

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

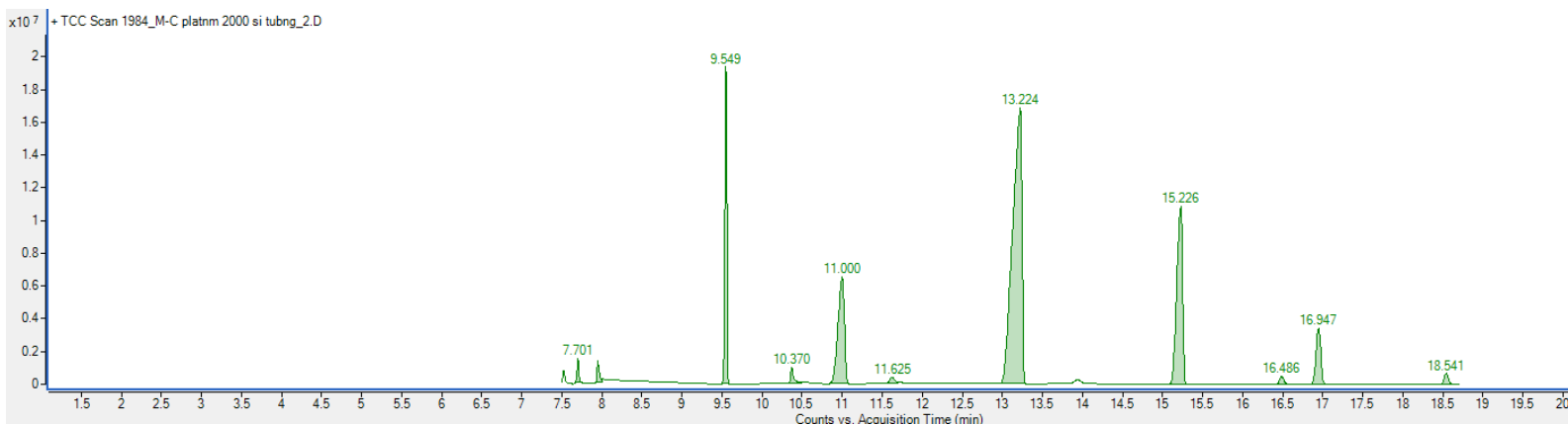
Sample: McMaster-Carr platinum cured silicone tubing 0.40 ID x 0.085 OD

Oddy test result: Temporary

Date collected: 01/08/2018

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



Library results

RT	Score	Formula	MW	Area	CAS #	Name
7.523	96.8	C7H16O3	148.1	1660908	0-00-0	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
7.700	96.7	C7H16O3	148.1	3026037	0-00-0	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
7.951	97.9	C8H18O	130.1	3103824	104-76-7	1-Hexanol, 2-ethyl-
9.550	95.8	C10H30O5Si5	370.1	35052455	541-02-6	Cyclopentasiloxane, decamethyl-
10.371	94.8	C8H18O3	162.1	2412234	112-34-5	Ethanol, 2-(2-butoxyethoxy)-
10.999	92.5	C10H30O5Si5	370.1	36594650	541-02-6	Cyclopentasiloxane, decamethyl-
11.624	96.0	C8H18O3	162.1	1919107	112-34-5	Ethanol, 2-(2-butoxyethoxy)-
13.223	95.9	C12H36O6Si6	444.1	132699777	540-97-6	Cyclohexasiloxane, dodecamethyl-
13.936	92.1	C12H24O3	216.2	1497171	77-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester
16.485	91.7	C16H30O4	286.2	1705823	6846-50-0	PENTAN-1,3-DIOLDIISOBUTYRATE, 2,2,4-TRIMETHYL-
16.947	90.4	C16H48O8Si8	592.2	14004142	556-68-3	Cyclooctasiloxane, hexadecamethyl-
18.540	83.9	C18H54O9Si9	666.2	2386266	556-71-8	OCTADECAMETHYLCYCLONONASILOXANE