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

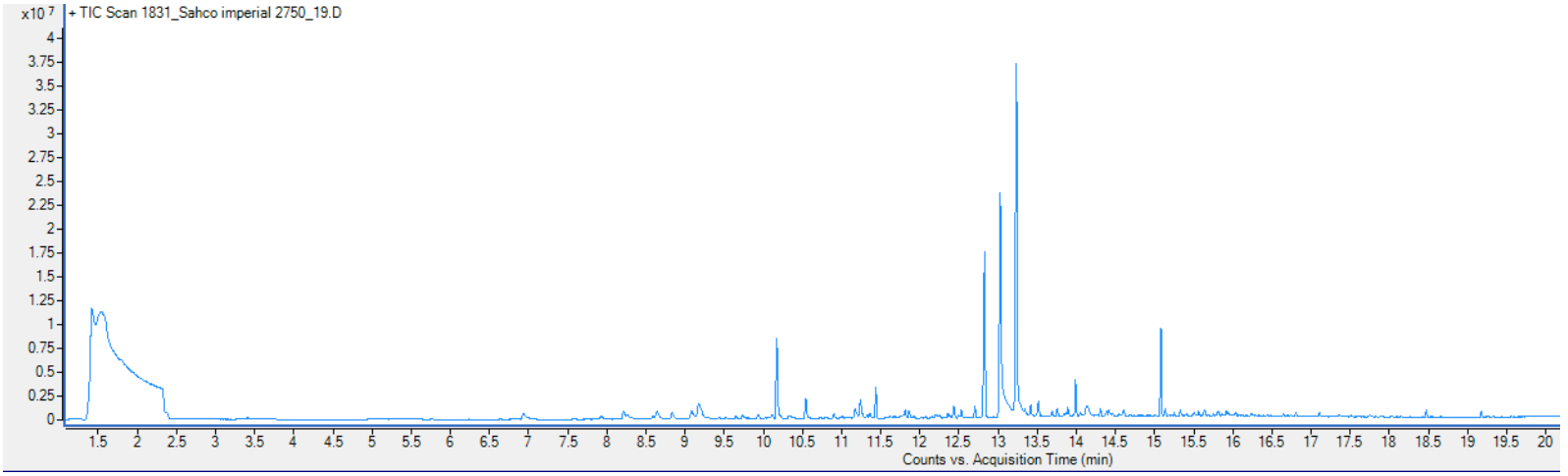
Sample: Sahco Imperial fabric; beige

Oddy test result: Temporary

Date collected: 09/20/2017

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 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) 13.2 min: 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester propanoic acid



Library results

RT	Score	Formula	MW	Area	CAS #	Name
1.423	84.8	O2	32.0	22833781	7782-44-7	Oxygen
1.526	88.0	O2	32.0	96496626	7782-44-7	Oxygen
3.411	90.5	C2H8O2Si	92.0	2372905	1066-42-8	Silanediol, dimethyl-
6.934	92.9	C6H14O2	118.1	2056118	111-76-2	Ethanol, 2-butoxy-
7.926	98.7	C7H6O	106.0	1021272	100-52-7	Benzaldehyde
8.214	94.0	C6H6O	94.0	2053391	108-95-2	Phenol
8.636	85.0	C8H16O	128.1	1276447	124-13-0	Octanal
8.650	81.0	C6H14O3	134.1	1073450	111-90-0	Ethanol, 2-(2-ethoxyethoxy)-
8.832	91.3	C7H16O3	148.1	1496624	20324-32-7	2-Propanol, 1-(2-methoxy-1-methylethoxy)-
9.175	96.0	C7H8O	108.1	5058333	100-51-6	Benzyl alcohol
10.173	97.7	C9H18O	142.1	11433867	124-19-6	Nonanal
10.541	89.0	C10H30O5Si5	370.1	2224932	541-02-6	Cyclopentasiloxane, decamethyl-
11.174	98.0	C10H20O	156.2	2564405	15356-70-4	Cyclohexanol, 5-methyl-2-(1-methylethyl)-, (1.alpha.,2.beta.,5.alpha.)-(.+/-.)-
11.238	93.8	C8H18O3	162.1	3011051	112-34-5	Ethanol, 2-(2-butoxyethoxy)-
11.438	98.2	C10H20O	156.2	3708816	112-31-2	Decanal
11.814	86.3	C10H22O3	190.2	1173712	29911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-
11.862	85.5	C10H22O3	190.2	1100394	29911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-
12.431	92.8	C12H36O6Si6	444.1	1188327	540-97-6	Cyclohexasiloxane, dodecamethyl-
12.706	84.8	C16H34	226.3	1227093	4390-04-9	Nonane, 2,2,4,4,6,8,8-heptamethyl-
12.827	90.6	C7H12O5	176.1	20260034	102-62-5	Glycerol 1,2-diacetate
13.025	86.6	C16H30O4	286.2	42824181	6846-50-0	2,2,4-Trimethyl-1,3-pentanediol diisobutyrate
13.236	92.7	C12H24O3	216.2	54002324	77-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester
13.417	95.3	C14H30	198.2	1294301	629-59-4	Tetradecane
13.514	97.1	C12H24O	184.2	1895345	112-54-9	Dodecanal
14.131	95.6	C12H26O	186.2	3442934	112-53-8	1-Dodecanol
14.414	95.4	C13H26O	198.2	987315	10486-19-8	Tridecanal
15.080	85.9	C16H30O4	286.2	8217055	6846-50-0	2,2,4-Trimethyl-1,3-pentanediol diisobutyrate