



CASSEN Testing Laboratories

Division of CASSEN Group Inc.

Advanced Scientific Solutions

51 International Blvd. Etobicoke, ON Canada M9W 6H3
Tel: (416) 679-9663 Toll Free: 1-866-423-3001 Fax: (416) 679-9668
info@cassen.ca www.cassen.ca

December 08, 2021

Woden Flooring
Unit A-9, 51 Caldari Road
Concord, Ontario
L4K 4G3

**RE: Analytical Report for Woden Flooring Project: Engineered Hardwood Flooring, OAK
CASSEN Work Order No. 2512016**

Dear Customer

We have completed the analysis of the 2 wood sample(s) that you submitted on November 23, 2021 for the determination of formaldehyde emission using microchamber extraction, followed by high performance liquid chromatography with ultra-violet detection. These samples were also submitted for the open characterization using headspace thermal desorption gas chromatography/mass spectrometry. Results of the analyses are summarized in the attached report, which includes the semi-quantitative concentrations of the top major VOCs identified, CAS numbers and the corresponding chromatograms for the open characterization package.

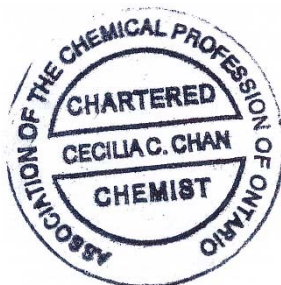
The headspace concentrations of the two formaldehyde samples were determined to be 0.3 ug/g, which is not considered elevated. Formaldehyde in flooring is commonly released from adhesives used in the wood. For VOC analysis, the major compound detected in the samples is acetic acid, which is abundant in natural hardwoods due to the hydrolysis of acetyl group esters in the hemicellulose and emitted especially during the drying of wood. Most VOCs detected may come from wood extractives and their degradation products as well as from adhesives. Other compounds detected include aldehydes, esters, glycol/glycol ethers/acetates, organic acids and terpenes/terpenoids.

For your information, we have attached a summary report on the results for VOC, which may help you in reviewing the data. Please feel free to give me a call at (416) 679-9663 should you need any clarification. Thank you for using our services.

Sincerely,

CASSEN Testing Laboratories

Cecilia Chan, M.Sc., C.Chem
Laboratory Director





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Woden Flooring

Unit A-9, 51 Caldari Road
Concord, Ontario, L4K 4G3

Analytical Report

CASSEN Work Order #: 2512016

Date Received: Nov. 23, 2021

Client Project Name / No.: Engineered Hardwood Flooring, OAK

# of Samples	Analysis Requested
2	Formaldehyde - Headspace
2	Open Characterization for VOC - Headspace

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Analytical Results

Date: December 06, 2021

Organization:	Woden Flooring	Work Order No.:	2512016
Address:	Unit A-9, 51 Caldari Road, Concord, Ontario, L4K 4G3	Date Received:	November 23, 2021
Contact:		Date Analyzed:	November 29, 2021
Project:	Engineered Hardwood Flooring, OAK	No. of Samples:	2
Analysis Requested:	Formaldehyde - Headspace		
Instrument:	High Performance Liquid Chromatography with Ultra-violet Detector		
CASSEN Method:	M.4735	Analyst:	LM
Reference Method:	CASSEN In-House Method	Reviewer:	QY
Sample Matrix:	Solid		

Formaldehyde

#	Lab ID	Sample Identification	Date Sampled (dd/mm/yy)	Sample Mass (g)	Amount	Concentration
					(µg)	(ug/g, ppm)
1	86364	1001	22/11/21	2.8783	0.7	0.3
2	86365	1002	22/11/21	2.2622	0.6	0.3

MRL

#	Analyte	CAS #	MRL (µg)
1	Formaldehyde	000050-00-0	0.1

Notes:

- 1) N.A.: Information not available or not applicable.
- 2) < is defined as less than the indicated minimum reporting limit (MRL). The analyte is either not detected or less than the minimum reporting limit (MRL).
- 3) MRL (Minimum Reporting Limit): The MRL stated in this analysis is the lowest limit of detection of the target analyte within a defined concentration range under the specific processing condition.
- 4) CAS Number is the Chemical Abstracts Service registry number corresponding to the target analyte.
- 5) The results obtained for the target analyte have been lab blank subtracted.
- 6) Amount is the mass of target analyte in milligrams (µg) detected in the sampled headspace.
- 7) Concentration is the total amount of target analyte expressed in micrograms per gram (µg/g) and in parts per million (ppm) of sample material in headspace.
- 8) CTL has established an ISO17025 reporting policy that a maximum of 3 significant figures will be reported for test results.
- 9) The sample(s) were received in acceptable condition unless otherwise noted.

