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

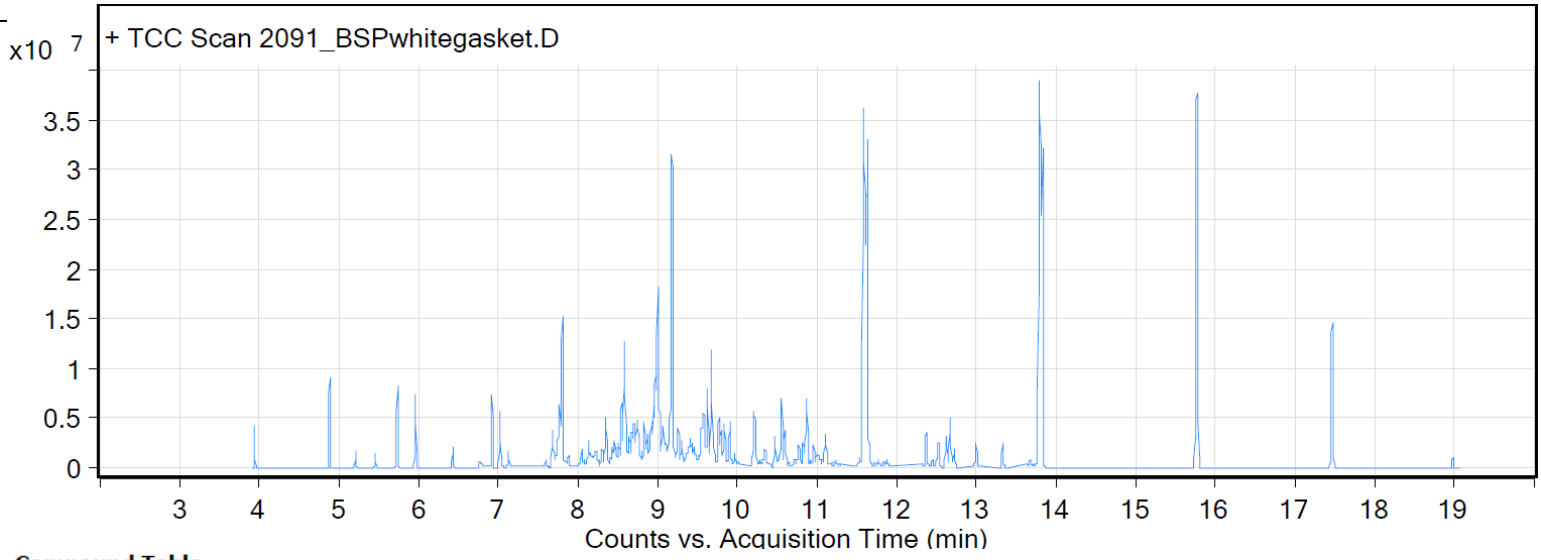
Sample: BSP silicone profile GmBH white silicone gasket

Oddy test result: unsuitable

Date collected: 3/16/2018

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 cryo-trapped for 2 min at -15°C; GC ramped from 35°C to 250 °C at 10°C/min. Data analyzed in Masshunter Qualitative Analysis. Deconvoluted data with > 85% match with a NIST 17.0 or Wiley 9 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.



Compound Table

RT	Score (Lib)	Area	Name	Formula
3.94	93.69	3157964	Silanediol, dimethyl-	C2H8O2Si
4.88	92.41	8121010	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
5.21	95.9	1615569	2-Pentanone, 4-hydroxy-4-methyl-	C6H12O2
5.73	85.31	10211141	Oxime-, methoxy-phenyl-_	C8H9NO2
5.96	96.88	8162916	Ethanol, 2-butoxy-	C6H14O2
6.43	96.39	2214092	2-Propanol, 1-butoxy-	C7H16O2
6.92	96.01	8523002	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
7.02	95.78	6517389	Propanoic acid, 3-ethoxy-, ethyl ester	C7H14O3
7.13	92.14	1931332	Isooctanol	C8H18O
7.68	94.23	6635276	1-Hexanol, 2-ethyl-	C8H18O
7.76	94.7	5861283	dl-Limonene	C10H16
7.78	87.89	5174318	Isooctanol	C8H18O
7.8	95.85	10928865	Benzyl Alcohol	C7H8O
7.88	95.4	1985738	(S)-(+)-5-Methyl-1-heptanol	C8H18O
8.13	87.67	3143947	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
8.22	85.64	2502295	Dodecane, 2,6,11-trimethyl-	C15H32
8.35	91.12	5831975	Tridecane, 6-methyl-	C14H30
8.44	91.1	4008202	Octane, 3,4,5,6-tetramethyl-	C12H26
8.47	90.14	3939368	Undecane, 4,6-dimethyl-	C13H28
8.68	87.62	5704328	Nonane, 4-methyl-	C10H22
8.75	89.88	9234912	Nonane, 3-methyl-5-propyl-	C13H28
8.83	86.98	6966766	Nonanal	C9H18O
8.88	87.8	3139264	Tetracosane	C24H50
8.93	89.58	7718339	Dodecane, 6-methyl-	C13H28
9	88.52	21479073	tetrahydro geraniol	C10H22O
9.14	88.58	8759074	Nonane, 3-methyl-5-propyl-	C13H28
9.18	96.52	43574042	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
9.2	86.13	1428561	2-methoxy[1]benzothieno[2,3-c]quinolin-6(5H)-one	C16H11NO2S
9.26	89.83	6155448	Undecane, 4,7-dimethyl-	C13H28
9.3	88.22	1929679	Octane, 2,3-dimethyl-	C10H22
9.51	90.41	1909745	Nonane, 4-methyl-5-propyl-	C13H28
9.67	85.41	15242080	Acetic acid, octyl ester	C10H20O2

9.76	86.74	7162227	Acetic acid, octyl ester	C10H20O2
9.9	89.72	5884351	Acetic acid, octyl ester	C10H20O2
9.96	96.64	2204897	Cyclohexanol, 5-methyl-2-(1-methylethyl)-	C10H20O
10.47	95.53	4429940	Pentasiloxane, dodecamethyl-	C12H36O4Si5
10.6	89.92	5536475	2-Ethylhexyl acrylate	C11H20O2
10.77	88.38	1672222	2-Propenoic acid, octyl ester	C11H20O2
11.1	89.01	2288742	(S)-(+)-5-Methyl-1-heptanol	C8H18O
11.23	87.8	1167902	Decyl octyl ether	C18H38O
11.53	90.94	1680463	6-Tridecene	C13H26
11.58	95.98	108161356	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.64	92.23	4301026	Tridecane	C13H28
11.77	87.66	1087127	1-Decanol, 2-hexyl-	C16H34O
12.37	90.12	5019742	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
12.67	93.05	6839127	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	C12H24O3
12.73	92.29	1614721	Hexasiloxane, tetradecamethyl-	C14H42O5Si6
13	95.58	3688462	Tetradecane	C14H30
13.67	92.29	1088934	Cyclopentane, nonyl-	C14H28
15.77	88.74	72983596	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
17.46	85.86	22248212	Cyclononasiloxane, octadecamethyl-	C18H54O9Si9