

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

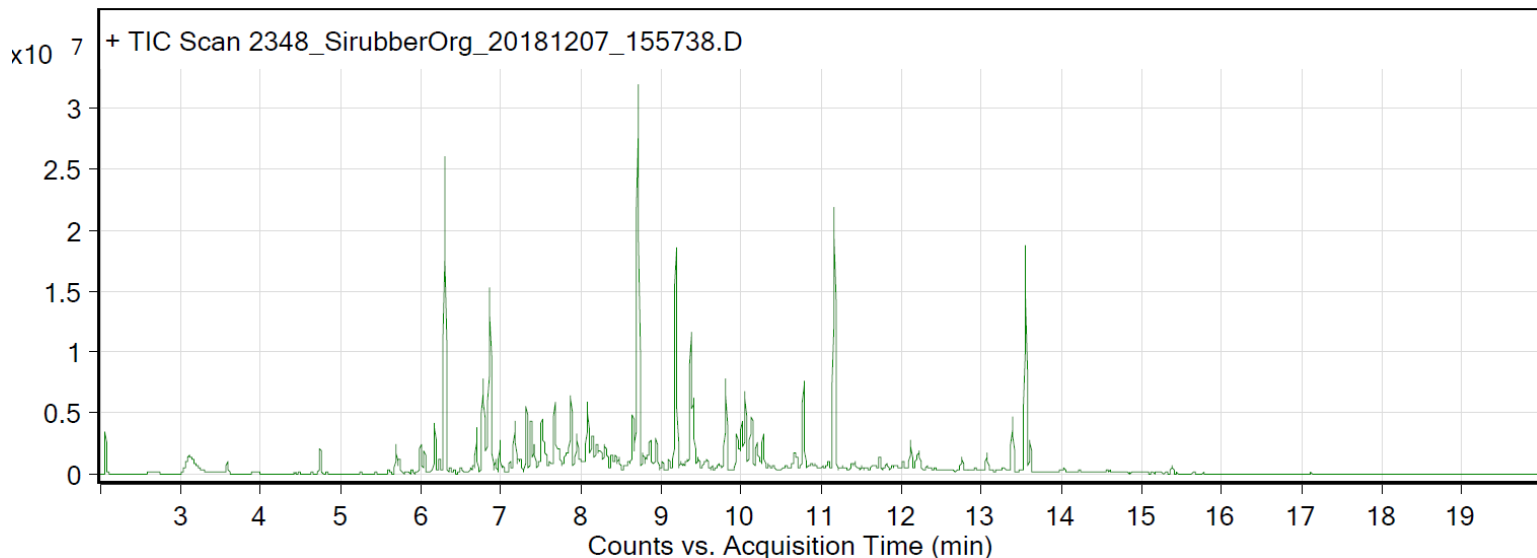
Sample: Stockwell Elastomerics: Norseal sponge silicone rubber, 0.062 R10470M Sil Sponge Plain

Oddy test result: Temporary

Date collected: 12/5/2018

Technique used: SPME with a PDMS/Carbon WR 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) 4.8 min: methoxyphenyl oxime;