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Date: December 8, 2021

Organization: Woden Flooring
Address: Unit A-9, 51 Caldari Road, Concord, Ontario, L4K 4G3
Contact:
Project: Engineered Hardwood Flooring, OAK

Work Order No.: 2512016
Date Submitted: November 23, 2021
Date Analyzed: November 29, 2021

Analysis Requested: Open Characterization for VOC - Headspace
Instrument: Thermal Desorption with Gas Chromatography Mass Spectrometry
CASSEN Method: M.2410
Reference Method: CTL In-House Method
Sample Matrix: Solid

No. of Samples: 2
Analyst: CK
Reviewer: QY

Sample Identification: 1001

CASSEN ID: 86364

Date Sampled: November 22, 2021

Date Analyzed: November 29, 2021

Sample Mass (g): 0.6119

GC/MS File: P09505.D

# ¹	CAS ² Number	Tentative Identification ³	R.T. ⁴ (min)	Amount ⁵ (ng)	Conc. ⁶ (ng/g, ppb)
1	000064-19-7	Acetic acid	17.51	1300	2200
2	000067-63-0	Isopropyl Alcohol	9.62	790	1300
3	007473-98-5	2-Hydroxy-2-methyl-1-phenylpropan-1-one	39.22	240	380
4	000064-17-5	Ethanol	8.87	100	170
5	000100-52-7	Benzaldehyde	30.86	39	64
6	000096-23-1	2-Propanol, 1,3-dichloro-	29.71	36	59
7	000078-40-0	Triethyl phosphate	35.10	32	52
8	000106-89-8	Epichlorohydrin	20.08	27	45
9	029911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-	37.09	25	41
10	000947-19-3	Methanone, (1-hydroxycyclohexyl)phenyl-	52.21	21	34
11	990056-03-8	(2-(2-butoxyisopropoxy)-2-propanol	37.01	20	33
12	000515-30-0	2-Hydroxy-2-phenylpropionic acid	39.00	19	31
13	006846-50-0	2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	45.66	17	28
14	000108-94-1	Cyclohexanone	28.57	17	28
15	000077-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	40.70	17	27
16	074367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester	40.52	12	19
17	000098-86-2	Acetophenone	33.99	11	18
18	000102-76-1	Triacetin	39.46	10	16
19	000108-65-6	1-Methoxy-2-propyl acetate	26.15	7	11
20	000066-25-1	Hexanal	23.47	7	11
21	000629-62-9	Pentadecane	41.26	5	8
22	000544-76-3	Hexadecane	43.60	4	7
23	000084-66-2	Diethyl Phthalate	46.68	4	7
24	000593-45-3	Octadecane	49.89	4	7
25	000100-97-0	Methenamine	38.01	4	7
26	000629-78-7	Heptadecane	46.40	4	6
27	020324-32-7	2-Propanol, 1-(2-methoxy-1-methylethoxy)- [DPGME]	31.85	4	6
28	000475-20-7	D-Longifolene	41.47	3	6
29	000541-02-6	Cyclopentasiloxane, decamethyl-	33.59	3	6
30	000139-66-2	Diphenyl sulfide	46.87	3	4
31	000108-38-3	m-Xylene + p-Xylene	26.16	3	4
32	000095-47-6	o-Xylene	27.32	3	4
33	001490-04-6	Menthol	36.16	2	4
34	000112-31-2	Decanal	36.31	2	3
35	000057-55-6	Propylene Glycol	23.59	2	3

See Final Page for Notes





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Date: December 8, 2021

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Address: Unit A-9, 51 Caldari Road, Concord, Ontario, L4K 4G3
Contact:
Project: Engineered Hardwood Flooring, OAK

