

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

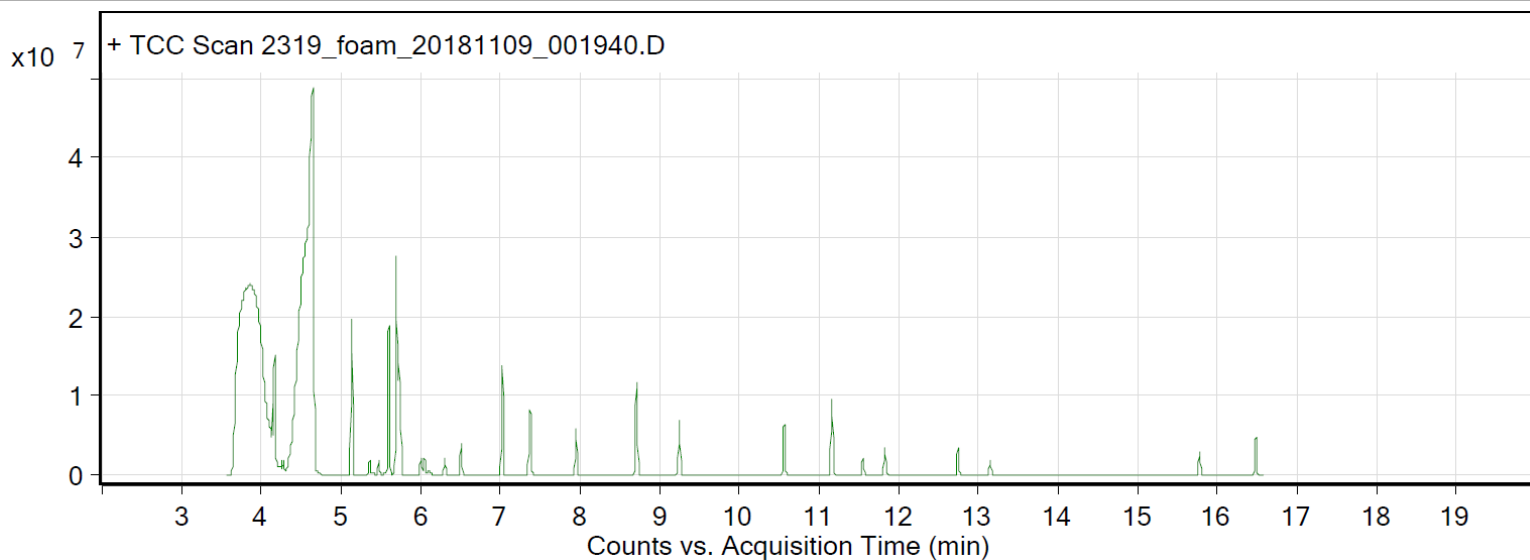
Sample: Dow Corning 1" blue polystyrene board

Oddy test result: temporary

Date collected: 11/9/2018

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) 11.5 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (2) 11.8 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name	Formula
4.16	98.7	29400032	Ethylbenzene	C8H10
4.28	97.58	3566193	unidentified C2-benzene	C8H10
4.59	96.19	6051240	Benzene, ethyl-	C8H10
4.66	96.8	6178907	Benzene, ethyl-	C8H10
5.14	97.57	30866325	Benzene, (1-methylethyl)-	C9H12
5.36	87.2	2858592	3,4-Bis(ethyl)-3-hexene	C10H20
5.47	92.26	2882879	Benzene, cyclopropyl-	C9H10
5.6	97.78	31206106	Benzene, propyl-	C9H12
5.7	93.86	26133677	Benzaldehyde	C7H6O
5.72	91.54	16237456	unidentified C3-benzene	C9H12
6	86.62	2726398	Phenol	C6H6O
6.3	95.86	3274726	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
6.5	95.94	5855385	Benzene, (1-methylpropyl)-	C10H14
7.03	97.46	21413205	PHENYL ACETALDEHYDE	C8H8O
7.38	98.64	10414958	Ethanone, 1-phenyl-	C8H8O
7.95	97.57	8961495	Nonanal	C9H18O
8.71	96.08	20781745	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
9.25	96.39	10556233	1-Dodecene	C12H24
11.16	96.22	17431776	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.55	89.64	3876366	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
11.82	92.99	6090789	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	C12H24O3
15.77	87.44	5146813	Cyclobutane, 1,3-diphenyl-, trans-	C16H16
16.48	86.27	8304984	1,1,3,3,5,5-Hexamethyl-1,5-diphenyl-trisiloxane	C18H28O2Si3