

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

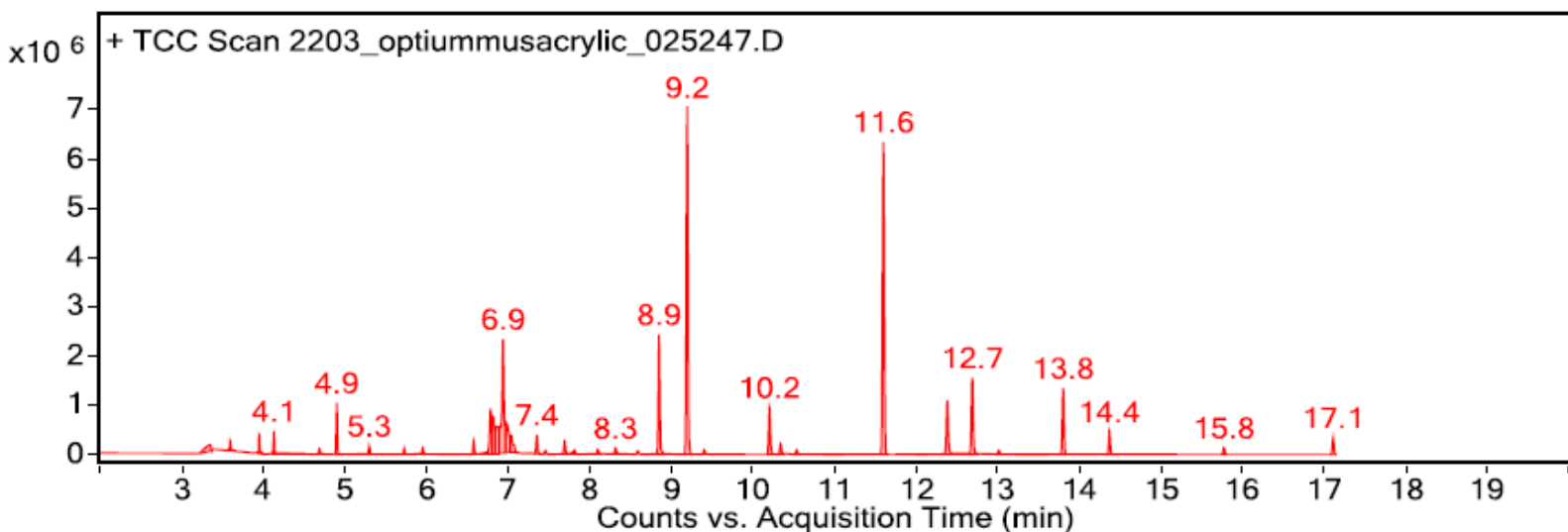
Sample: Tru-View Optium museum acrylic washed with Micro-90

Oddy test result: Temporary

Date GC-MS collected: 6/20/2018

Technique used: SPME Arrow 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 sample at 60°C for 20 minutes; fiber exposure to sample at 60°C for 20 minutes; fiber injected into 220°C inlet and cryotrapped 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: 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



Library results

RT	Score	Formula	MW	Area	CAS #	Name
3.600	94.8	C2H4O2	60.0	140591	64-19-7	Acetic acid
3.900	95.7	C2H8O2Si	92.0	290052	1066-42-8	Silanediol, dimethyl-
4.100	89.9	C5H8O2	100.1	375109	80-62-6	2-Propenoic acid, 2-methyl-, methyl ester
4.700	88.9	C5H10O2	102.1	144569	75-98-9	Propanoic acid, 2,2-dimethyl-
4.900	92.5	C6H18O3Si3	222.1	917272	541-05-9	Cyclotrisiloxane, hexamethyl-
5.300	86.4	C5H8O3	116.0	158583	58653-97-7	2-methyl-2-methoxycarbonyl-oxirane
5.700	84.4	C8H9NO2	151.1	123443	1000222-86-6	Oxime-, methoxy-phenyl-
6.600	96.2	C6H8O2	112.1	295067	20019-64-1	2(5H)-Furanone, 5,5-dimethyl-
6.900	81.0	C11H22O	170.2	600283	999109-47-9	3-(t-Butyl)-4,4-dimethyl-1-penten-3-ol
6.900	81.7	C6H6O	94.0	214030	108-95-2	Phenol
6.900	94.7	C8H24O4Si4	296.1	1801455	556-67-2	Cyclotetrasiloxane, octamethyl-
7.400	97.6	C8H16O	128.1	453343	124-13-0	Octanal
7.500	82.5	C7H7N	105.1	97281	0-00-0	Benzylamine
7.700	95.3	C8H18O	130.1	342099	104-76-7	1-Hexanol, 2-ethyl-
7.800	86.8	C7H8O	108.1	134007	100-51-6	Benzenemethanol
8.800	97.9	C9H18O	142.1	2973326	124-19-6	Nonanal
9.200	94.7	C10H30O5Si5	370.1	9527508	541-02-6	Cyclopentasiloxane, decamethyl-
10.200	96.9	C8H8O3	152.0	1346134	119-36-8	Methyl salicylate
10.300	95.3	C10H20O	156.2	270113	112-31-2	Decanal
10.500	92.3	C8H10O2	138.1	135324	122-99-6	Ethanol, 2-phenoxy-
11.600	95.7	C12H36O6Si6	444.1	9096836	540-97-6	Cyclohexasiloxane, dodecamethyl-

12.400	90.7	C12H24O3	216.2	1645740	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.700	93.9	C12H24O3	216.2	2295160	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
13.000	89.2	C13H28	184.2	109999	17312-82-2	Undecane, 4,6-dimethyl-
14.400	92.5	C14H22O	206.2	591884	96-76-4	Phenol, 2,4-bis(1,1-dimethylethyl)-
15.800	89.2	C16H48O8Si8	592.2	203912	556-68-3	Cyclooctasiloxane, hexadecamethyl-
17.100	84.4	C18H28O2Si3	360.1	457545	17977-72-9	1,1,3,3,5,5-Hexamethyl-1,5-diphenyl-trisiloxane