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

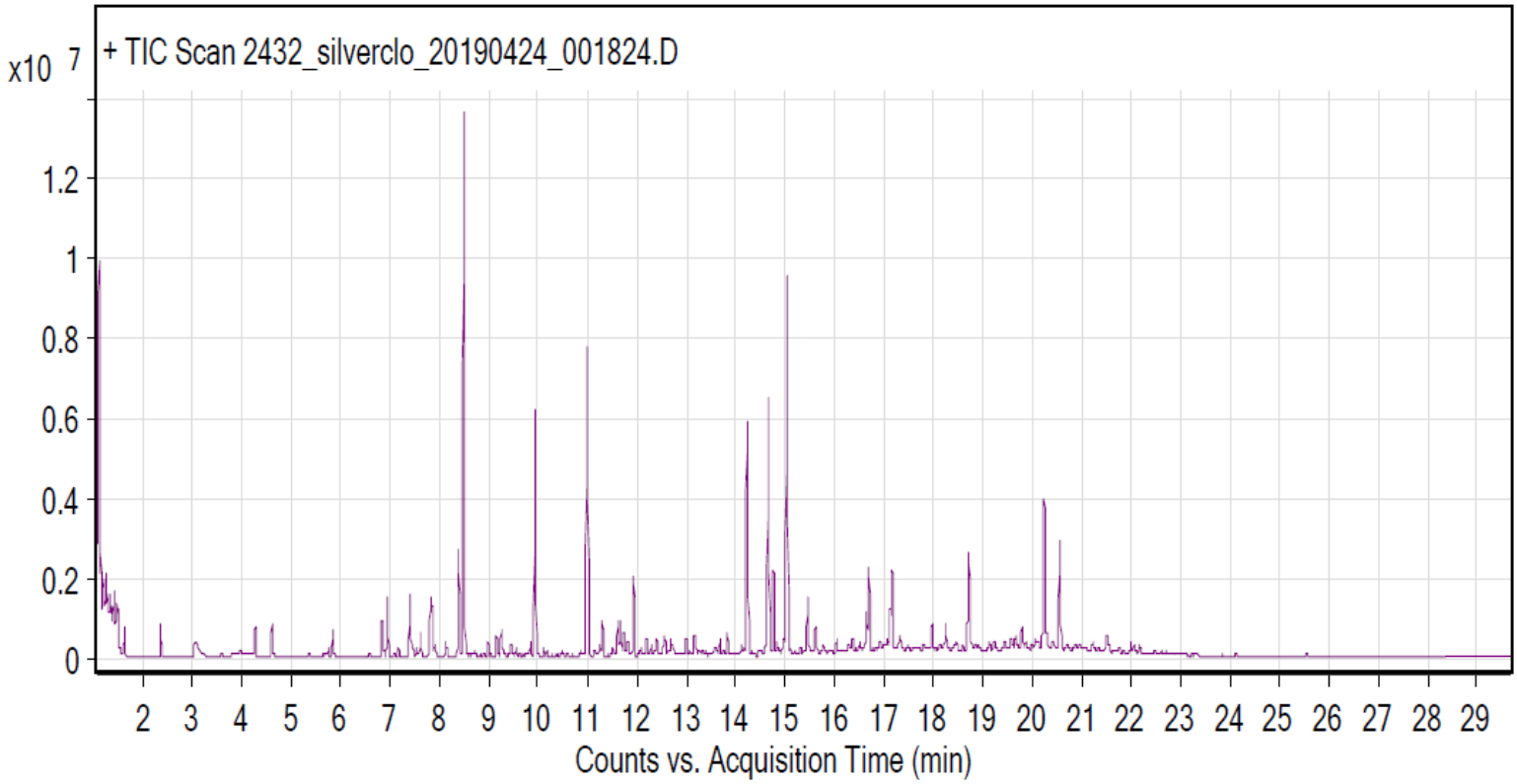
Sulfur-containing compounds – known to tarnish and corrode some metals

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: Gaylord Pacific Silvercloth
Date collected: 4/24/2019
Oddy test result: Temporary
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 35°C to 225 °C at 7.5°C/min. Data analyzed in masshunter Qualitative. Samples > 90% match with a NIST 17.0 library are reported. VOCs not highlighted are because they were also observed in blanks: (1) 15.0 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name
3.07	93	2439183	Hexanal
3.98	91.66	625696	2-Furancarboxaldehyde
4.61	95.2	1333657	2-Pentanone, 4-hydroxy-4-methyl-
5.84	95.74	1003507	Ethanol, 2-butoxy-
6.84	94.66	1546314	Hexanal, 2-ethyl-
6.95	98.13	2380584	N-benzylidene-dimethylammonium chloride
7.4	95.67	2326208	Phenol
7.46	90.66	886180	Hexanoic acid
7.62	92.08	815440	Furan, 2-pentyl-
7.85	92.95	1806106	Octanal
8.13	97.81	821047	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
8.38	95.28	2523387	dl-Limonene
8.39	96.15	3132255	1-Hexanol, 2-ethyl-
8.5	96.46	26559665	Benzyl alcohol
9.15	94.39	803078	Ethanone, 1-phenyl-
9.25	94.53	1148485	1-Octanol
9.94	96.77	11019943	Nonanal
10.99	90.74	13511886	Cyclopentasiloxane, decamethyl-
11.3	93.39	1407706	Cyclohexanol, 5-methyl-2-(1-methylethyl)-
11.61	90.39	1543738	Ethanol, 2-(2-butoxyethoxy)-
11.73	91.67	761314	Benzoic acid, 2-hydroxy-, methyl ester

11.93	97.01	3487900	Decanal
12.4	90.61	782247	2-Propenoic acid, 2-ethylhexyl ester
13.16	93.89	812837	1-Decanol
13.68	95.89	671532	Tetradecane
15.04	94.63	19013350	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
15.45	94.39	2511936	Eicosane
15.61	93.5	1229795	Dodecanal
17.12	93.18	1999918	Tridecane