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

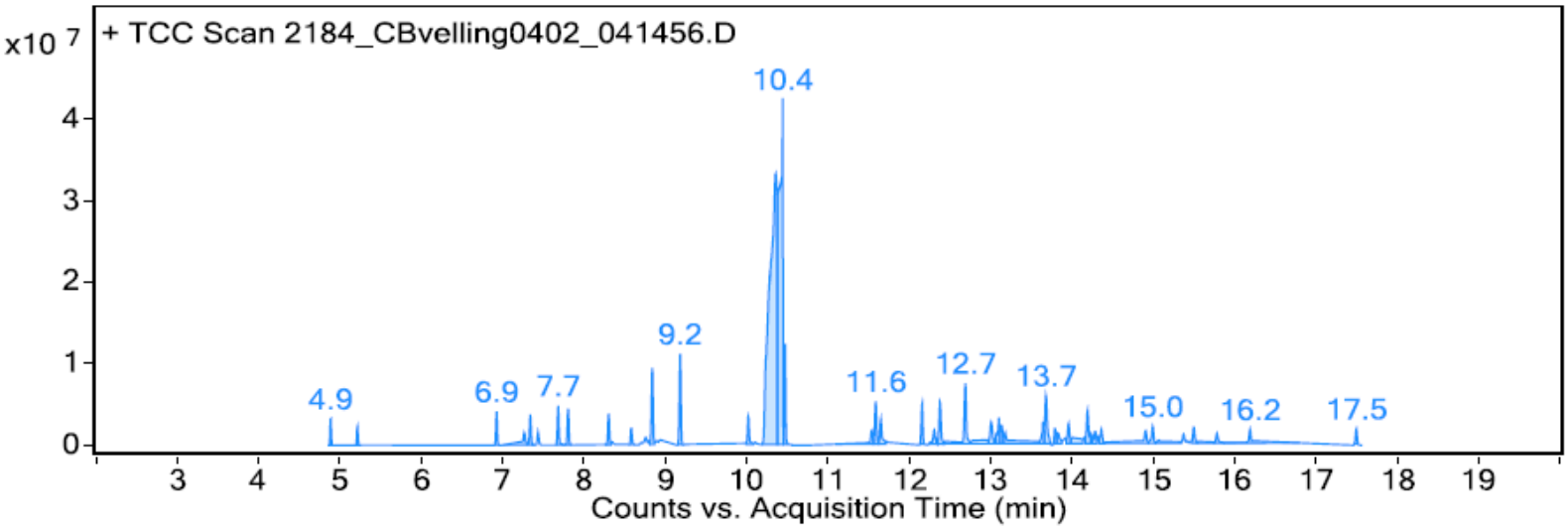
Sample: Creation Baumann Velling 0402 blue velvet cotton fabric

Oddy test result: Temporary

Date collected: 05/31/2018

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
4.900	92.5	C6H18O3Si3	222.1	3032026	541-05-9	Cyclotrisiloxane, hexamethyl-
5.200	95.8	C6H12O2	116.1	2331867	123-42-2	2-Pentanone, 4-hydroxy-4-methyl-
6.900	95.2	C8H24O4Si4	296.1	4673307	556-67-2	Cyclotetrasiloxane, octamethyl-
7.300	97.9	C8H16O	128.1	3143060	124-13-0	Octanal
7.400	98.2	C7H16O3	148.1	2037954	0-00-0	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
7.700	97.4	C8H18O	130.1	5922211	104-76-7	1-Hexanol, 2-ethyl-
7.800	95.6	C7H8O	108.1	5565806	100-51-6	Benzyl Alcohol
8.300	91.8	C8H18O	130.1	4638647	111-87-5	1-Octanol
8.800	86.7	C15H32	212.3	1977838	3891-98-3	Dodecane, 2,6,10-trimethyl-
8.800	97.0	C9H18O	142.1	12288868	124-19-6	Nonanal
9.200	95.4	C10H30O5Si5	370.1	14516417	541-02-6	Cyclopentasiloxane, decamethyl-
10.000	96.1	C8H18O3	162.1	4843706	112-34-5	Ethanol, 2-(2-butoxyethoxy)-
10.400	84.1	C10H20O	156.2	17771245	112-31-2	Decanal
10.500	94.9	C5H6N2O3	142.0	7324496	5176-82-9	1,3-Dimethyl-2,4,5-trioxoimidazolidine
11.500	93.8	C13H26	182.2	2421288	2437-56-1	1-Tridecene
11.600	95.8	C12H36O6Si6	444.1	7131363	540-97-6	Cyclohexasiloxane, dodecamethyl-
11.600	93.6	C13H28	184.2	4849845	629-50-5	Tridecane
12.200	93.8	C7H12O5	176.1	6814183	102-62-5	Glycerol 1,2-diacetate
12.300	80.5	C19H38	266.3	2421433	13151-89-8	Tridecane, 4-cyclohexyl-

12.400	90.0	C12H24O3	216.2	7476999	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.700	93.6	C12H24O3	216.2	11124413	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
13.000	93.5	C14H30	198.2	4807972	629-59-4	Tetradecane
13.100	86.2	C13H26O	198.2	2595212	10486-19-8	Tridecanal
13.600	88.1	C17H36	240.3	2209383	6008-17-9	5,5-Dibutylnonane
13.700	94.5	C14H28	196.2	5425674	2882-98-6	Cyclopentane, nonyl-
13.800	87.1	C18H38	254.3	1952685	3892-00-0	Pentadecane, 2,6,10-trimethyl-
14.000	95.8	C12H26O	186.2	3136699	112-53-8	1-Dodecanol
14.200	95.2	C15H30	210.2	6450789	13360-61-7	1-Pentadecene
14.300	90.7	C15H32	212.3	2637253	629-62-9	pentadecane
14.900	87.1	C20H42O3S	362.3	2095839	1000309-13-6	Sulfurous acid, hexyl tetradecyl ester
15.000	94.8	C15H30	210.2	2880380	2883-02-5	n-Nonylcyclohexane
15.500	92.1	C17H36	240.3	2811362	1000360-41-3	5,5-Diethyltridecane
15.800	90.1	C15H30O2	242.2	1778323	10233-13-3	Dodecanoic acid, 1-methylethyl ester
16.200	92.9	C16H32	224.3	2389605	295-65-8	Cyclohexadecane
17.500	98.1	C14H12O2	212.1	2895618	120-51-4	Benzyl benzoate