Work Order No.: 2512016
Date Submitted: November 23, 2021
Date Analyzed: November 29, 2021

Analysis Requested: Open Characterization for VOC - Headspace
Instrument: Thermal Desorption with Gas Chromatography Mass Spectrometry
CASSEN Method: M.2410
Reference Method: CTL In-House Method
Sample Matrix: Solid

No. of Samples: 2
Analyst: CK
Reviewer: QY

Sample Identification: 1002

CASSEN ID: 86365

Date Sampled: November 22, 2021

Date Analyzed: November 29, 2021

Sample Mass (g): 0.7843

GC/MS File: P09506.D

# ¹	CAS ² Number	Tentative Identification ³	R.T. ⁴ (min)	Amount ⁵ (ng)	Conc. ⁶ (ng/g, ppb)
1	000064-19-7	Acetic acid	17.51	1200	1600
2	000067-63-0	Isopropyl Alcohol	9.58	790	1000
3	000064-17-5	Ethanol	8.16	390	500
4	000067-64-1	Acetone	9.21	140	180
5	000100-52-7	Benzaldehyde	30.87	32	41
6	000515-30-0	2-Hydroxy-2-phenylpropionic acid	39.00	30	38
7	000064-18-6	Formic acid	16.08	25	32
8	007473-98-5	2-Hydroxy-2-methyl-1-phenylpropan-1-one	39.22	19	24
9	000098-86-2	Acetophenone	33.99	14	18
10	000108-65-6	1-Methoxy-2-propyl acetate	26.16	14	18
11	000096-23-1	2-Propanol, 1,3-dichloro-	29.73	14	18
12	041169-42-0	1,3-Propanedione, 2,2-dimethyl-1,3-diphenyl-	45.31	11	14
13	000075-07-0	Acetaldehyde	6.44	8	11
14	000106-89-8	Epichlorohydrin	20.09	7	9
15	000947-19-3	Methanone, (1-hydroxycyclohexyl)phenyl-	52.21	6	8
16	000487-68-3	Benzaldehyde, 2,4,6-trimethyl-	39.27	6	8
17	000100-97-0	Methenamine	38.03	6	8
18	000134-85-0	Methanone, (4-chlorophenyl)phenyl-	34.90	5	6
19	000123-86-4	Acetic acid, butyl ester (Butyl Acetate)	23.64	5	6
20	000057-55-6	Propylene Glycol	23.65	5	6
21	000108-94-1	Cyclohexanone	28.58	4	5
22	000078-40-0	Triethyl phosphate	35.11	3	4
23	000066-25-1	Hexanal	23.48	3	4
24	000077-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	40.70	3	4
25	000475-20-7	D-Longifolene	41.48	3	4
26	000108-38-3	m-Xylene + p-Xylene	26.16	2	3
27	001490-04-6	Menthol	36.16	2	3
28	000065-85-0	Benzoic acid	36.72	2	3
29	000112-31-2	Decanal	36.32	2	3
30	000110-62-3	Pentanal	18.50	2	2
31	000095-47-6	o-Xylene	27.32	2	2
32	990056-03-8	(2-(2-butoxyisopropoxy)-2-propanol	37.00	1	2
33	000104-76-7	1-Hexanol, 2-ethyl-	32.10	1	2
34	000079-09-4	Propanoic acid	21.09	1	2
35	000108-88-3	Toluene	21.37	1	1

See Final Page for Notes





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Date: December 8, 2021

Organization: Woden Flooring
Address: Unit A-9, 51 Caldari Road, Concord, Ontario, L4K 4G3
Contact:
Project: Engineered Hardwood Flooring, OAK

Work Order No.: 2512016
Date Submitted: November 23, 2021
Date Analyzed: November 29, 2021

Notes:

