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

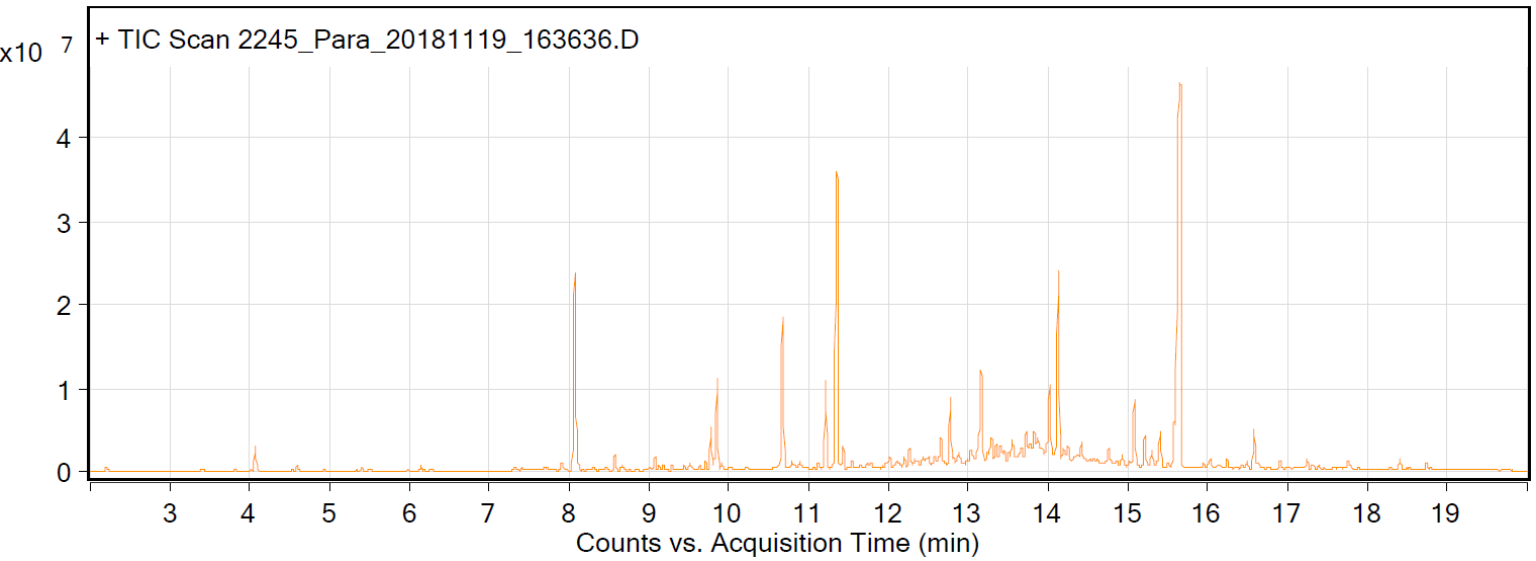
Halogenated compounds – can become reactive with exposure to heat and UV light

