24O3
13.05	93.41	5021906	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	C12H24O3
13.26	96.67	14098696	1-Tetradecene	C14H28
13.36	95.02	28563388	Tetradecane	C14H30
14.09	87.15	6661886	Carbonic acid, bis(2-ethylhexyl) ester	C17H34O3

14.39	85.33	4927280	1-Tetradecanol	C14H30O
14.54	87.31	8417293	Carbonic acid, 2-ethylhexyl undecyl ester	C20H40O3
14.64	93.99	4682808	pentadecane	C15H32
14.69	89.58	3236405	bis(2-Ethylhexyl) ether	C16H34O
14.74	91.49	6261539	Phenol, 2,4-bis(1,1-dimethylethyl)-	C14H22O
15.77	93.96	5735574	1-Hexadecanol	C16H34O
15.86	94.34	5189793	Hexadecane	C16H34