

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

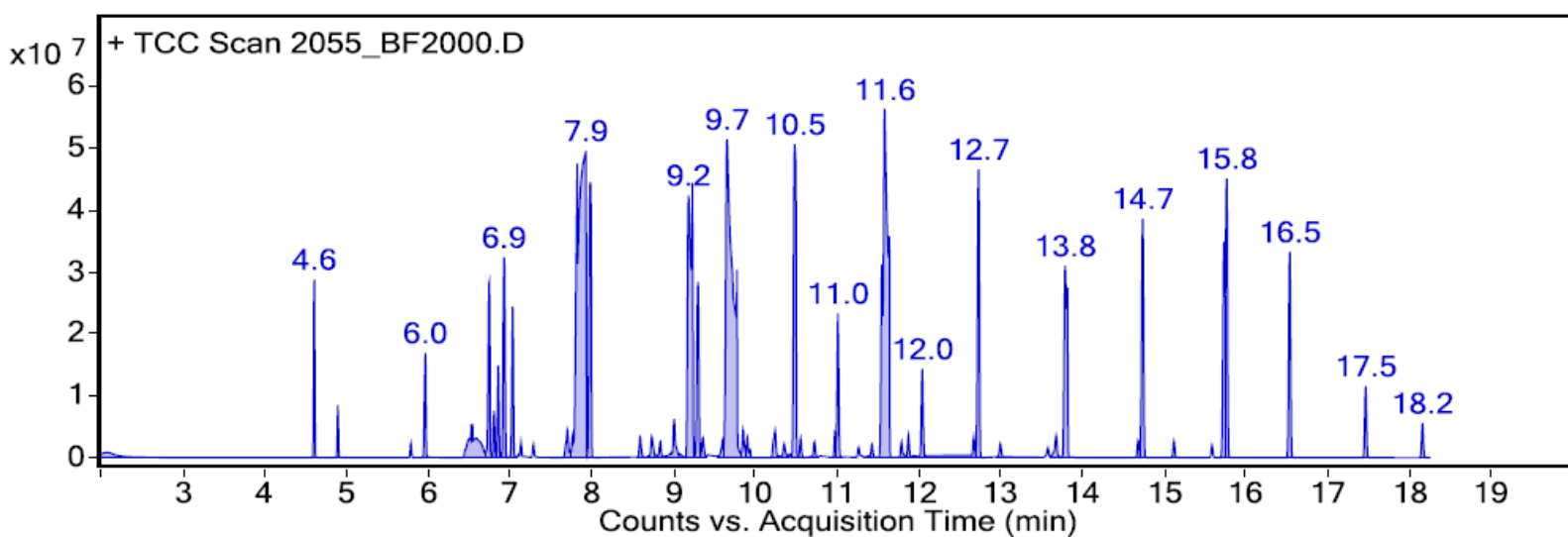
Sample: Rogers Corporation Bisco BF-2000 black ultra soft foamed silicone with pressure sensitive adhesive

Oddy test result: Temporary

Date GC-MS collected: 03/09/2018

Technique used: SPME Arrow 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 sample at 60°C for 20 minutes; fiber exposure to sample at 60°C for 20 minutes; fiber injected into 220°C inlet and cryotrapped 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) 12.7 min: 2-methyl-, 3-hydroxyl-, 2,4,4-trimethylpentyl ester propanoic acid



