

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

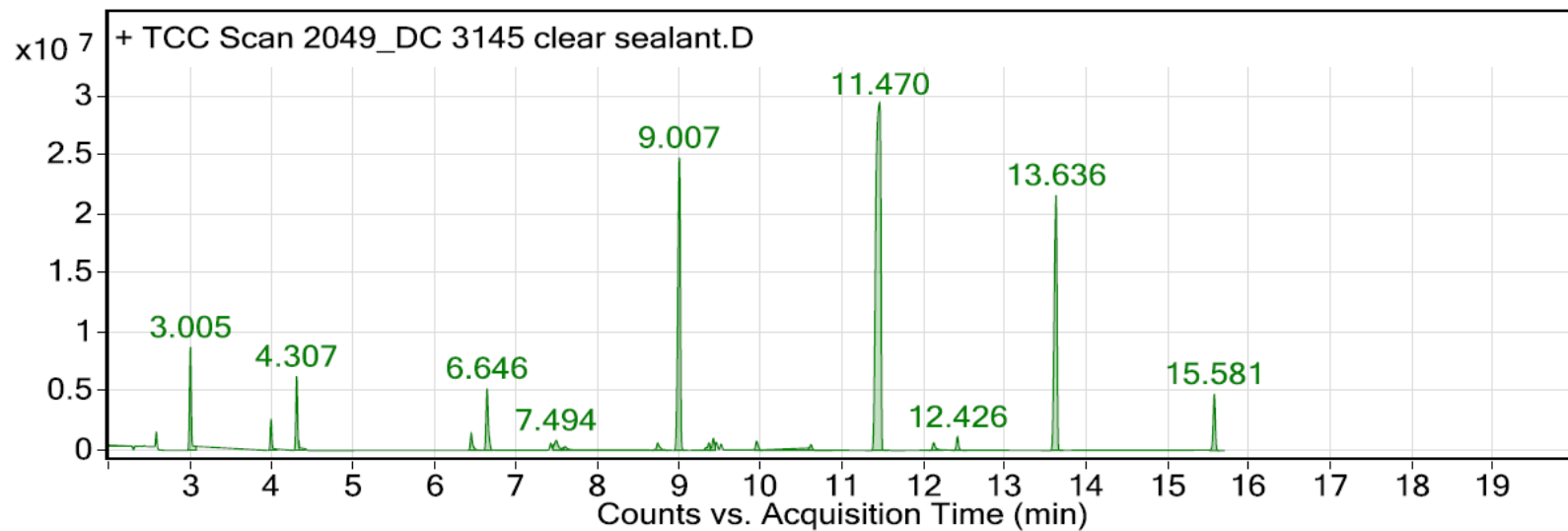
Sample: Dow Corning 3145 clear adhesive

Oddy test result: Temporary

Date GC-MS collected: 12/08/2017

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) ~12.1 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (2) ~12.4 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Library results

RT	Score	Formula	MW	Area	CAS #	Name
2.584	95.0	C3H10OSi	90.1	1420791	1066-40-6	Silanol, trimethyl-
3.003	96.8	C4H10O	74.1	13517005	71-36-3	1-Butanol
4.309	94.8	C6H18O3Si3	222.1	9693583	541-05-9	Cyclotrisiloxane, hexamethyl-
6.648	96.1	C8H24O4Si4	296.1	10186073	556-67-2	Cyclotetrasiloxane, octamethyl-
7.429	96.5	C10H16	136.1	1143032	138-86-3	dl-Limonene
7.498	92.1	C8H18O	130.1	2349042	817-91-4	1-Heptanol, 4-methyl-
7.606	97.5	C8H18O	130.1	1043808	7212-53-5	5-Methyl-1-heptanol
8.743	89.2	C8H18O	130.1	1501045	1653-40-3	1-Heptanol, 6-methyl-
9.009	96.3	C10H30O5Si5	370.1	54491340	541-02-6	Cyclopentasiloxane, decamethyl-
9.373	80.9	C8H16O2	144.1	1258670	1000368-21-4	Acetic acid, 3-methylpentyl ester
9.426	85.7	C10H20O2	172.1	1762627	112-14-1	Acetic acid, octyl ester
9.466	97.6	C12H36O4Si5	384.1	1093180	141-63-9	Pentasiloxane, dodecamethyl-
9.522	88.3	C10H20O2	172.1	888622	112-14-1	Acetic acid, octyl ester
9.959	87.8	C11H20O2	184.1	1567441	2499-59-4	2-Propenoic acid, octyl ester
10.625	82.6	C11H20O2	184.1	1020069	2499-59-4	2-Propenoic acid, octyl ester
11.440	92.9	C29H22P2	432.1	6740274	999699-38-8	3-Diphenylphosphino-4,6-diphenyl-.lamda.(3)-phosphinine
12.133	92.9	C12H24O3	216.2	1698956	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.425	92.7	C12H24O3	216.2	2072282	77-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester
13.634	82.8	C14H42O7Si7	518.1	51116330	107-50-6	Cycloheptasiloxane, tetradecamethyl-
15.578	91.2	C16H48O8Si8	592.2	8571096	556-68-3	Cyclooctasiloxane, hexadecamethyl-