

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

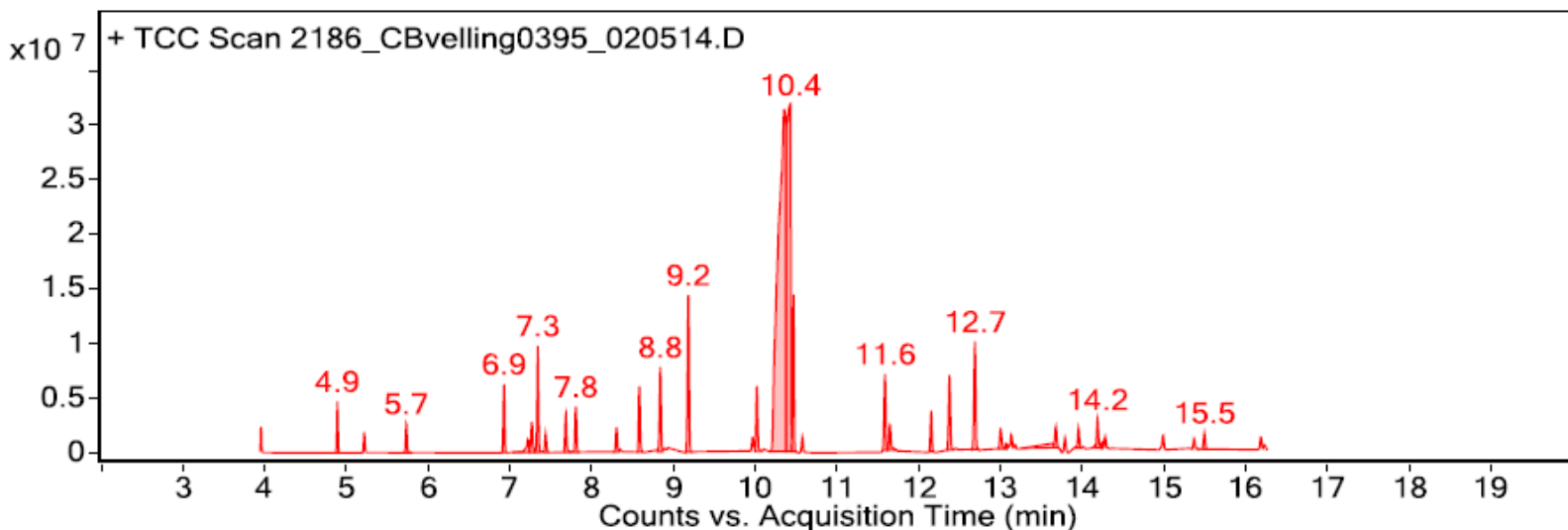
Sample: Creation Baumann Velling 0395 gray velvet cotton fabric

Oddy test result: Temporary

Date collected: 06/01/2018

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
4.000	93.7	C2H8O2Si	92.0	1951508	1066-42-8	Silanediol, dimethyl-
4.900	92.5	C6H18O3Si3	222.1	4047613	541-05-9	Cyclotrisiloxane, hexamethyl-
5.200	96.2	C6H12O2	116.1	1809820	123-42-2	2-Pentanone, 4-hydroxy-4-methyl-
5.700	85.8	C8H9NO2	151.1	2931124	1000222-86-6	Oxime-, methoxy-phenyl-
6.900	94.6	C8H24O4Si4	296.1	7089334	556-67-2	Cyclotetrasiloxane, octamethyl-
7.300	87.8	C7H16O3	148.1	1784369	0-00-0	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
7.300	97.8	C8H16O	128.1	6211032	124-13-0	Octanal
7.400	98.2	C7H16O3	148.1	2228705	0-00-0	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
7.700	97.4	C8H18O	130.1	4329730	104-76-7	1-Hexanol, 2-ethyl-
7.800	95.8	C7H8O	108.1	5276691	100-51-6	Benzyl Alcohol
8.300	86.7	C8H18O	130.1	2792027	111-87-5	1-Octanol
8.800	97.3	C9H18O	142.1	9986738	124-19-6	Nonanal
9.200	95.4	C10H30O5Si5	370.1	18830865	541-02-6	Cyclopentasiloxane, decamethyl-
10.000	97.8	C10H20O	156.2	1827742	15356-70-4	Cyclohexanol, 5-methyl-2-(1-methylethyl)-, (1.alpha.,2.beta.,5.alpha.)-(./.-.)-
10.000	96.1	C8H18O3	162.1	4431633	112-34-5	Ethanol, 2-(2-butoxyethoxy)-
10.400	83.0	C10H20O	156.2	17295507	112-31-2	Decanal
10.400	83.4	C16H34D2N2	258.3	12256698	999337-93-7	N,N-Bis[2-(deuteriomethyl)hexyl]ethylenediamine
10.500	95.3	C5H6N2O3	142.0	11395028	5176-82-9	1,3-Dimethyl-2,4,5-trioximidazolidine
11.600	95.9	C12H36O6Si6	444.1	10087122	540-97-6	Cyclohexasiloxane, dodecamethyl-
11.600	95.1	C13H28	184.2	3652799	629-50-5	Tridecane
12.200	93.3	C7H12O5	176.1	4779750	102-62-5	Glycerol 1,2-diacetate

12.400	90.0	C12H24O3	216.2	10124215	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.700	93.9	C12H24O3	216.2	14252757	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
13.000	90.7	C14H30	198.2	3304706	629-59-4	Tetradecane
13.100	91.1	C13H26O	198.2	1952737	10486-19-8	Tridecanal
13.700	94.3	C14H28	196.2	3404711	2882-98-6	Cyclopentane, nonyl-
14.000	96.8	C12H26O	186.2	2750232	112-53-8	1-Dodecanol
14.200	95.3	C15H30	210.2	4308604	13360-61-7	1-Pentadecene
14.300	93.0	C15H32	212.3	2229949	629-62-9	pentadecane
15.000	94.8	C15H30	210.2	2048427	2883-02-5	n-Nonylcyclohexane
15.500	91.3	C17H36	240.3	2233587	1000360-41-3	5,5-Diethyltridecane
16.200	92.8	C16H32	224.3	1812530	6785-23-5	Cyclopentane, undecyl-