

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

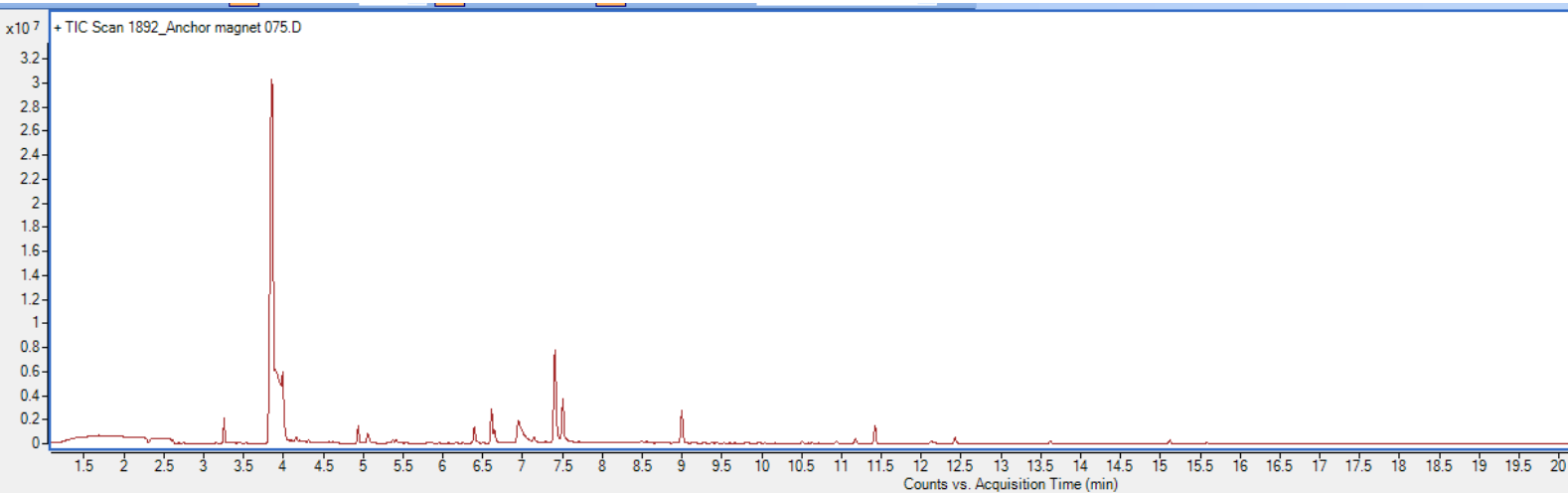
Sample: Anchor Magnetic sheet 0.75mm white gloss sheet

Oddy test result: Permanent

Date collected: 12/11/2017

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



Library results

RT	Score	Formula	MW	Area	CAS #	Name
3.258	97.1	C3H6Cl2	112.0	2334899	78-87-5	Propane, 1,2-dichloro-
3.993	97.4	C3H7NO	73.1	3954353	68-12-2	Formamide, N,N-dimethyl-
4.160	92.9	C8H18	114.1	938085	111-65-9	Octane
4.937	99.7	C8H10	106.1	2009751	100-41-4	Ethylbenzene
5.057	98.3	C8H10	106.1	1737227	95-47-6	o-Xylene
6.394	98.9	C7H6O	106.0	2342923	100-52-7	Benzaldehyde
6.611	98.4	C6H6O	94.0	4906308	108-95-2	Phenol
6.650	96.0	C8H24O4Si4	296.1	1234240	556-67-2	Cyclotetrasiloxane, octamethyl-
6.945	95.3	C7H8O	108.1	9847876	100-51-6	Benzyl Alcohol
7.144	96.8	C8H17Cl	148.1	695181	999062-61-7	3-CHLOROMETHYLHEPTANE
7.404	98.2	C8H18O	130.1	16836720	104-76-7	1-Hexanol, 2-ethyl-
7.504	97.4	C7H8O	108.1	6124854	100-51-6	Benzyl Alcohol
8.995	91.9	C10H30O5Si5	370.1	4108034	541-02-6	Cyclopentasiloxane, decamethyl-
11.420	91.5	C12H36O6Si6	444.1	2166638	540-97-6	Cyclohexasiloxane, dodecamethyl-
12.422	93.6	C12H24O3	216.2	850834	77-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester