

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

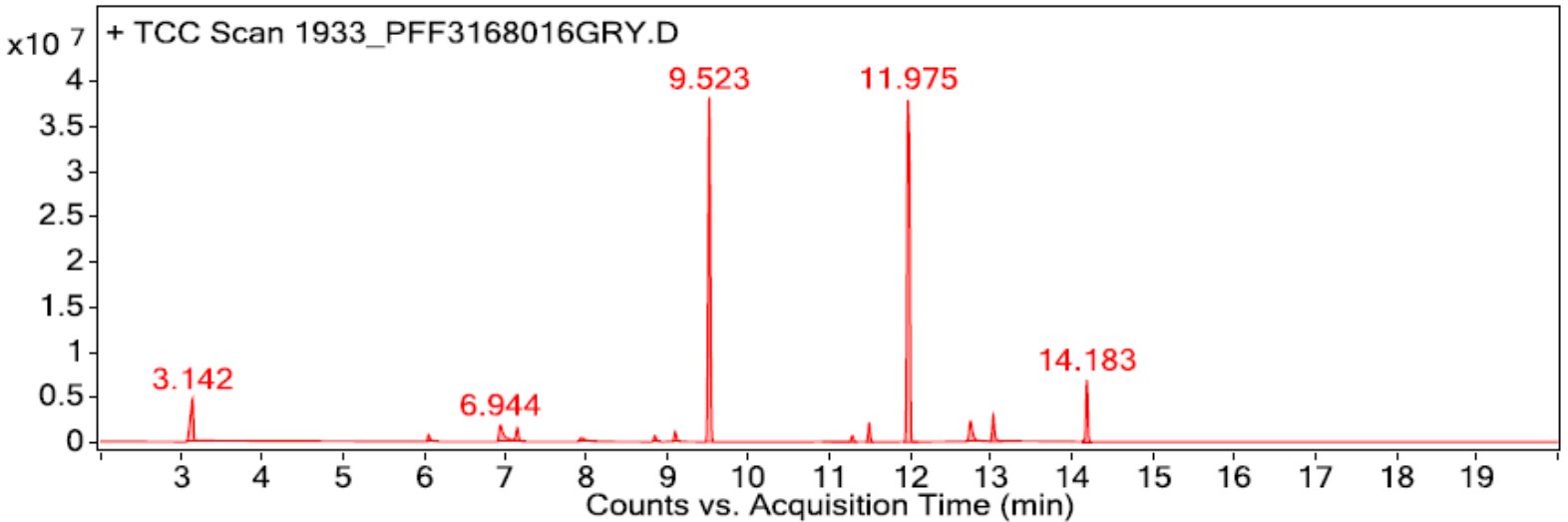
Sample: Pierre Frey F3168016 gray fabric

Oddy test result: Temporary

Date collected: 02/09/2018

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



Library results

RT	Score	Formula	MW	Area	CAS #	Name
3.140	98.0	C2H4O2	60.0	12864416	64-19-7	Acetic acid
6.055	97.0	C6H14O2	118.1	1849192	111-76-2	Ethanol, 2-butoxy-
6.942	96.6	C4H10O3	106.1	8078417	111-46-6	Ethanol, 2,2'-oxybis-
7.155	95.4	C8H24O4Si4	296.1	1805388	556-67-2	Cyclotetrasiloxane, octamethyl-
7.943	96.4	C8H18O	130.1	2346302	104-76-7	1-Hexanol, 2-ethyl-
8.849	92.1	C9H12O	136.1	1397911	617-94-7	Benzenemethanol, .alpha.,.alpha.-dimethyl-
9.100	97.8	C9H18O	142.1	2034599	124-19-6	Nonanal
9.521	96.4	C10H30O5Si5	370.1	74387011	541-02-6	Cyclopentasiloxane, decamethyl-
11.287	87.4	C12H24O2	200.2	1169896	7434-89-1	Hexanoic acid, 2-ethyl-, 2-methylpropyl ester
11.976	96.0	C12H36O6Si6	444.1	94008625	540-97-6	Cyclohexasiloxane, dodecamethyl-
12.746	90.6	C12H24O3	216.2	6988016	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
13.028	93.4	C12H24O3	216.2	5801330	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
14.183	80.5	C14H42O7Si7	518.1	11159737	107-50-6	Cycloheptasiloxane, tetradecamethyl-