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

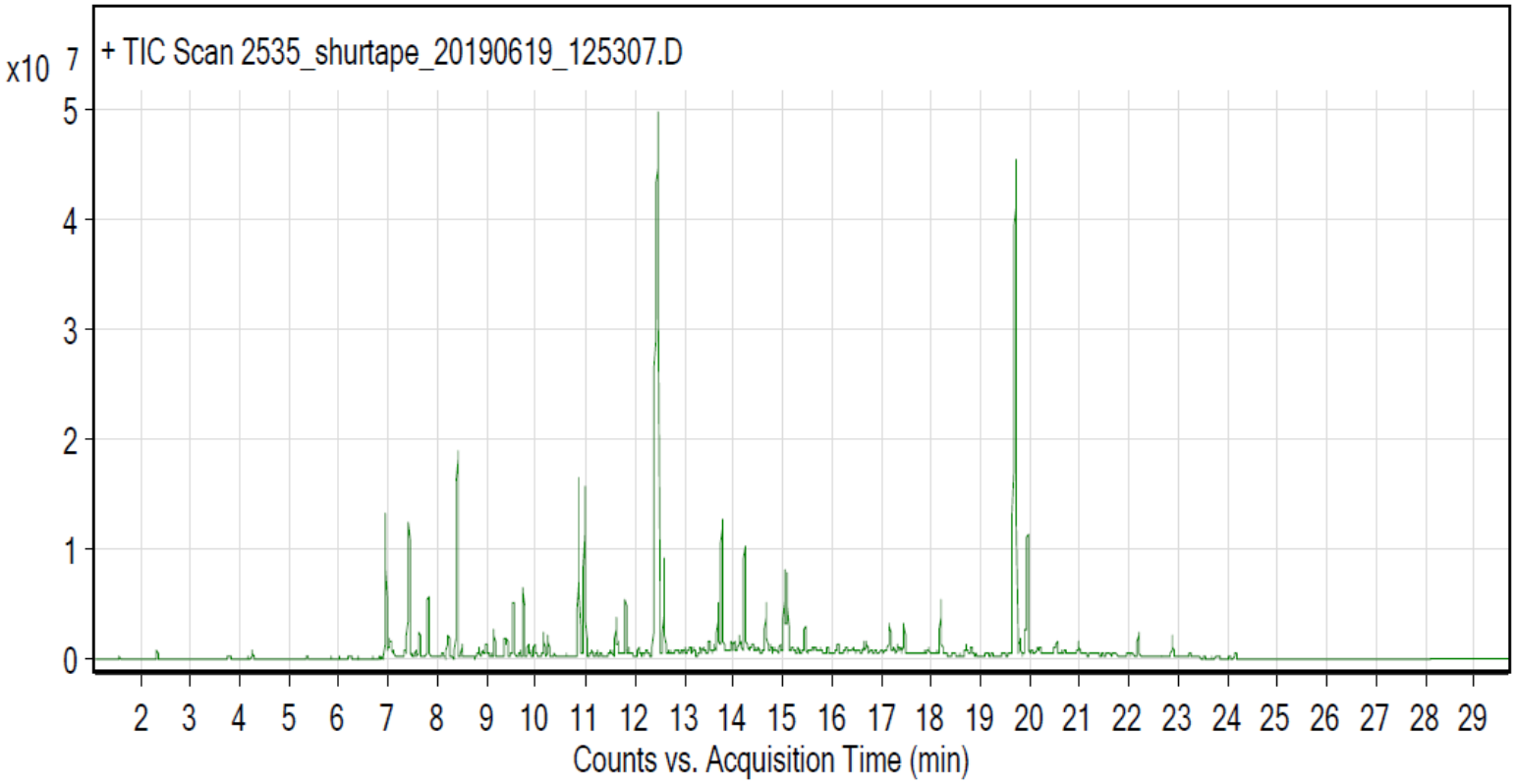
Sulfur-containing compounds – known to tarnish and corrode some metals

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: Shurtape rubber-based adhesive
Date collected: 6/19/2019
Oddy test result: unsuitable
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 35°C to 225 °C at 7.5°C/min. Data analyzed in Masshunter Qualitative. Samples > 90% match with a NIST 17.0 library are reported. VOCs not highlighted are because they were also observed in blanks: (1) 15.0 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name
6.94	97.91	1655486	Benzaldehyde
6.95	94.86	23767758	1-Butanamine, N-butyl-
7.04	94.7	6112574	1-Butanamine, N-butyl-
7.4	91.66	772375	Benzene, 1-propenyl-
7.43	96.4	27748105	Phenol
7.57	92.36	700368	O-(tert-Butoxycarbonyl)-N-isopropylidene oxime
7.63	94.91	4275663	Benzene, 1,2,3-trimethyl-
7.81	90.8	8451444	Cyclotetrasiloxane, octamethyl-
8.11	96.03	622676	2-Ethylhexyl methacrylate
8.23	95.75	2399216	Benzene, 1,2,3-trimethyl-
8.37	94.69	1672152	dl-Limonene
8.41	96.82	41798107	1-Hexanol, 2-ethyl-
8.84	92.33	1846248	Benzene, (1-methylpropyl)-
8.99	94.1	1475642	Benzene, 1-ethyl-2,3-dimethyl-
9.15	96.71	4519206	Ethanone, 1-phenyl-
9.37	94.95	2949569	Benzene, 1-ethyl-2,3-dimethyl-
9.41	92.36	2598636	Benzene, 1-methyl-2-(1-methylethyl)-
9.74	95.74	10487050	Benzoic acid, methyl ester
9.83	94.69	1827521	Pentadecane
9.96	94.15	1735484	Benzene, 1-ethyl-2,3-dimethyl-

10.16	95.44	3442340	Benzene, 1,2,3,4-tetramethyl-
10.24	95.19	3256234	Benzene, 1,2,3,4-tetramethyl-
10.87	97.38	31475036	Acetic acid, 2-ethylhexyl ester
11.23	95.99	878169	Undecane, 3-methyl-
11.49	95.2	786381	Naphthalene
11.61	90.71	6333142	Ethanol, 2-(2-butoxyethoxy)-
11.81	94.64	9251162	Undecane
12.07	90.36	1489171	Undecane, 4,6-dimethyl-
13.68	91.72	8649026	Dodecane, 2,6,10-trimethyl-
13.76	95.93	23858419	Formamide, N,N-dibutyl-
15.03	93.44	14886121	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
15.08	96.2	14666413	2-Propenoic acid, 1,7,7-trimethylbicyclo[2.2.1]hept-2-yl ester, exo-
15.44	94.6	4474748	Undecane, 4,7-dimethyl-
17.11	92.3	730548	Hexacosane