Compound Table

RT	Score (Lib)	Area	Name	Formula
1.72	91.25	1247721	Toluene	C7H8
2.06	93.65	2758528	Silanediol, dimethyl-	C2H8O2Si
3.11	92.42	11592711	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
3.58	92.35	1319420	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
3.94	96.65	866106	unidentified C2-benzene	C8H10
4.75	85.25	3444080	Oxime-, methoxy-phenyl_	C8H9NO2
6.04	97.75	2432895	.alpha.-Methylstyrene	C9H10
6.17	92.13	6022241	Isooctanol	C8H18O
6.22	89.21	799924	Benzene, 1,2,3-trimethyl-	C9H12
6.3	97.14	36917358	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
6.31	95.46	2458005	Decane	C10H22
6.36	94.44	579168	Octanal	C8H16O
6.69	90.83	5497795	Heptane, 2,2,4,6,6-pentamethyl-	C12H26
6.77	92.61	10139846	1-Hexanol, 2-ethyl-	C8H18O
6.88	88.89	9631419	Octyl ester of formic acid	C9H18O2
6.93	89.45	1550429	Undecane, 3,6-dimethyl-	C13H28
6.99	95.96	3552900	(S)-(+)-5-Methyl-1-heptanol	C8H18O
7.18	91.05	7582590	Dodecane, 2,6,11-trimethyl-	C15H32
7.32	90.89	7897843	Dodecane, 2,6,11-trimethyl-	C15H32
7.38	91.67	5507666	Ethanone, 1-phenyl-	C8H8O
7.41	87.12	3087651	Decane, 2,5,6-trimethyl-	C13H28
7.67	85.62	8294637	Benzenemethanol, .alpha.,.alpha.-dimethyl-	C9H12O
7.83	94.09	708716	Benzoic acid, methyl ester	C8H8O2
7.87	96.04	12729044	Undecane	C11H24
7.95	95.37	6424647	Nonanal	C9H18O
8.14	88.27	5826106	Hexacosane	C26H54
8.19	89.54	3950430	1-Hexanol, 5-methyl-2-(1-methylethyl)-	C10H22O
8.3	93.57	5880236	Undecane, 4,7-dimethyl-	C13H28
8.38	90.54	2731174	Undecane, 2,8-dimethyl-	C13H28
8.43	89.29	1890729	Undecane, 5,6-dimethyl-	C13H28

8.47	86.28	1792039	Decane	C10H22
8.64	96.97	7985113	Acetic acid, 2-ethylhexyl ester	C10H20O2
8.71	95.32	54989670	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
8.77	86.11	2092445	Undecane, 4-methyl-	C12H26
8.87	85.29	4789561	3,7-Dimethyloctyl acetate	C12H24O2
8.94	91.75	4546334	Undecane, 3-methyl-	C12H26
9.1	88.49	1309094	(S)-(+)-5-Methyl-1-heptanol	C8H18O
9.16	85.82	1042878	Undecane, 3-methylene-	C12H24
9.19	97.21	30431168	Pentasiloxane, dodecamethyl-	C12H36O4Si5
9.25	85.75	1560401	1-Tetradecene	C14H28
9.37	92.99	19425554	Dodecane	C12H26
9.46	85.22	1789224	Decanal	C10H20O
9.81	94.8	11227019	2-Ethylhexyl acrylate	C11H20O2
9.94	85.35	4547170	2-Ethyl-1-hexyl propionate	C11H22O2
10.02	93.47	712582	Pentasiloxane, dodecamethyl-	C12H36O4Si5
10.05	88.41	9763694	2-Propenoic acid, octyl ester	C11H20O2
10.14	86.11	4598612	1-Heptanol, 3-methyl-	C8H18O
10.27	86.78	5056751	2-PROPENOIC ACID, ISODECYL ESTER	C13H24O2
10.41	85.54	801162	Octane, 1,1'-oxybis-	C16H34O
10.67	95.49	3620708	1-Tridecene	C13H26
10.78	95	11579290	Tridecane	C13H28
11.16	97.21	36896546	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.73	91.27	1752270	Tridecane, 3-methyl-	C14H30
11.93	85.11	982764	1-Dodecene, 2-ethyl-	C14H28
12.11	94.93	3924250	Tetradecane	C14H30
12.76	88.85	2013600	1-Tetradecanol	C14H30O
13.07	89.25	2326651	2,6-di(t-butyl)-4-hydroxy-4-methyl-2,5-cyclohexadien-1-one	C15H24O2
13.55	92.81	24828292	Phenol, 2,4-bis(1,1-dimethylethyl)-	C14H22O
13.61	97.8	3543441	Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-	C15H24O
15.38	88.72	1027246	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8