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

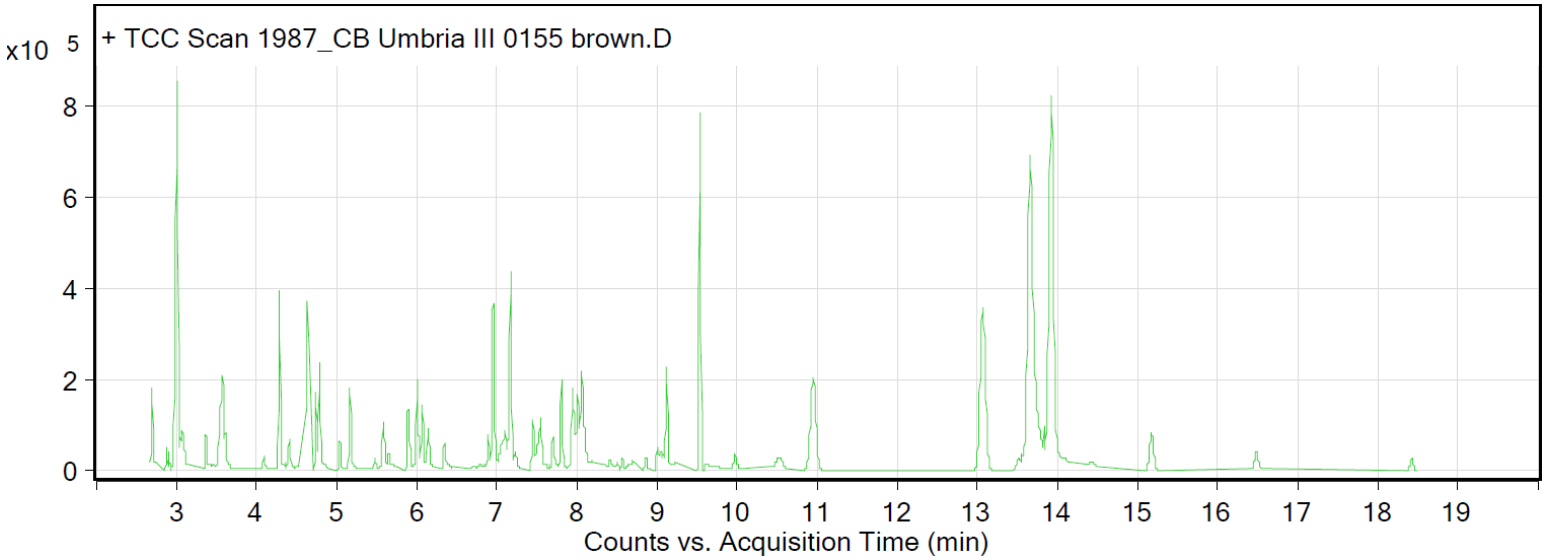
Sample: Creation Baumann Umbria III 0155 taupe cotton fabric

Oddy test result: Temporary

Date collected: 1/8/2018

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) 13.6 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (2) 13.9 min: 2-methyl-, 3-hydroxyl-2,2,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name	Formula
2.69	92.52	210748	2-Propanone	C3H6O
2.88	94.18	63804	Silanol, trimethyl-	C3H10OSi
3.01	98.26	1923887	Acetic acid	C2H4O2
3.07	94.41	90326	2-Acetyl-1,3-dioxolane	C5H8O3
3.57	97	613123	Propanoic acid	C3H6O2
4.09	88.84	55645	Propanoic acid, 2-methyl-	C4H8O2
4.28	94.52	596731	Benzene, methyl-	C7H8
4.41	91.77	135943	Butanoic acid	C4H8O2
4.63	97.26	587805	Hexanal	C6H12O
4.74	98.5	264736	Tetrachloroethylene	C2Cl4
4.78	95.09	187552	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
4.79	96.09	166193	Acetic acid, butyl ester	C6H12O2
5.04	93.13	113333	2-Furancarboxaldehyde	C5H4O2
5.17	96.48	297390	2-Pentanone, 4-hydroxy-4-methyl-	C6H12O2
5.48	92.64	47454	1-Methoxy-2-propyl ester of acetic acid	C6H12O3
5.58	97.28	246884	Benzene, 1,4-dimethyl-	C8H10
5.65	85.15	62161	Pentanoic acid	C5H10O2
5.89	94.78	215951	Styrene	C8H8
5.91	85.92	76059	Benzene, 1,4-dimethyl-	C8H10
6	95.67	273769	Heptanal	C7H14O
6.06	95.81	158514	Ethanol, 2-butoxy-	C6H14O2
6.14	92.49	96237	Butanoic acid, 4-hydroxy-	C4H8O3
6.34	95	104716	2,4-Pentanediol, 2-methyl-	C6H14O2
6.89	92.5	102927	Decane, 2,6,8-trimethyl-	C13H28
6.95	96.97	534435	Benzaldehyde	C7H6O
7.1	90.35	139083	Hexanoic acid	C6H12O2

7.17	95.65	585486	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
7.45	92.74	182418	unidentified C3-benzene	C9H12
7.55	94.1	110913	Octanal	C8H16O
7.7	90.63	156815	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.81	95.08	173189	1,2-Propanediol, diacetate	C7H12O4
7.94	95.88	494458	1-Hexanol, 2-ethyl-	C8H18O
8.01	95.18	208508	dl-Limonene	C10H16
8.06	85.61	319661	Benzenemethanol	C7H8O
8.56	91.97	46146	Ethanone, 1-phenyl-	C8H8O
9	95.54	75519	Benzoic acid, methyl ester	C8H8O2
9.12	97.9	350889	Nonanal	C9H18O
9.53	88.31	1221265	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
9.97	86.88	69435	trans-2-Nonenal	C9H16O
10.51	85.42	114832	Nonanal	C9H18O
10.95	89.07	920531	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
13.07	88.7	1691505	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
13.51	88.8	115446	1,3-Diacetin	C7H12O5
13.65	92.81	3748928	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
13.92	92.5	3509274	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	C12H24O3
18.42	91.24	86406	Benzyl benzoate	C14H12O2