

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

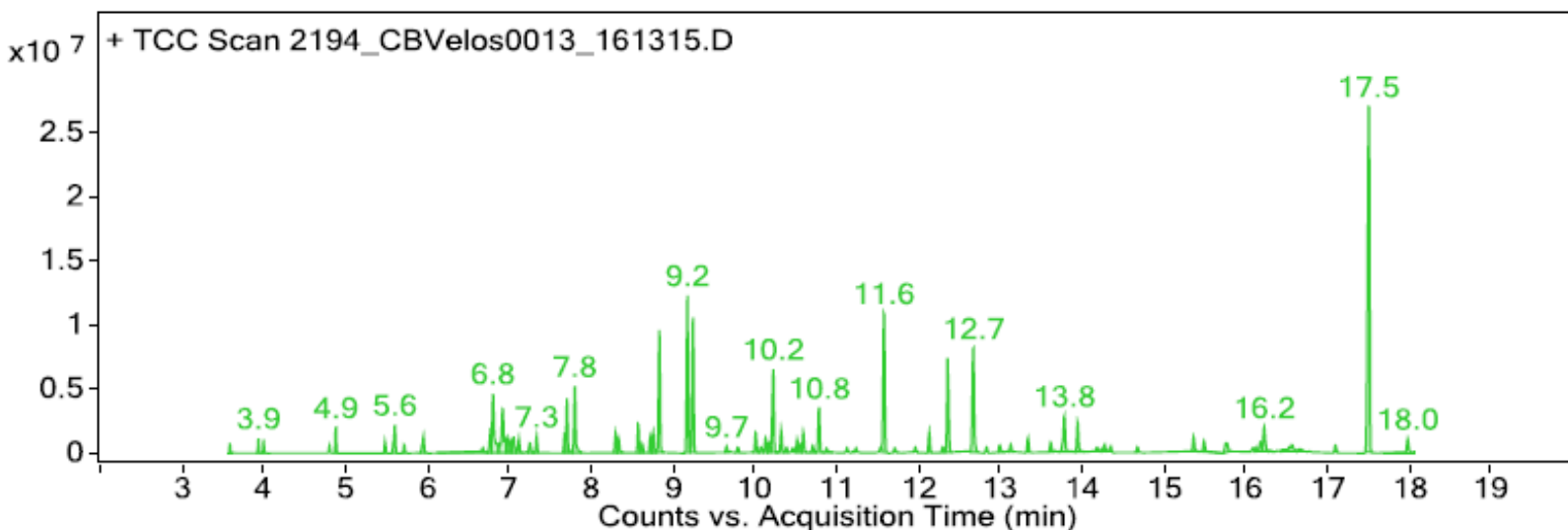
Sample: Creation Baumann Velos II 0013 black velvet polyester fabric with flame retardant

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	583078	64-19-7	Acetic acid
3.900	93.6	C2H8O2Si	92.0	881420	1066-42-8	Silanediol, dimethyl-
4.000	95.8	C6H15N	101.1	727300	121-44-8	Triethylamine
4.800	97.0	C6H12O	100.1	475998	66-25-1	Hexanal
4.900	92.5	C6H18O3Si3	222.1	1887580	541-05-9	Cyclotrisiloxane, hexamethyl-
5.500	96.7	C8H10	106.1	879772	0-00-0	METHYLLAURATE
5.600	97.4	C8H10	106.1	2973405	0-00-0	unidentified C2-benzene
5.700	85.2	C8H9NO2	151.1	675604	1000222-86-6	Oxime-, methoxy-phenyl-
6.000	91.8	C6H14O2	118.1	1333699	111-76-2	Ethanol, 2-butoxy-
6.800	97.1	C7H6O	106.0	3745423	100-52-7	Benzaldehyde
6.900	87.4	C6H6O	94.0	1159138	108-95-2	Phenol
6.900	94.7	C8H24O4Si4	296.1	2614764	556-67-2	Cyclotetrasiloxane, octamethyl-
7.100	95.3	C8H14O	126.1	1756250	110-93-0	6-Methyl-5-hepten-2-one
7.100	97.5	C5H8O3	116.0	1132943	592-20-1	2-Propanone, 1-(acetyloxy)-
7.200	91.4	C9H12	120.1	500583	526-73-8	Benzene, 1,2,3-trimethyl-
7.300	92.6	C6H14O3	134.1	685315	111-90-0	Ethanol, 2-(2-ethoxyethoxy)-
7.300	97.7	C8H16O	128.1	1446772	124-13-0	Octanal
7.700	92.0	C8H18O	130.1	1777472	104-76-7	1-Hexanol, 2-ethyl-
7.700	96.9	C6H10O4	146.1	4791416	106-65-0	Butanedioic acid, dimethyl ester
7.800	95.4	C7H8O	108.1	6588185	100-51-6	Benzyl Alcohol
7.800	94.5	C5H9NO	99.1	610220	872-50-4	2-Pyrrolidinone, 1-methyl-
8.300	94.4	C10H20O	156.2	877940	18479-58-8	7-Octen-2-ol, 2,6-dimethyl-
8.600	94.8	C6H5NO2	123.0	853410	98-95-3	Benzene, nitro-
8.700	96.6	C8H8O2	136.1	966022	93-58-3	Benzoic acid, methyl ester
8.800	93.8	C10H18O	154.1	1926455	78-70-6	Linalool
8.800	97.7	C9H18O	142.1	12104462	124-19-6	Nonanal

