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

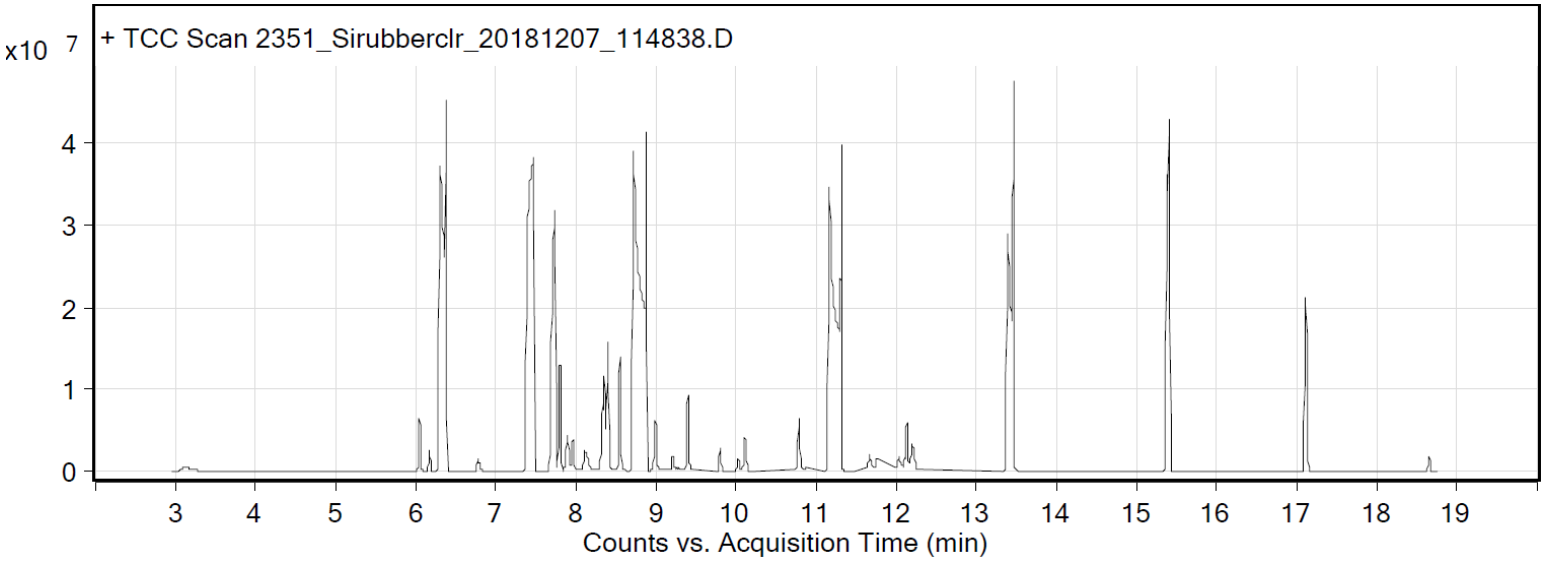
Alkynes – can become reactive when exposed to heat or UV light

Sample: McMaster Carr Food grade high temperature silicone rubber sheeting, catalog 5827T21

Oddy test result: temporary

Date collected: 12/7/2018

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 cryo-trapped for 2 min at -15°C; GC ramped from 35°C to 250 °C at 10°C/min. Data analyzed in Masshunter Qualitative Analysis. Deconvoluted data with > 85% match with a NIST 17.0 or Wiley 9 library are reported.



Compound Table

RT	Score (Lib)	Area	Name	Formula
3.12	89.04	5275425	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
6.04	97.5	9291029	.alpha.-Methylstyrene	C9H10
6.17	94.25	4083057	Heptane, 2,2,4,6,6-pentamethyl-	C12H26
6.37	87.82	8140029	(R)-4-(1-ethoxyethoxy)-3-fluoro-4-methyl-1-pentanol acetate	C12H23FO4
6.78	89.51	3540447	1-Hexanol, 2-ethyl-	C8H18O
7.89	89.81	5215109	Undecane	C11H24
7.96	97	3978469	Nonanal	C9H18O
8.13	85.66	5168891	(S)-(+)-6-Methyl-1-octanol	C9H20O
8.33	85.25	18907708	1-Nonanol	C9H20O
8.4	89.69	26082964	1-Nonanol	C9H20O
8.54	95.62	23266245	(S)-(+)-6-Methyl-1-octanol	C9H20O
8.72	95.58	269137652	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
8.88	91.57	15606460	Tri-o-trimethylsilyl, N-trifluoroacetyl derivative of Terbutaline	C23H42F3NO4Si3
8.99	97.48	12010317	1-Nonanol	C9H20O
9.4	95.35	14191925	Dodecane	C12H26
9.8	94.93	4722069	Benzothiazole	C7H5NS
10.78	93.17	11390834	Tridecane	C13H28
11.16	96.35	212288189	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
12.13	95.36	9065180	Tetradecane	C14H30
15.38	88.76	98000498	Cyclooctasiloxane, hexadecamethyl-	C16H48O8Si8
17.11	87.52	43665130	Cyclononasiloxane, octadecamethyl-	C18H54O9Si9