

**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

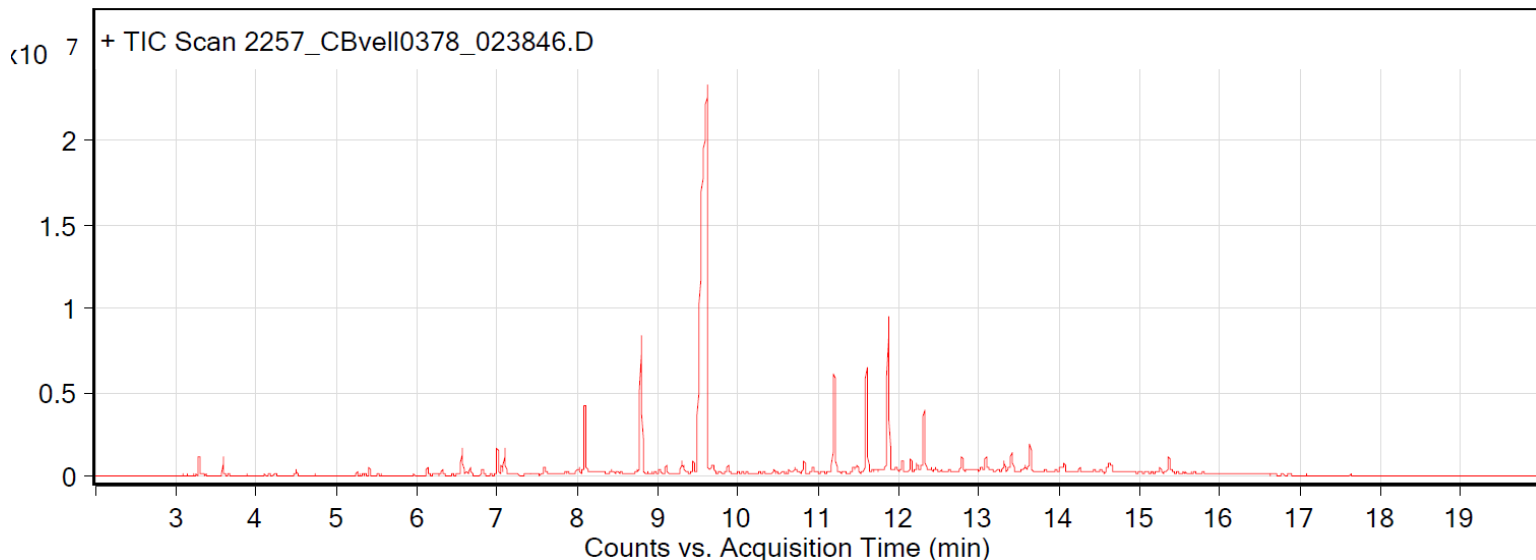
Sample: Creation Baumann Velling 0378 cotton velvet fabric

Oddy test result: Temporary

Date collected: 8/18/2018

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 cryo-trapped for 2 min at -15°C; GC ramped from 35°C to 250 °C at 10°C/min. Data analyzed in Masshunter Qualitative Analysis. Deconvoluted data with > 85% match with a NIST 17.0 or Wiley 9 library are reported.

VOCs not highlighted are because they were also observed in blanks: (1) 11.6 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester propanoic acid; (3) 11.9 min: 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name	Formula
6.56	96.23	2072909	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
7	95.32	2151189	1-Hexanol, 2-ethyl-	C8H18O
7.09	94.44	2207241	Benzyl Alcohol	C7H8O
8.09	97	6106113	Nonanal	C9H18O
8.79	94.71	12614034	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
9.44	95.82	1223018	Dodecane	C12H26
9.55	85.21	7513149	Decanal	C10H20O
10.82	94.2	1165491	Tridecane	C13H28
11.2	95.64	9498400	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.6	89.82	9316227	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
11.87	93.72	14528480	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	C12H24O3
12.05	94.47	1146377	1-Tetradecene	C14H28
12.15	94.54	1197733	Tetradecane	C14H30
12.79	88.67	1599662	1-Tetradecanol	C14H30O
13.64	97.22	2266239	Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-	C15H24O
14.63	87.35	1138728	Propanoic acid, 2-methyl-, 1-(1,1-dimethylethyl)-2-methyl-1,3-propanediyl ester	C16H30O4
15.37	87.39	1502679	2,5-Cyclohexadiene-1,4-dione, 2,5-bis(1,1-dimethylpropyl)-	C16H24O2