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

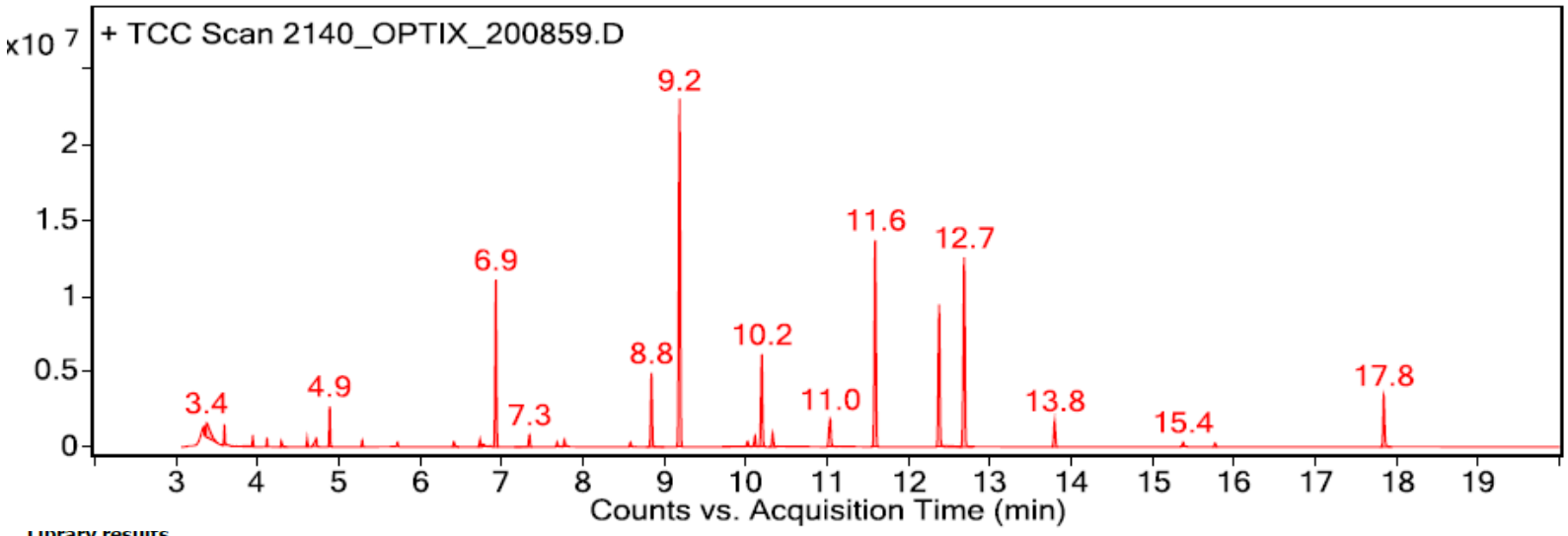
Sample: Plaskolite extruded OPTIX acrylic PMMA sheets

Oddy test result: Temporary

Date collected: 05/14/2018

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) 5.7 min: methoxy-phenyl-oxime; (2) 12.4 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester propanoic acid; (3) 12.7 min: 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester propanoic acid



Library results

RT	Score	Formula	MW	Area	CAS #	Name
3.200	81.3	C5H8O2	100.1	549430	140-88-5	2-Propenoic acid, ethyl ester
3.300	88.5	C5H8O2	100.1	4139362	80-62-6	Methyl methacrylate
3.400	88.5	C5H8O2	100.1	8472613	80-62-6	Methyl methacrylate
3.600	97.9	C2H4O2	60.0	873844	64-19-7	Acetic acid
3.900	95.1	C2H8O2Si	92.0	606428	1066-42-8	Silanediol, dimethyl-
4.100	88.6	C5H8O2	100.1	444056	80-62-6	Methyl methacrylate
4.300	84.7	C3H8O2	76.1	433371	57-55-6	1,2-Propanediol
4.700	90.1	C5H10O2	102.1	1193557	75-98-9	Propanoic acid, 2,2-dimethyl-
4.900	92.5	C6H18O3Si3	222.1	2490881	541-05-9	Cyclotrisiloxane, hexamethyl-
5.300	88.6	C5H8O3	116.0	414894	58653-97-7	2-methyl-2-methoxycarbonyl-oxirane
5.700	85.7	C8H9NO2	151.1	351670	1000222-86-6	Oxime-, methoxy-phenyl-_
6.900	96.5	C8H24O4Si4	296.1	12650870	556-67-2	Cyclotetrasiloxane, octamethyl-
7.300	95.3	C8H16O	128.1	958323	124-13-0	Octanal
7.700	95.8	C8H18O	130.1	392787	104-76-7	1-Hexanol, 2-ethyl-
7.800	95.9	C10H16	136.1	605910	138-86-3	dl-Limonene
8.800	97.8	C9H18O	142.1	6067187	124-19-6	Nonanal
9.200	96.1	C10H30O5Si5	370.1	31376034	541-02-6	Cyclopentasiloxane, decamethyl-
10.000	96.1	C8H18O3	162.1	519036	112-34-5	Ethanol, 2-(2-butoxyethoxy)-
10.100	96.7	C12H24	168.2	905438	112-41-4	1-Dodecene
10.200	96.9	C8H8O3	152.0	8283969	119-36-8	Methyl salicylate
10.300	98.2	C10H20O	156.2	1119297	112-31-2	Decanal
11.000	93.7	C6H11NO	113.1	3369276	105-60-2	Caprolactam
11.600	96.1	C12H36O6Si6	444.1	19206145	540-97-6	Cyclohexasiloxane, dodecamethyl-
12.400	89.2	C12H24O3	216.2	12938205	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.700	93.9	C12H24O3	216.2	18008224	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
13.800	80.3	C14H42O7Si7	518.1	2471901	107-50-6	Cycloheptasiloxane, tetradecamethyl-
15.800	88.7	C16H48O8Si8	592.2	370447	556-68-3	Cyclooctasiloxane, hexadecamethyl-
17.800	97.2	C15H22O3	250.2	4780240	118-60-5	2-Ethylhexyl salicylate