Nitrogen-containing, not amine – can react with other off-gassed chemicals

Alkynes – can become reactive when exposed to heat or UV light

Sample: MGK: Paramex Long Lasting Insecticidal Net
Oddy test result: Temporary
Date collected:
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)13.8 min: 2-methyl-, 3-hydroxyl-2,2,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name	Formula
0.22	88	1913368	Oxygen	O2
4.06	98.1	4795155	Octane	C8H18
4.59	93.3	1182956	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
6.14	97.75	1016108	Nonane	C9H20
7.9	95.91	1400507	1-Decene	C10H20
8.07	96.98	37664003	Decane	C10H22
8.09	95.93	7193729	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
8.12	95.22	855605	Octanal	C8H16O
8.3	87.72	799914	Undecane, 4,6-dimethyl-	C13H28
8.66	97.35	896207	Benzyl Alcohol	C7H8O
9.01	85.28	804060	Octane, 2,6-dimethyl-	C10H22
9.07	93.61	2844102	Undecane, 4,7-dimethyl-	C13H28
9.12	92.19	931248	Nonane, 2,3-dimethyl-	C11H24
9.18	93.25	1177353	Octane, 2,3,3-trimethyl-	C11H24
9.51	87.17	1496642	1-Nonene, 4,6,8-trimethyl-	C12H24
9.64	94.46	830585	1-Undecene	C11H22
9.71	91.1	1601142	Benzoic acid, methyl ester	C8H8O2
9.78	97.59	8028166	Undecane	C11H24
9.85	98.1	16897831	Nonanal	C9H18O
9.91	92.55	1480989	Dodecane, 4,6-dimethyl-	C14H30
10.67	95.02	29084513	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
10.79	90	1975800	Undecane, 2-methyl-	C12H26
10.89	89.22	1963391	Undecane, 3-methyl-	C12H26
11.21	97.25	17020360	1-Dodecene	C12H24
11.36	96.46	76259274	Dodecane	C12H26
11.43	95.96	4049644	Decanal	C10H20O
11.55	91.62	1687198	Undecane, 2,6-dimethyl-	C13H28
12.2	93.77	2129631	Dodecane, 4-methyl-	C13H28
12.26	93.74	4258706	Dodecane, 2-methyl-	C13H28
12.37	89.41	1006919	1-Decanol	C10H22O
12.51	88.42	2687816	Undecane, 3,8-dimethyl-	C13H28

12.62	87.52	1222222	(R,R)-3,8-Dimethyldecane	C12H26
12.66	91.99	7839691	Decyl heptyl ether	C17H36O
12.77	95.91	14398260	Tridecane	C13H28
13.13	90.96	9241782	Nonane, 2,2,4,4,6,8,8-heptamethyl-	C16H34
13.16	96.08	16603803	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
13.29	89.71	9816022	Undecane, 5,5-dimethyl-	C13H28
13.35	87.42	5466162	Dodecane, 2,6,11-trimethyl-	C15H32
13.41	88.56	5095350	Decane, 2,5,9-trimethyl-	C13H28
13.5	89.98	2864676	Undecane, 4,4-dimethyl-	C13H28
13.66	88.06	6684318	Pentadecane	C15H32
13.72	91.42	8263503	Nonane, 2,2,4,4,6,8,8-heptamethyl-	C16H34
13.82	90.27	7213326	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	C12H24O3
13.87	87.68	8690407	Sulfurous acid, 2-ethylhexyl undecyl ester	C19H40O3S
14.02	95.46	24070788	1-Tetradecene	C14H28
14.13	95.67	42863136	Tetradecane	C14H30
14.19	89.57	6399346	Tridecane, 6-methyl-	C14H30
14.25	87.02	3579110	Dodecanal	C12H24O
14.62	89.6	2571333	Dodecane, 2,6,11-trimethyl-	C15H32
14.76	91.53	6161248	1-Tetradecanol	C14H30O
14.93	91.13	2736172	Tetradecane, 2-methyl-	C15H32
15.08	91.34	12756094	2,6-di(t-butyl)-4-hydroxy-4-methyl-2,5-cyclohexadien-1-one	C15H24O2
15.21	92.68	5222603	2,6-DI-T-BUTYL-4-METHYLENE-2,5-CYCLOHEXADIENE-1-ONE	C15H22O
15.3	95.84	3751322	1-Pentadecene	C15H30
15.49	92.8	798846	Benzene, 1-methyl-3-phenoxy-	C13H12O
16.04	87.13	1477051	n-Nonylcyclohexane	C15H30
16.24	92.03	1526460	Pentadecane, 3-methyl-	C16H34
16.5	95.83	1238809	1-Hexadecene	C16H32
16.58	92.22	7843949	Hexadecane	C16H34
16.9	95.42	1528446	Dodecanoic acid, 1-methylethyl ester	C15H30O2
17.24	88.76	1746249	Cyclohexadecane	C16H32
17.32	90.45	1188422	Decyl octyl ether	C18H38O
17.76	96.73	1491933	Benzaldehyde, 3-phenoxy-	C13H10O2
18.4	90.16	2002017	3-Phenoxybenzyl chloride	C13H11ClO
18.74	92.71	1284989	Benzenemethanol, 3-phenoxy-	C13H12O2