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

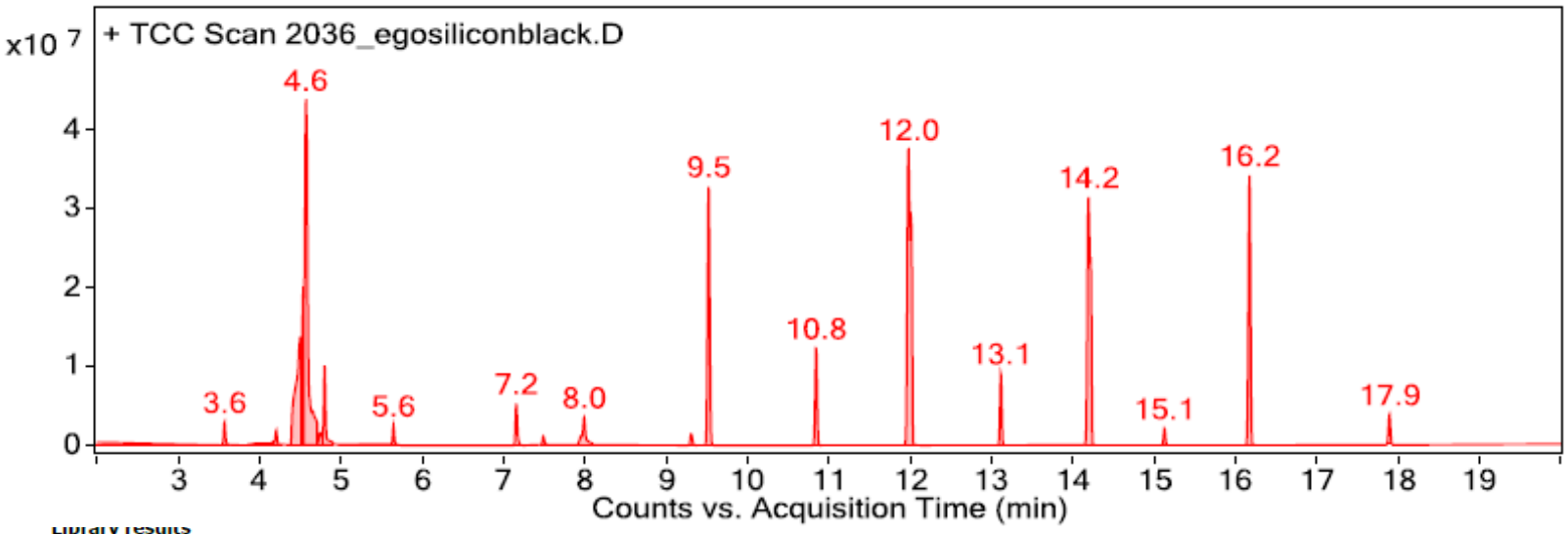
Alkynes – can become reactive when exposed to heat or UV light

Sample: Ego Silicone 460 Black

Oddy test result: Permanent

Date GC-MS collected: 02/09/2018

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.



Library results

RT	Score	Formula	MW	Area	CAS #	Name
1.900	87.4	C2H6O	46.0	6952378	115-10-6	Dimethyl ether
3.600	89.9	C3H7NO	73.1	4575575	127-06-0	2-Propanone, oxime
4.200	95.6	C6H16O2Si	148.1	3367502	78-62-6	Silane, diethoxydimethyl-
4.500	85.9	C4H9NO	87.1	14015837	96-29-7	2-Butanone, oxime
4.600	97.2	C5H11NO2	117.1	162152323	7529-22-8	Morpholine, 4-methyl-, 4-oxide
4.700	94.7	C4H9NO	87.1	3225123	110-91-8	Morpholine
4.800	93.4	C6H18O3Si3	222.1	14782847	541-05-9	Cyclotrisiloxane, hexamethyl-
5.600	96.4	C7H18O3Si	178.1	3748675	2031-67-6	Silane, triethoxymethyl-
7.200	95.9	C8H24O4Si4	296.1	8857134	556-67-2	Cyclotetrasiloxane, octamethyl-
7.500	95.8	C10H22	142.2	1879364	124-18-5	Decane
8.000	92.9	C8H18O	130.1	3707542	104-76-7	1-Hexanol, 2-ethyl-
8.000	97.4	C10H16	136.1	5892425	138-86-3	dl-Limonene
9.300	90.8	C10H28O4Si3	296.1	2533072	3555-45-1	Silicic acid, diethyl bis(trimethylsilyl) ester
9.500	96.1	C10H30O5Si5	370.1	61510300	541-02-6	Cyclopentasiloxane, decamethyl-
10.800	97.4	C12H36O4Si5	384.1	21014626	141-63-9	Pentasiloxane, dodecamethyl-
12.000	95.9	C12H36O6Si6	444.1	111936670	540-97-6	Cyclohexasiloxane, dodecamethyl-
12.000	87.6	C28H31NO3	429.2	5048316	999695-89-1	(E)-3-[1-(1,2-Dimethyl-3-indolyl)-2-methylpropylidene]-4-adamantylidenedihyd...
13.100	94.2	C14H42O5Si6	458.2	14399365	107-52-8	Hexasiloxane, tetradecamethyl-
14.200	82.4	C14H42O7Si7	518.1	93373286	107-50-6	Cycloheptasiloxane, tetradecamethyl-
15.100	88.2	C16H48O6Si7	532.2	3349362	541-01-5	Heptasiloxane, hexadecamethyl-
16.200	87.9	C16H48O8Si8	592.2	62251159	556-68-3	Cyclooctasiloxane, hexadecamethyl-
17.900	84.9	C18H54O9Si9	666.2	6729470	556-71-8	Cyclononasiloxane, octadecamethyl-
21.200	85.2	C30H50	410.4	20329270	111-02-4	Squalene