

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

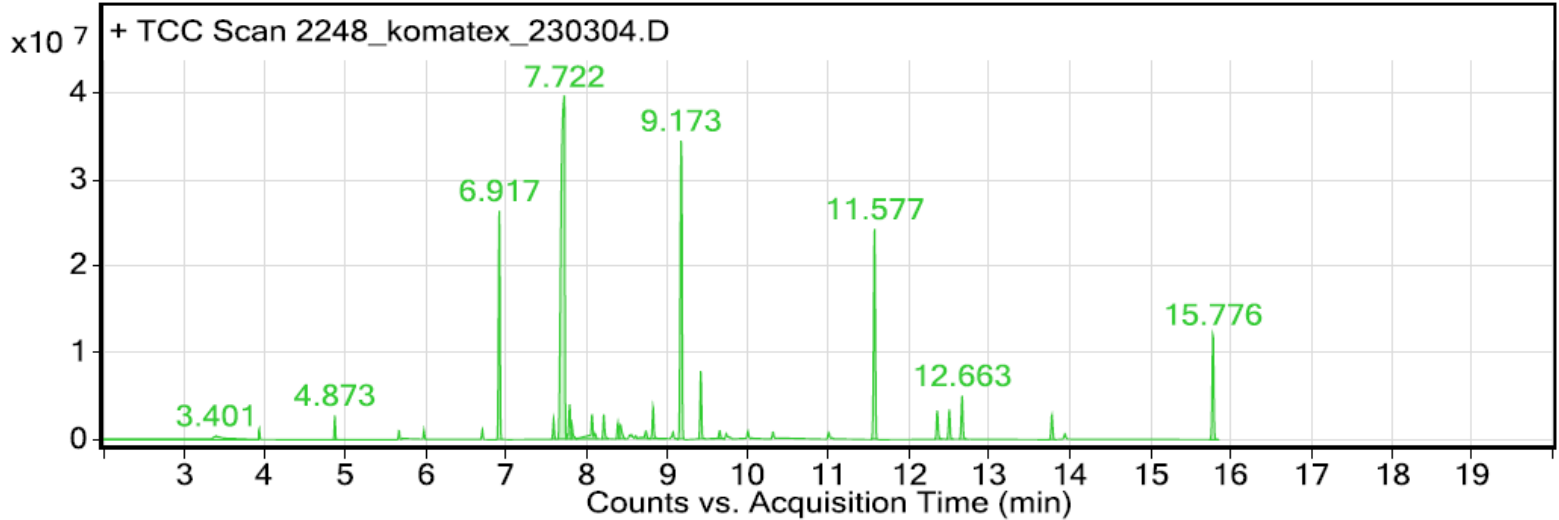
Alkynes – can become reactive when exposed to heat or UV light

Sample: Kommerling: Komatex 2210 foamed PVC board

Date collected: 07/23/2018

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 crotrapped for 2 min at -15°C; GC ramped from 40°C to 225 °C at 10°C/min. Data analyzed in masshunter Qualitative. Samples > 80% match with a NIST 17.0 library are reported.

VOCs not highlighted are because they were also observed in blanks: : (1) 12.4 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (2) 12.7 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Library results

RT	Score	Formula	MW	Area	CAS #	Name
3.399	81.3	C3H4N2O2	100.0	2826018	6832-16-2	Methyldiazoacetate
3.934	95.1	C2H8O2Si	92.0	1098555	1066-42-8	Silenediol, dimethyl-
4.873	92.5	C6H18O3Si3	222.1	2396562	541-05-9	Cyclotrisiloxane, hexamethyl-
5.670	90.3	C8H18O	130.1	1028444	142-96-1	Butane, 1,1'-oxybis-
5.980	96.1	C7H14O2	130.1	1095023	590-01-2	Propanoic acid, butyl ester
6.705	92.1	C11H24	156.2	1256081	62016-28-8	Octane, 2,2,6-trimethyl-
6.916	95.2	C8H24O4Si4	296.1	35585333	556-67-2	Cyclotetrasiloxane, octamethyl-
7.590	92.3	C12H26	170.2	2659592	13475-82-6	Heptane, 2,2,4,6,6-pentamethyl-
7.721	85.9	C10H22O	158.2	92287504	112-30-1	1-Decanol
7.788	90.4	C11H24	156.2	2993592	62016-19-7	Octane, 6-ethyl-2-methyl-
8.067	91.7	C10H22	142.2	3548273	5911-04-6	Nonane, 3-methyl-
8.103	88.2	C10H22	142.2	960287	5911-04-6	Nonane, 3-methyl-
8.214	88.7	C15H32	212.3	3887890	31295-56-4	Dodecane, 2,6,11-trimethyl-
8.389	92.3	C13H28	184.2	3114165	6117-97-1	Dodecane, 4-methyl-
8.423	84.3	C8H15NO3	173.1	1335412	999114-56-5	O-(tert-Butoxycarbonyl)-N-isopropylidene oxime
8.555	85.6	C12H26	170.2	1018254	17312-53-7	Decane, 3,6-dimethyl-
8.737	93.2	C13H28	184.2	1456862	17301-32-5	Undecane, 4,7-dimethyl-
8.825	97.4	C9H18O	142.1	4939771	124-19-6	Nonanal
9.175	96.4	C10H30O5Si5	370.1	55044510	541-02-6	Cyclopentasiloxane, decamethyl-
9.418	96.4	C10H20O2	172.1	9718982	103-09-3	Acetic acid, 2-ethylhexyl ester
9.653	90.1	C17H36O3S	320.2	1392929	999508-28-5	Sulfurous acid, 2-ethylhexyl nonyl ester
9.734	85.2	C12H26	170.2	1097245	1002-43-3	Undecane, 3-methyl-
10.004	88.2	C8H18O3	162.1	1256257	112-34-5	Ethanol, 2-(2-butoxyethoxy)-
10.314	94.7	C10H20O	156.2	1076330	112-31-2	Decanal
11.006	90.2	C6H11NO	113.1	1243622	105-60-2	Caprolactam
11.576	96.6	C12H36O6Si6	444.1	36544500	540-97-6	Cyclohexasiloxane, dodecamethyl-
12.355	90.4	C12H24O3	216.2	4585642	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.663	94.1	C12H24O3	216.2	7100622	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
13.778	80.2	C14H42O7Si7	518.1	4009103	107-50-6	Cycloheptasiloxane, tetradecamethyl-
13.940	94.5	C12H26O	186.2	997156	112-53-8	1-Dodecanol
15.779	93.6	C17H26O2	262.2	17165119	14035-34-8	2,6-Bis(1,1-dimethylethyl)-4-(1-oxopropyl)phenol