N.A.: Not Available

- 1) **Rank** is based on the descending order of concentration.
- 2) **CAS Number** is the Chemical Abstracts Service registry number corresponding to the tentatively identified compound (first listed co-eluting compound) listed beside it. The tentative identification and its corresponding CAS Number were obtained as the best possible match from the results of the NIST Mass Spectral Library search.
- 3) **Tentative Identification** is based on the best match result of the mass spectral identification; results are not confirmed unless calibrated with reference standards.
- 4) **Retention Time (R.T.)** is the time that the VOC eluted from the column in the chromatogram.
- 5) **Amount** is the semi-quantitative estimate of the mass of the VOC in nanograms (ng) detected in the headspace sample. The value depends on the VOC's response compared to selected reference compounds. Amounts should be used for qualitative and comparison purposes only.
- 6) **Conc.** is the semi-quantitative estimate of the concentration of the VOC in nanograms per gram (ng/g) and in parts per billion (ppb) of sampled material in headspace.
- 7) This **Certificate of Analysis** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.
- 8) Please note that this report is strictly focused on VOCs or compounds that are detectable using this method with a mass scanning range from 33 amu to 450 amu. Unstable/reactive compounds as well as those outside this range cannot be detected.
- 9) The sample(s) were received in acceptable condition unless otherwise noted.
- 10) **CASSEN Testing Laboratories** has established a reporting policy that a maximum of three significant figures will be used for test results in compliance with the precision requirement of ISO 17025.



Summary of Results

Work Order No. 2512016 - Woden Flooring

Sample Name: 1001

The top three VOCs identified in this headspace sample are:

1. Acetic acid
2. Isopropyl Alcohol
3. 2-Hydroxy-2-methyl-1-phenylpropan-1-one

The other major compounds found in this sample can be categorized into the following classes:

- **Alcohols:**
[Isopropyl Alcohol], [Ethanol]
- **Aldehydes:**
[Benzaldehyde], [Hexanal], [Decanal]
- **Aliphatic Hydrocarbons (Alkanes):**
[Pentadecane], [Hexadecane], [Octadecane], [Heptadecane]
- **Aromatic Hydrocarbons:**
[m-Xylene + p-Xylene], [o-Xylene]
- **Epoxides:**
[Epichlorohydrin]
- **Esters:**
[2,2,4-Trimethyl-1,3-pentanediol diisobutyrate], [Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester], [Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester]
- **Glycerols/ Glycerol Esters:**
[Triacetin]
- **Glycols/Glycol Ethers/acetates:**
[2-Propanol, 1-(2-butoxy-1-methylethoxy)-], [(2-(2-butoxyisopropoxy)-2-propanol], [1-Methoxy-2-propyl acetate], [2-Propanol, 1-(2-methoxy-1-methylethoxy)- [DPGME]], [Propylene Glycol]
- **Halogenated Compounds:**
[2-Propanol, 1,3-dichloro-]
- **Ketones:**
[Methanone, (1-hydroxycyclohexyl)phenyl-], [Cyclohexanone], [Acetophenone], [2-Hydroxy-2-methyl-1-phenylpropan-1-one], [Methanone, (4-chlorophenyl)phenyl-]
- **Organic Acids:**
[Acetic acid], [2-Hydroxy-2-phenylpropionic acid]
- **Organic Phosphates:**
[Triethyl phosphate]

- **Phthalate Esters:**
[Diethyl Phthalate]
- **Siloxanes/Silanes:**
[Cyclopentasiloxane, decamethyl-]
- **Sulphur-Containing Compounds:**
[Diphenyl sulfide]
- **Terpenes/Terpenoids:**
[D-Longifolene], [Menthol]

Sample Name: 1002

The top three VOCs identified in this headspace sample are:

1. Acetic acid
2. Isopropyl Alcohol
3. Ethanol

The other major compounds found in this sample can be categorized into the following classes:

