

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

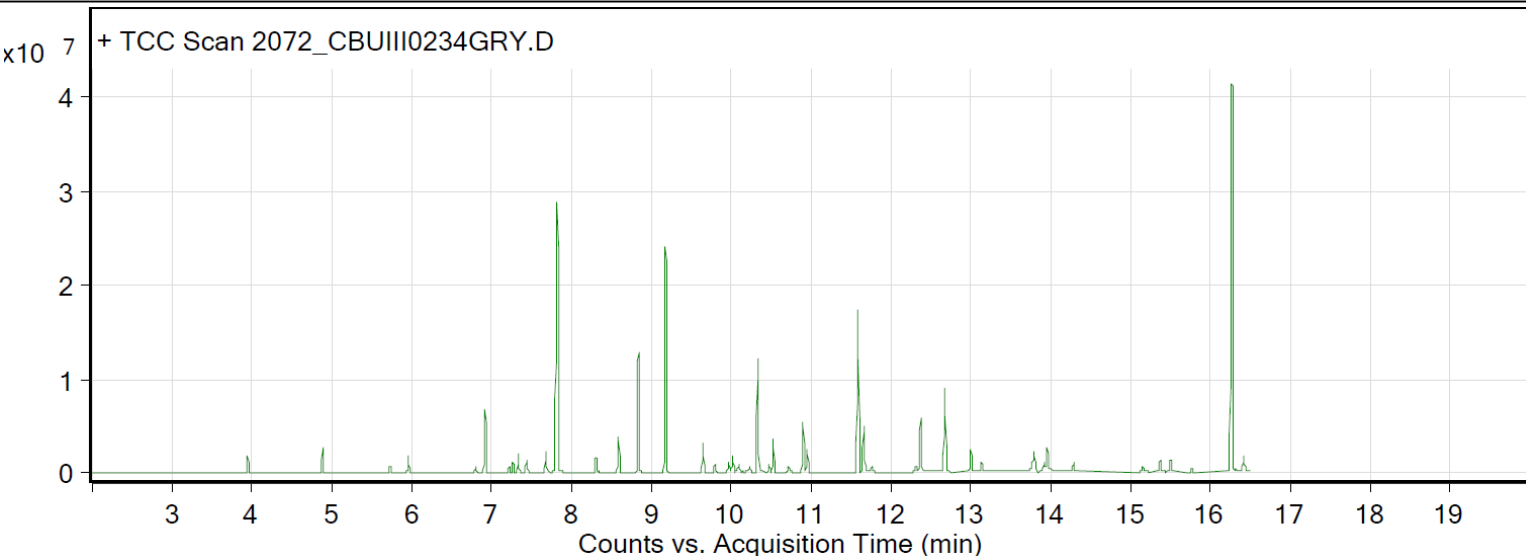
Sample: Creation Baumann Unisono III 0234 gray

Oddly test result: Temporary

Date collected: 3/9/2018

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) 5.7 min: methoxyphenyl oxime; (2) 12.4 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (3) 12.7 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name	Formula
3.95	93.7	1251293	Silanediol, dimethyl-	C2H8O2Si
4.88	92.48	2250308	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
5.73	86.13	725241	Oxime-, methoxy-phenyl-	C8H9NO2
5.96	93.44	2107331	Ethanol, 2-butoxy-	C6H14O2
6.8	96.72	1014944	Benzaldehyde	C7H6O
6.91	85.91	1681342	Phenol	C6H6O
6.92	96.17	7221846	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
7.22	88.04	726263	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.27	87.41	1438816	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.34	97.74	1585522	Octanal	C8H16O
7.44	97.98	1798291	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.68	97.49	2967683	1-Hexanol, 2-ethyl-	C8H18O
7.82	91.2	49119454	Benzyl Alcohol	C7H8O
8.59	92.87	4812872	Benzenemethanol, .alpha.,.alpha.-dimethyl-	C9H12O
8.84	97.74	16095232	Nonanal	C9H18O
9.18	95.27	31918637	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
9.65	97.55	4100573	Pentasiloxane, dodecamethyl-	C12H36O4Si5
9.79	88.02	1202677	1-Nonanol	C9H20O
9.97	97.61	1516701	Cyclohexanol, 5-methyl-2-(1-methylethyl)-	C10H20O
10.02	95.43	1552577	Ethanol, 2-(2-butoxyethoxy)-	C8H18O3
10.09	88.17	1325615	1,3-Dioxane-5-methanol, 5-ethyl-	C7H14O3
10.33	97.93	15961423	Decanal	C10H20O
10.47	95.19	1165543	Pentasiloxane, dodecamethyl-	C12H36O4Si5
10.52	92.96	3794697	Ethanol, 2-phenoxy-	C8H10O2
10.9	92.59	7241891	1-Phenoxypropan-2-ol	C9H12O2

10.95	96.05	2759571	Hexanoic acid, 2-ethyl-, 2-methylpropyl ester	C12H24O2
11.59	96.04	25376644	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.66	92.9	5862421	Formamide, N,N-dibutyl-	C9H19NO
11.76	96.39	817401	Undecanal	C11H22O
12.37	90.31	7940894	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
12.68	93.59	13044736	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	C12H24O3
13	95.26	3492790	Tetradecane	C14H30
13.13	96.85	1358024	Dodecanal	C12H24O
13.95	96.69	2378147	1-Dodecanol	C12H26O
14.28	92.88	1378014	pentadecane	C15H32
15.15	93.18	783390	Pentadecane, 3-methyl-	C16H34
15.5	94.37	1840408	Hexadecane	C16H34
15.76	90.04	787482	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
16.27	86.92	69307924	2,5-Cyclohexadiene-1,4-dione, 2,5-bis(1,1-dimethylpropyl)-	C16H24O2