

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

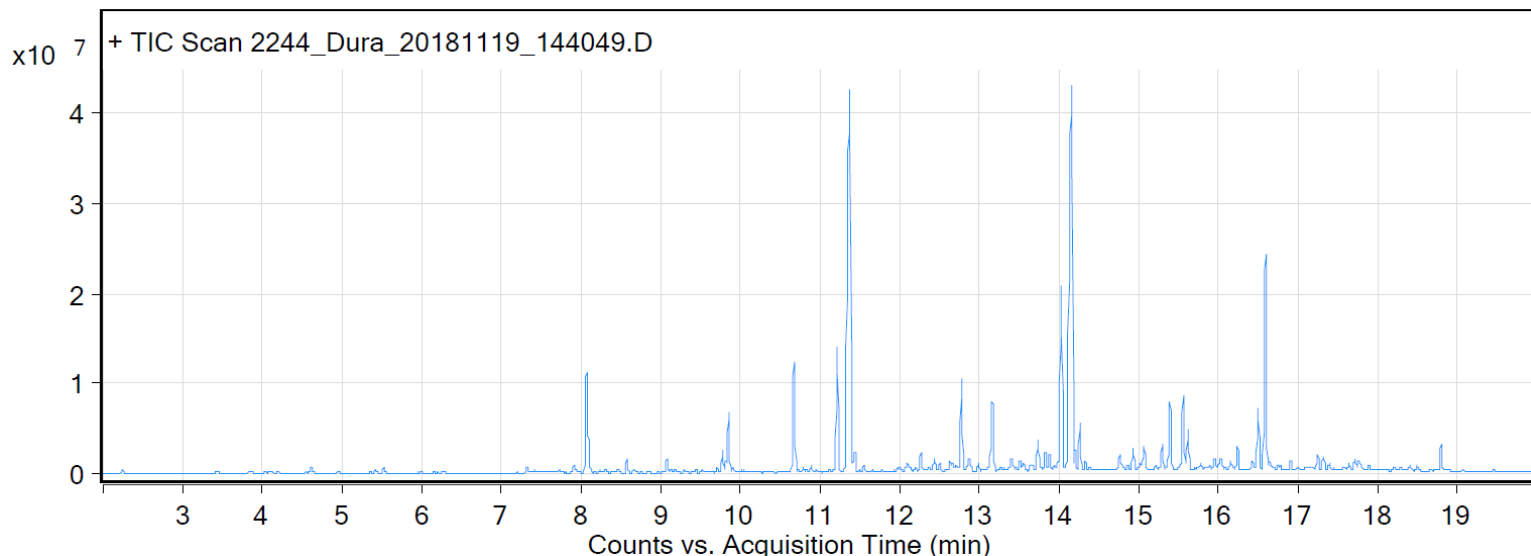
Sample: Shobikaa Impex Private Limited: Long Lasting insecticidal net

Oddy test result: unsuitable

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) 13.5 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (2) 13.8 min: 2-methyl-, 3-hydroxyl-2,2,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name	Formula
8.07	97.27	16431292	Decane	C10H22
8.09	96.19	5365166	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
9.08	94.1	2462219	Undecane, 4,7-dimethyl-	C13H28
9.78	97.75	3707813	Undecane	C11H24
9.82	91.61	1343991	Dodecane	C12H26
9.85	98.17	10151263	Nonanal	C9H18O
10.67	95.41	19191787	Cyclopentasiloxane, decamethyl-	C10H30O5Si5
10.89	96.03	1286284	Undecane, 3-methyl-	C12H26
11.21	97.48	23525802	1-Dodecene	C12H24
11.37	96.45	119509584	Dodecane	C12H26
11.39	88.61	1414382	4-Octanone	C8H16O
11.55	89.64	1258514	Dodecyl octyl ether	C20H42O
12.09	89.77	2013781	Decane, 5,6-dipropyl-	C16H34
12.26	94.47	3562445	Dodecane, 2-methyl-	C13H28
12.5	90.12	1472208	Dodecane, 4,6-dimethyl-	C14H30
12.62	87.39	1738995	Tetradecane	C14H30
12.66	85.77	1447965	Cyclotridecane	C13H26
12.77	95.61	16707084	Tridecane	C13H28
12.88	87.9	1949044	Undecanal	C11H22O
13.14	87.16	2392899	Undecane, 3,7-dimethyl-	C13H28
13.16	96	11267484	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
13.4	90.3	2875565	2-Butyl-1-decene	C14H28
13.5	89.86	1602027	Tridecane, 5-methyl-	C14H30
13.55	89.2	1569260	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	C12H24O3
13.73	90.66	5933890	Tridecane, 3-methyl-	C14H30
13.82	93.76	3205854	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	C12H24O3
13.88	95.9	2905285	2-Propenoic acid, 1,7,7-trimethylbicyclo[2.2.1]hept-2-yl ester, exo-	C13H20O2

14.02	96.67	39482212	1-Tetradecene	C14H28
14.16	95.91	121423223	Tetradecane	C14H30
14.2	94.71	3020496	7-Tetradecene	C14H28
14.26	98.44	7655647	Dodecanal	C12H24O
14.32	93.45	1621804	7-Tetradecene	C14H28
14.76	91.99	3924715	Cyclopentane, nonyl-	C14H28
14.93	92.78	4063742	Tetradecane, 2-methyl-	C15H32
15.29	96.04	4688394	1-Pentadecene	C15H30
15.56	92.93	10280653	Phenol, 2,4-bis(1,1-dimethylethyl)-	C14H22O
15.62	97.77	5883274	Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-	C15H24O
15.78	90.63	1522970	1-Tetradecene	C14H28
15.95	92.46	2258236	Decane, 5-propyl-	C13H28
16.15	90.24	2039828	Sulfurous acid, butyl tridecyl ester	C17H36O3S
16.24	93.33	4026199	Pentadecane, 3-methyl-	C16H34
16.5	96.69	12302104	Cetene	C16H32
16.59	94.9	42541646	Hexadecane	C16H34
16.9	96.2	1609872	Dodecanoic acid, 1-methylethyl ester	C15H30O2
17.24	93.49	3098804	Cyclohexadecane	C16H32
17.32	96.29	2813144	Octane, 1,1'-oxybis-	C16H34O
17.64	95.79	1331053	1-Heptadecene	C17H34
17.71	93.69	2180632	Heptadecane	C17H36
17.76	96.33	1483954	Benzaldehyde, 3-phenoxy-	C13H10O2
18.79	94.3	4781919	Octadecane	C18H38