- **Alcohols:**
[Isopropyl Alcohol], [Ethanol], [1-Hexanol, 2-ethyl-]
- **Aldehydes:**
[Benzaldehyde], [Acetaldehyde], [Benzaldehyde, 2,4,6-trimethyl-], [Hexanal], [Decanal], [Pentanal]
- **Aromatic Hydrocarbons:**
[m-Xylene + p-Xylene], [o-Xylene], [Toluene]
- **Epoxides:**
[Epichlorohydrin]
- **Esters:**
[Acetic acid, butyl ester (Butyl Acetate)], [Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester]
- **Glycols/Glycol Ethers/acetates:**
[1-Methoxy-2-propyl acetate], [Propylene Glycol], [(2-(2-butoxyisopropoxy)-2-propanol]
- **Halogenated Compounds:**
[2-Propanol, 1,3-dichloro-]
- **Ketones:**
[Acetone], [Acetophenone], [1,3-Propanedione,2,2-dimethyl-1,3-diphenyl-], [Methanone, (1-hydroxycyclohexyl)phenyl-], [Cyclohexanone], [2-Hydroxy-2-methyl-1-phenylpropan-1-one]
- **Nitrogen-Containing Compounds:**
[Methenamine]
- **Organic Acids:**
[Acetic acid], [2-Hydroxy-2-phenylpropionic acid], [Formic acid], [Benzoic acid], [Propanoic acid]
- **Organic Phosphates:**
[Triethyl phosphate]

- **Terpenes/Terpenoids:**
[D-Longifolene], [Menthol]

Possible Relevant Sources

Alcohols

- **Ethanol**
Sources: Ethanol is used extensively as a solvent in the manufacturing of varnishes, ink, cleaners, detergents, and paint. It is present in alcoholic drinks and used in perfumes, aftershave, and many personal care and pharmaceutical products. Ethanol is also used in disinfectants such as hand sanitizers and as a fuel and gasoline additive.
Odour: Sweet, alcoholic
- **Isopropyl Alcohol**
Sources: Isopropyl alcohol is used as solvent for gums, in antifreeze products, shellac, essential oils, quick drying inks, and resins. It is also used in paints, rubbing alcohol, cleaners, personal care products, and as an antiseptic agent and disinfectant.
Odour: Pleasant, sharp, rubbing alcohol
- **1-Hexanol, 2-ethyl-**
Sources: It is used as a raw material for plasticizers and in the production of acrylates, surfactants, defoamers, and fuel and lube additives. It can be emitted from carpets, sheet vinyl flooring, photocopiers, and some plastics. It is also a naturally occurring plant volatile and can be found in a variety of fruits.
Odour: Sweet, floral, characteristic

Aldehydes

- **Hexanal**
Sources: Hexanal can be found from emissions of pressed wood products (hardwood plywood wall paneling, particle board, and fibreboard), furniture (composed of pressed wood), carpet, fabrics, adhesives, alkyd paint, and polyurethane wood finish.
Odour: Pungent
- **Acetaldehyde**
Sources: Sources of acetaldehyde include emissions from combustion processes such as vehicle emissions, boilers and process heaters, fireplaces and woodstoves, coffee roasting, and tobacco smoking. Acetaldehyde is a metabolic intermediate in humans and higher plants. The degradation of hydrocarbons, sewage, and solid biological wastes as well as the open burning and incineration of gas, fuel, oil, and coal produce acetaldehyde.
Odour: Pungent, fruity
- **Benzaldehyde**
Sources: Benzaldehyde is used as a food additive, fragrance additive, and an industrial solvent for resins. It can be formed during burning/heating processes.
Odour: Pleasant almond-like odour
- **Pentanal**
Sources: Pentanal is used in food flavoring, rubber manufacture, and is found in some foodstuff. It is emitted from building materials, furnishings, alkyd paints etc.
Odour: Acrid, pungent
- **Decanal**
Sources: Decanal is used in fragrances and flavourings and is also found in indoor air originating from acoustical ceiling panels, carpets, and some resilient flooring materials.

Odour: Buckwheat, citrus, fatty

Aliphatic Hydrocarbons (Alkanes)

Common Sources: Aliphatic hydrocarbons are components of mixed solvent for varnishes, paint, paint removers, sheet vinyl flooring, coatings, printing inks, adhesives and degreasers. Aliphatic hydrocarbons are also ingredients of petrochemical fuels, solvents and lubricants such as gasoline, mineral spirit, naphtha and motor oil etc. Emissions from combustion also generate many hydrocarbons especially those of lower molecular weight.

- **Pentadecane**

Odour: Waxy

Aromatic Hydrocarbons

Common Sources: Aromatic hydrocarbons are used as solvents especially for paints, lacquers, coatings, gums, inks, adhesives, and resins. They are also used as raw material in the production of other materials, ingredients of petrochemical fuels, and emissions from burning, heating or combustion processes.