RT	Score	Formula	MW	Area	CAS #	Name
2.100	93.0	C3H10OSi	90.1	12793229	1066-40-6	Silanol, trimethyl-
6.000	97.5	C6H14O2	118.1	21178274	111-76-2	Ethanol, 2-butoxy-
6.500	91.1	C4H10O2	90.1	12799922	110-63-4	1,4-Butanediol
6.600	84.6	C4H10O2	90.1	24136831	110-63-4	1,4-Butanediol
6.800	97.9	C7H6O	106.0	6873264	100-52-7	Benzaldehyde
6.900	94.9	C8H24O4Si4	296.1	49857510	556-67-2	Cyclotetrasiloxane, octamethyl-
7.000	95.6	C7H14O3	146.1	27745679	763-69-9	Propanoic acid, 3-ethoxy-, ethyl ester
7.100	93.2	C8H18O	130.1	2797661	26952-21-6	Isooctanol
7.300	93.0	C8H24O4Si4	296.1	2689248	556-67-2	Cyclotetrasiloxane, octamethyl-
7.700	94.6	C8H18O	130.1	3936213	104-76-7	1-Hexanol, 2-ethyl-

7.700	91.1	C10H30O3Si4	310.1	4896513	17928-28-8	Methyltris(trimethylsiloxy)silane
7.800	90.7	C10H16	136.1	4378328	138-86-3	dl-Limonene
7.900	87.6	C7H8O	108.1	241476002	822-80-0	Bicyclo[2.2.1]hepta-2,5-dien-7-ol
8.700	97.1	C8H8O2	136.1	3328022	93-58-3	Benzoic acid, methyl ester
8.700	91.7	C35H72	492.6	2824377	630-07-9	Pentatriacontane
8.800	94.7	C9H18O	142.1	3703089	124-19-6	Nonanal
9.000	88.7	C8H18O	130.1	11283238	1653-40-3	1-Heptanol, 6-methyl-
9.200	95.1	C10H30O5Si5	370.1	111672677	541-02-6	Cyclopentasiloxane, decamethyl-
9.200	82.9	C12H34O4Si4	354.2	34427787	72182-11-7	3-Isopropoxy-1,1,1,5,5,5-hexamethyl-3-(trimethylsiloxy)trisiloxane
9.300	91.5	C8H24O4Si4	296.1	49039325	556-67-2	Cyclotetrasiloxane, octamethyl-
9.400	93.5	C10H30O5Si5	370.1	3571316	541-02-6	Cyclopentasiloxane, decamethyl-
9.700	93.9	C12H36O4Si5	384.1	212640761	141-63-9	Pentasiloxane, dodecamethyl-
9.800	81.7	C2H7N	45.1	5647481	124-40-3	Methanamine, N-methyl-
9.900	93.5	C10H30O5Si5	370.1	3674347	541-02-6	Cyclopentasiloxane, decamethyl-
9.900	92.2	C10H30O5Si5	370.1	3779312	541-02-6	Cyclopentasiloxane, decamethyl-
10.200	94.6	C12H36O4Si5	384.1	3476580	141-63-9	Pentasiloxane, dodecamethyl-
10.200	94.0	C12H26	170.2	5360515	112-40-3	Dodecane
10.400	86.3	C10H22O	158.2	3981725	999083-84-1	tetrahydro geraniol
12.000	95.7	C14H42O5Si6	458.2	20972773	107-52-8	Hexasiloxane, tetradecamethyl-
12.700	93.0	C12H24O3	216.2	4616789	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
12.700	96.0	C14H42O5Si6	458.2	60971910	107-52-8	Hexasiloxane, tetradecamethyl-
13.000	94.4	C14H30	198.2	3431786	629-59-4	Tetradecane
13.800	82.5	C14H42O7Si7	518.1	78184296	107-50-6	Cycloheptasiloxane, tetradecamethyl-
14.700	80.5	C18H52O7Si7	576.2	3835209	71579-69-6	3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane
14.700	90.2	C16H48O6Si7	532.2	63110447	541-01-5	Heptasiloxane, hexadecamethyl-
15.100	80.9	C18H52O7Si7	576.2	3869043	71579-69-6	3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane
15.800	87.9	C16H48O8Si8	592.2	50730051	556-68-3	Cyclooctasiloxane, hexadecamethyl-
17.500	85.3	C18H54O9Si9	666.2	16992590	556-71-8	Cyclononasiloxane, octadecamethyl-