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

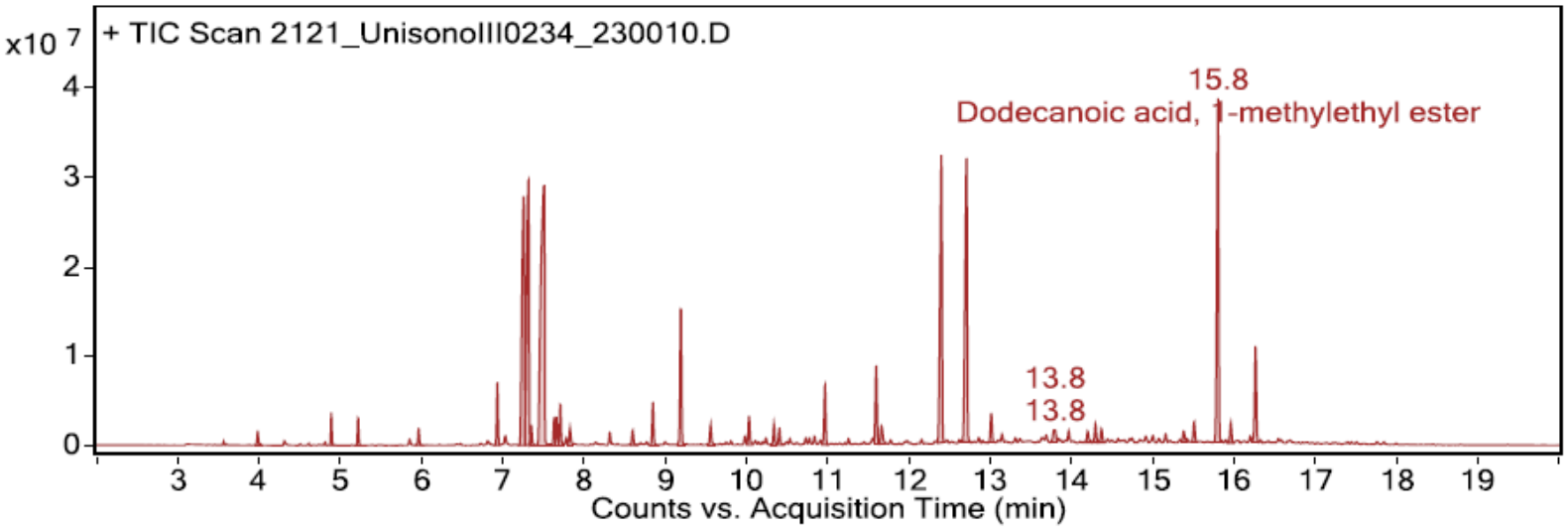
Sample: Creation Baumann Unisono III 0234 gray cotton fabric

Oddy test result: Temporary

Date collected: 04/18/2018

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 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) 5.7 min: methoxyphenyl oxime; (2) 12.4 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (3) 12.7 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Library results

RT	Score	Formula	MW	Area	CAS #	Name
4.000	88.7	C2H8O2Si	92.0	1920081	1066-42-8	Silanediol, dimethyl-
4.900	97.6	C6H18O3Si3	222.1	3178935	541-05-9	Cyclotrisiloxane, hexamethyl-
5.200	95.7	C6H12O2	116.1	3266730	123-42-2	2-Pentanone, 4-hydroxy-4-methyl-
6.000	93.9	C6H14O2	118.1	2223926	111-76-2	Ethanol, 2-butoxy-
6.900	98.7	C8H24O4Si4	296.1	8156226	556-67-2	Cyclotetrasiloxane, octamethyl-
7.300	98.0	C7H16O3	148.1	62330122	0-00-0	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
7.300	98.3	C7H16O3	148.1	57352969	0-00-0	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
7.400	86.3	C7H16O3	148.1	2595798	55956-21-3	1-Propanol, 2-(2-methoxy-1-methylethoxy)-
7.500	92.6	C7H16O3	148.1	93754454	20324-32-7	2-Propanol, 1-(2-methoxy-1-methylethoxy)-
7.600	95.0	C7H16O3	148.1	3596670	13588-28-8	1-Propanol, 2-(2-methoxypropoxy)-
7.700	94.2	C7H16O3	148.1	3719983	13588-28-8	1-Propanol, 2-(2-methoxypropoxy)-
7.700	97.0	C8H18O	130.1	5700119	104-76-7	1-Hexanol, 2-ethyl-
7.800	85.2	C7H8O	108.1	2700190	100-51-6	Benzyl alcohol
8.900	95.0	C9H18O	142.1	6160702	124-19-6	Nonanal
9.200	97.6	C10H30O5Si5	370.1	20821263	541-02-6	Cyclopentasiloxane, decamethyl-
9.600	95.0	C8H18O2	146.1	3166232	144-19-4	1,3-Pentanediol, 2,2,4-trimethyl-
10.000	95.0	C8H18O3	162.1	4472889	54446-78-5	Ethanol, 1-(2-butoxyethoxy)-
10.300	86.9	C10H20O	156.2	3072431	112-31-2	Decanal
11.000	96.9	C12H24O2	200.2	9149530	7434-89-1	Hexanoic acid, 2-ethyl-, 2-methylpropyl ester
11.600	95.3	C12H36O6Si6	444.1	12509176	540-97-6	Cyclohexasiloxane, dodecamethyl-
12.400	89.7	C12H24O3	216.2	56892465	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.700	97.5	C12H24O3	216.2	59388124	77-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester
13.000	96.6	C14H30	198.2	4816051	629-59-4	Tetradecane
14.200	88.1	C17H36O	256.3	2113280	2490-48-4	1-Hexadecanol, 2-methyl-
14.300	92.7	C15H32	212.3	3028977	629-62-9	Pentadecane
15.500	91.9	C16H34	226.3	3479156	544-76-3	Hexadecane
15.800	98.7	C15H30O2	242.2	60898052	10233-13-3	Dodecanoic acid, 1-methylethyl ester
16.000	91.0	C13H10O	182.1	3178779	119-61-9	Benzophenone
16.300	91.0	C16H24O2	248.2	15788451	4584-63-8	2,5-Cyclohexadiene-1,4-dione, 2,5-bis(1,1-dimethylpropyl)-