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

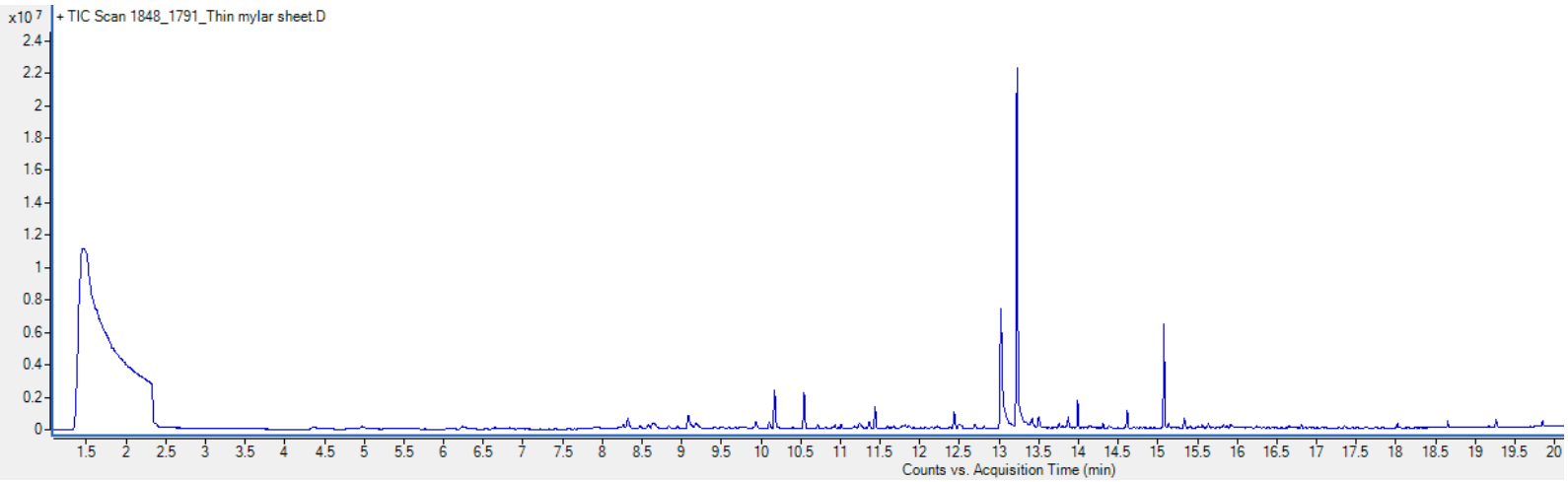
Sample: Mylar sheeting

Oddy test result: Permanent

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) 13.0 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester propanoic acid; (2) 13.2 min: 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester propanoic acid



Library results

RT	Score	Formula	MW	Area	CAS #	Name
4.360	96.3	C7H8	92.1	721852	108-88-3	Benzene, methyl-
6.241	96.4	C8H10	106.1	752932	95-47-6	o-Xylene
8.324	96.5	C8H14O	126.1	1217792	110-93-0	6-Methyl-5-hepten-2-one
8.635	95.1	C8H16O	128.1	713417	124-13-0	Octanal
9.084	90.2	C10H16	136.1	1915701	138-86-3	dl-Limonene
9.179	95.1	C7H8O	108.1	842568	100-51-6	Benzyl Alcohol
10.172	98.4	C9H18O	142.1	3132992	124-19-6	Nonanal
10.542	92.9	C10H30O5Si5	370.1	2288437	541-02-6	Cyclopentasiloxane, decamethyl-
11.439	98.3	C10H20O	156.2	1528198	112-31-2	Decanal
12.432	93.5	C12H36O6Si6	444.1	907091	540-97-6	Cyclohexasiloxane, dodecamethyl-
13.020	91.3	C12H24O3	216.2	15703477	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
13.226	94.1	C12H24O3	216.2	28452112	77-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester
13.498	92.3	C14H26O2	226.2	808039	126-86-3	2,4,7,9-Tetramethyl-5-decyn-4,7-diol
13.874	82.6	C13H22O	194.2	704247	3796-70-1	5,9-Undecadien-2-one, 6,10-dimethyl-, (E)-
14.614	85.2	C16H48O6Si7	532.2	972117	541-01-5	Heptasiloxane, hexadecamethyl-
15.080	92.7	C16H30O4	286.2	3979230	74381-40-1	Propanoic acid, 2-methyl-, 1-(1,1-dimethylethyl)-2-methyl-1,3-propanediyl ester