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

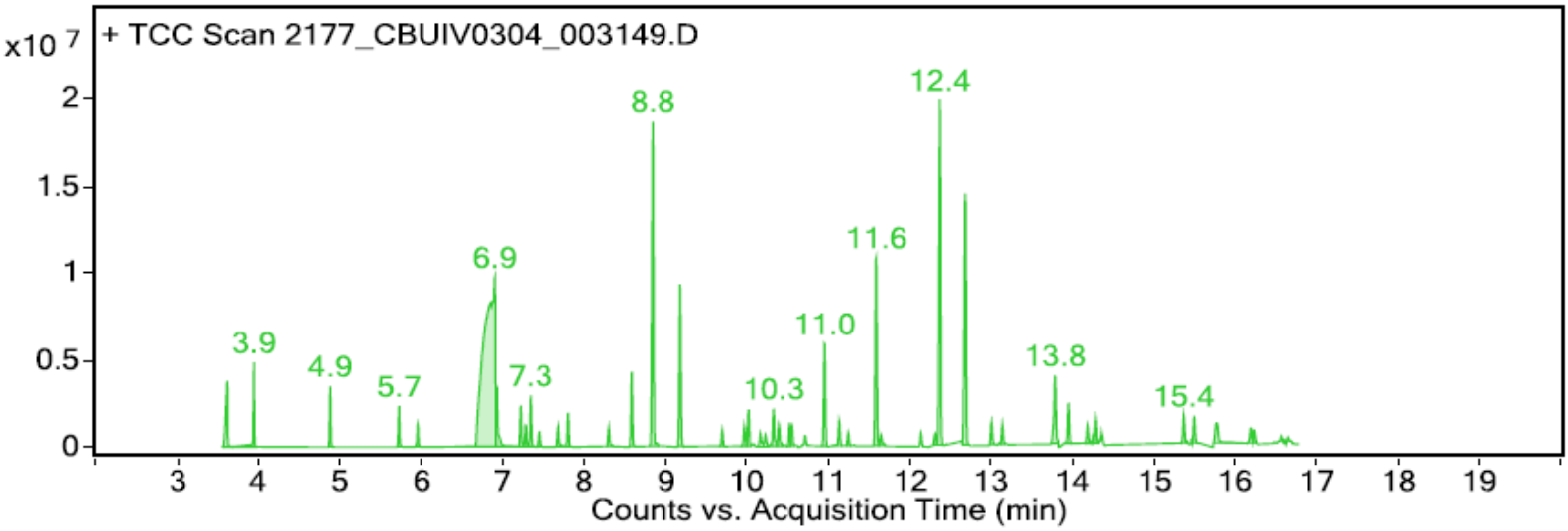
Sample: Creation Baumann Unisono IV 0304 gray cotton fabric

Oddy test result: Temporary

Date collected: 06/26/2018

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 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



Library results

RT	Score	Formula	MW	Area	CAS #	Name
3.600	98.0	C2H4O2	60.0	5914014	64-19-7	Acetic acid
3.900	89.2	C2H8O2Si	92.0	3561603	1066-42-8	Silanediol, dimethyl-
4.900	92.5	C6H18O3Si3	222.1	3068347	541-05-9	Cyclotrisiloxane, hexamethyl-
5.700	86.3	C8H9NO2	151.1	2468909	1000222-86-6	Oxime-, methoxy-phenyl-_
6.000	91.8	C6H14O2	118.1	1507915	111-76-2	Ethanol, 2-butoxy-
6.800	80.7	C7H14	98.1	1015633	999009-70-0	Propylcyclobutane
6.900	94.0	C4H10O3	106.1	86368141	111-46-6	Ethanol, 2,2'-oxybis-
6.900	90.3	C8H24O4Si4	296.1	5216666	556-67-2	Cyclotetrasiloxane, octamethyl-
7.200	95.6	C6H14O3Si	162.1	2964426	1000376-38-1	1,3,6-Trioxa-2-silacyclooctane, 2,2,-dimethylsilyl-
7.300	88.4	C7H16O3	148.1	931492	0-00-0	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
7.300	97.9	C8H16O	128.1	2160801	124-13-0	Octanal
7.400	98.2	C7H16O3	148.1	1036661	0-00-0	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
7.700	94.6	C8H18O	130.1	1470621	104-76-7	1-Hexanol, 2-ethyl-
7.800	96.2	C7H8O	108.1	2413601	100-51-6	Benzyl Alcohol
8.800	97.5	C9H18O	142.1	24924472	124-19-6	Nonanal
9.200	95.6	C10H30O5Si5	370.1	12521475	541-02-6	Cyclopentasiloxane, decamethyl-
10.000	97.8	C10H20O	156.2	1639010	1490-04-6	Cyclohexanol, 5-methyl-2-(1-methylethyl)-
10.000	94.8	C8H18O3	162.1	1605534	112-34-5	Ethanol, 2-(2-butoxyethoxy)-
10.300	82.9	C10H20O	156.2	2862345	112-31-2	Decanal
10.500	93.5	C8H10O2	138.1	1910144	122-99-6	Ethanol, 2-phenoxy-
10.700	80.0	C7H5NS	135.0	914766	95-16-9	Benzothiazole
11.000	96.4	C12H24O2	200.2	8145859	7434-89-1	Hexanoic acid, 2-ethyl-, 2-methylpropyl ester

11.100	95.9	C10H18O	154.1	1908888	3913-81-3	2-Decenal, (E)-
11.200	97.3	C10H22O	158.2	1046366	112-30-1	1-Decanol
11.600	96.0	C12H36O6Si6	444.1	15783402	540-97-6	Cyclohexasiloxane, dodecamethyl-
11.600	93.4	C13H28	184.2	914557	629-50-5	Tridecane
12.100	93.7	C9H14O6	218.1	1023845	102-76-1	Triacetin
12.400	89.1	C12H24O3	216.2	16096399	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.700	94.0	C12H24O3	216.2	21773043	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
13.000	94.6	C14H30	198.2	2088984	629-59-4	Tetradecane
13.100	97.3	C12H24O	184.2	1634742	112-54-9	Dodecanal
13.800	80.1	C14H42O7Si7	518.1	5569490	107-50-6	Cycloheptasiloxane, tetradecamethyl-
14.000	96.9	C12H26O	186.2	3291003	112-53-8	1-Dodecanol
14.200	95.3	C15H30	210.2	1567859	13360-61-7	1-Pentadecene
14.300	94.7	C15H32	212.3	2182796	629-62-9	pentadecane
15.500	89.9	C16H34	226.3	2266544	544-76-3	Hexadecane
15.800	90.5	C16H48O8Si8	592.2	1464882	556-68-3	Cyclooctasiloxane, hexadecamethyl-
15.800	89.5	C15H30O2	242.2	1360471	10233-13-3	Dodecanoic acid, 1-methylethyl ester
16.200	92.7	C16H32	224.3	1360187	295-65-8	Cyclohexadecane
16.200	92.0	C18H38O	270.3	1224720	1000406-38-3	Decyl octyl ether
16.600	87.7	C17H36O	256.3	944632	1454-85-9	n-Heptadecanol-1
16.700	83.1	C17H36	240.3	950067	629-78-7	Heptadecane