

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

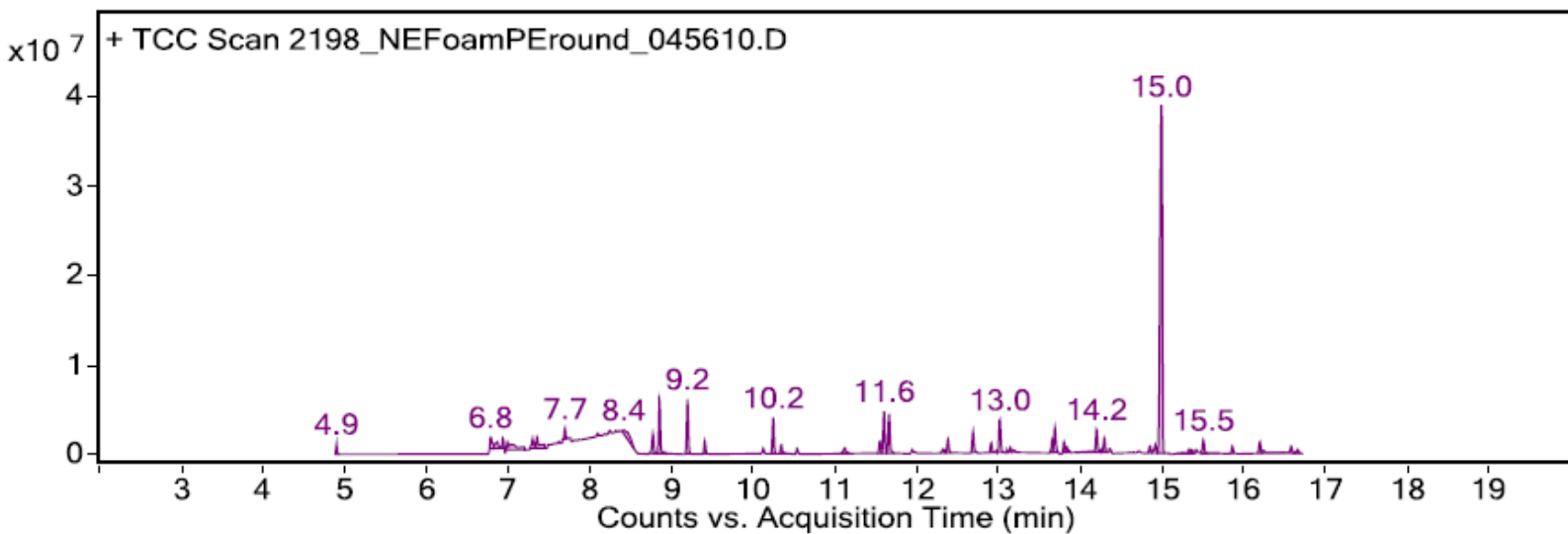
Sample: New England Foam Proflex Profile PE round foam white

Oddly test result: Temporary

Date collected: 06/20/2018

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) 12.4 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (2) 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	1023021	541-05-9	Cyclotrisiloxane, hexamethyl-
6.900	86.9	C6H12O2	116.1	2466782	142-62-1	Hexanoic acid
6.900	94.0	C8H24O4Si4	296.1	1538515	556-67-2	Cyclotetrasiloxane, octamethyl-
7.300	88.8	C10H22	142.2	2770429	124-18-5	Decane
7.400	96.3	C8H16O	128.1	1182198	124-13-0	Octanal
7.700	95.9	C8H18O	130.1	679898	104-76-7	1-Hexanol, 2-ethyl-
8.200	80.3	C7H14O2	130.1	4509836	111-14-8	Heptanoic acid
8.400	89.6	C3H8O3	92.0	66440476	56-81-5	1,2,3-Propanetriol
8.800	96.4	C11H24	156.2	2259515	1120-21-4	Undecane
8.900	97.6	C9H18O	142.1	6154257	124-19-6	Nonanal
9.200	92.8	C10H30O5Si5	370.1	8125841	541-02-6	Cyclopentasiloxane, decamethyl-
10.100	91.5	C12H24	168.2	814025	112-41-4	1-Dodecene
10.200	95.5	C12H26	170.2	5384384	112-40-3	Dodecane
10.300	97.8	C10H20O	156.2	1432274	112-31-2	Decanal
10.500	92.7	C8H10O2	138.1	919262	122-99-6	Ethanol, 2-phenoxy-
11.100	94.4	C9H18O2	158.1	1424583	112-05-0	Nonanoic acid
11.500	95.9	C13H26	182.2	2058293	2437-56-1	1-Tridecene
11.600	95.6	C12H36O6Si6	444.1	6858838	540-97-6	Cyclohexasiloxane, dodecamethyl-
11.700	94.4	C13H28	184.2	6398590	629-50-5	Tridecane

11.900	84.6	C10H22	142.2	795256	124-18-5	Decane
12.300	82.5	C19H38	266.3	818352	13151-89-8	Tridecane, 4-cyclohexyl-
12.400	90.5	C12H24O3	216.2	2369857	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.700	93.8	C12H24O3	216.2	3797497	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
12.900	96.2	C14H28	196.2	1635450	295-17-0	Cyclotetradecane
13.000	95.5	C14H30	198.2	6154684	629-59-4	Tetradecane
13.100	90.1	C18H38O	270.3	972715	112-92-5	1-Octadecanol
13.600	86.8	C17H36	240.3	1035463	6008-17-9	5,5-Dibutylnonane
13.700	94.8	C14H28	196.2	2878086	2882-98-6	Cyclopentane, nonyl-
13.800	91.5	C21H44	296.3	1234728	54833-23-7	Eicosane, 10-methyl-
14.200	95.6	C15H30	210.2	4206927	13360-61-7	1-Pentadecene
14.300	94.8	C15H32	212.3	2779086	629-62-9	pentadecane
14.400	81.6	C15H24O	220.2	783280	128-37-0	Butylated Hydroxytoluene
14.900	86.6	C20H42O3S	362.3	989862	1000309-13-6	Sulfurous acid, hexyl tetradecyl ester
15.400	88.8	C16H32	224.3	762751	629-73-2	1-Hexadecene
15.500	88.4	C15H32	212.3	2192229	3891-98-3	Dodecane, 2,6,10-trimethyl-
15.900	84.4	C16H24O	232.2	1143834	6738-27-8	2,5-Cyclohexadien-1-one, 2,6-bis(1,1-dimethylethyl)-4-ethylidene-
16.200	89.2	C16H32	224.3	1943849	295-65-8	Cyclohexadecane
16.600	95.5	C19H38	266.3	1414239	18435-45-5	1-Nonadecene
16.700	93.7	C17H36	240.3	800176	629-78-7	Heptadecane