9.200	95.5	C10H30O5Si5	370.1	15741268	541-02-6	Cyclopentasiloxane, decamethyl-
9.200	97.0	C7H12O4	160.1	13665714	1119-40-0	Pentanedioic acid, dimethyl ester
9.700	93.2	C9H16O	140.1	609415	18829-56-6	2-Nonenal, (E)-
9.800	82.8	C12H26O	186.2	649799	112-53-8	1-Dodecanol
10.000	96.2	C8H18O3	162.1	2115142	112-34-5	Ethanol, 2-(2-butoxyethoxy)-
10.100	83.5	C10H12O2	164.1	517285	2216-45-7	p-Methylbenzyl acetate
10.100	96.1	C10H8	128.1	1310313	275-51-4	Azulene
10.200	97.3	C8H8O3	152.0	1074012	119-36-8	Methyl salicylate
10.200	84.9	C5H8N2O2	128.1	9484503	999032-96-6	DIHYDROURACIL, 1-N-METHYL-
10.300	96.1	C10H20O	156.2	2338033	112-31-2	Decanal
10.500	94.6	C12H36O4Si5	384.1	522583	141-63-9	Pentasiloxane, dodecamethyl-
10.500	93.0	C8H10O2	138.1	1131862	122-99-6	Ethanol, 2-phenoxy-
10.600	95.6	C10H20O	156.2	2106221	1117-61-9	6-Octen-1-ol, 3,7-dimethyl-, (R)-
10.700	91.9	C7H5NS	135.0	829333	95-16-9	Benzothiazole
10.800	97.8	C8H14O4	174.1	4272508	627-93-0	Hexanedioic acid, dimethyl ester
10.900	80.1	C9H7N	129.1	538363	91-22-5	Quinoline
11.100	90.8	C10H18O	154.1	496768	3913-81-3	2-Decenal, (E)-
11.200	97.3	C10H22O	158.2	471094	112-30-1	1-Decanol
11.500	80.5	C12H20O2	196.1	674976	76-49-3	ENDOBNRYL ACETATE
11.600	96.0	C12H36O6Si6	444.1	15659857	540-97-6	Cyclohexasiloxane, dodecamethyl-
11.700	96.1	C11H10	142.1	559088	2471-83-2	1H-Indene, 1-ethylidene-
12.000	97.3	C16H34	226.3	683684	4390-04-9	Nonane, 2,2,4,4,6,8,8-heptamethyl-
12.100	93.3	C7H12O5	176.1	2128826	25395-31-7	1,2,3-Propanetriol, diacetate
12.300	85.0	C15H26O2	238.2	699138	24717-85-9	Citronellyl tiglate
12.400	90.1	C12H24O3	216.2	8741344	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.700	93.5	C12H24O3	216.2	12225725	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
12.800	96.3	C12H10	154.1	670888	92-52-4	1,1'-Biphenyl
13.000	93.3	C14H30	198.2	915936	629-59-4	Tetradecane
13.100	97.8	C12H24O	184.2	818704	112-54-9	Dodecanal
13.300	92.5	C13H20O2	208.1	1610781	128-51-8	Nopyl acetate
13.600	86.4	C13H22O	194.2	1089671	3796-70-1	5,9-Undecadien-2-one, 6,10-dimethyl-, (E)-
13.800	80.4	C14H42O7Si7	518.1	3974668	107-50-6	Cycloheptasiloxane, tetradecamethyl-
13.900	96.9	C12H26O	186.2	3257941	112-53-8	1-Dodecanol
14.300	93.4	C15H32	212.3	866199	629-62-9	pentadecane
14.400	84.2	C14H22O	206.2	680589	96-76-4	Phenol, 2,4-bis(1,1-dimethylethyl)-
14.700	92.3	C14H20O	204.2	701711	999191-00-0	LILY ALDEHYDE
15.500	90.5	C15H32	212.3	1191536	3891-98-3	Dodecane, 2,6,10-trimethyl-
15.800	90.4	C16H48O8Si8	592.2	868403	556-68-3	Cyclooctasiloxane, hexadecamethyl-
15.800	89.0	C15H30O2	242.2	742555	10233-13-3	Dodecanoic acid, 1-methylethyl ester
16.100	81.4	C13H22O3	226.2	498578	24851-98-7	Dihydro methyl jasmonate
16.200	91.0	C16H32	224.3	581539	6785-23-5	Cyclopentane, undecyl-
16.200	92.8	C16H34O	242.3	1004996	629-82-3	Octane, 1,1'-oxybis-
17.100	83.8	C18H28O2Si3	360.1	879547	17977-72-9	1,1,3,3,5,5-Hexamethyl-1,5-diphenyl-trisiloxane
17.500	96.8	C14H12O2	212.1	46680323	120-51-4	Benzyl benzoate
18.000	94.8	C17H34O2	270.3	1498324	110-27-0	Isopropyl Myristate