- **Xylene**

Odour: Aromatic, sweet

- **Toluene**

Odour: Sweet, pungent

Epoxides

- **Epichlorohydrin**

Sources: It is used as an Insect fumigant; however, it is primarily utilized in the manufacturing of epoxy and phenoxy resins.

Odour: Chloroform-like, irritating

Esters

- **Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester**

Sources: Component of Texanol

- **Acetic acid, butyl ester (Butyl Acetate)**

Sources: It is used mainly as a solvent for oil based lacquers and enamels, as well as a solvent in inks. Other applications include aerosol paint concentrates, paint and varnish removers, nail enamels and polishes, synthetic resin, and rubber adhesives.

Odour: Fruity

- **2,2,4-Trimethyl-1,3-pentanediol diisobutyrate**

Sources: It is used as an additive in plastic (plasticizer) and as the coalescent agent for latex paints. It is also used as a retarder solvent in coil coatings and high-bake enamels, as wood preservative carriers, floor polishes and as solvent for nail polish, cosmetics, and personal care products.

Odour: Unpleasant, musty

Glycerols/ Glycerol Esters

- **Triacetin**

Sources: It is used as used as a humectant, a plasticizer, and as a solvent. It is also used as an additive in fuel, food and cigarettes.

Odour: Slightly fruity or fatty odor

Glycols/Glycol Ethers/acetates

- **Propylene Glycol**

Sources: Propylene glycol is used in foods, pharmaceutical, and personal care products as well as industrial applications including polyester and alkyd resins, paints and coatings, antifreeze coolants and heat transfer fluids, plasticizers, household detergents, industrial solvents, and aircraft de-icing fluids. Due to its lower toxicity, propylene glycol is more commonly used in residential and small commercial applications.

Odour: Characteristic glycol odour

- **1-Methoxy-2-propyl acetate**

Sources: It is a relatively fast evaporating glycol ether and provides excellent active solvency for a wide range of resin types, including acrylics, epoxies, alkyds, and polyesters. Its primary uses include solvent based coatings (e.g. polyurethanes) and solvent-based silk screen printing inks. Some other specific examples are paints, inks, lacquers, varnishes, cleaners, coatings, ink removers, and pesticides solvent.

Odour: Ester-like

- **2-Propanol, 1-(2-methoxy-1-methylethoxy)- [DPGME]**

Sources: Also known as dipropylene glycol monomethyl ether, it is a clear, colorless, combustible liquid with a slight ether odor. The main commercial uses include: a) solvent for paints, varnishes, inks, strippers, and degreasers; b) coalescing agents for water-based paints and inks – promotes polymer fusion during the drying process; c) coatings for automotive, architectural, industrial maintenance, wood and coil coatings, and metal finishing; d) chemical additives – for the oil production and drilling industry. DPGME is also used in many consumer products such as cleaning products (for carpets, glass paint brush, sanitary/disinfectant), cosmetics (solvent and coupler with emollient properties and product stabilizer), floor polish, aluminum polishers/brighteners, leather and textile dyes, rust removers etc.

Odour: Mild, ether

- **2-Propanol, 1-(2-butoxy-1-methylethoxy)-**

Sources: It is also known as 1-(2-butoxy-1-methylethoxy)-2-Propanol and is part of DOW "Dowanol" glycol ethers. It is a slow evaporating solvent used in household and industrial cleaning formulations as coupling agent, surface coatings (e.g. architectural, automotive and industrial maintenance), coalescing agent for latex coating and solvent for inks and cosmetics, as well as plasticizers.

Odour: Ether-like odour

Halogenated Compounds

- **2-Propanol, 1,3-dichloro-**

Sources: It is also known as 1,3-dichlorohydrin and is used in high volume as an intermediate in epichlorohydrin production. It is also used to manufacture lacquers, and as a solvent for nitrocellulose and hard resins, and possible use as a dye fixative/anti-fading agent in detergent formulations.

Odour: Slightly-chlorine-like

Ketones

- **Acetone**

Sources: Acetone occurs in the nature as well as a man-made compound. It is used to produce other chemicals and as a solvent for surface coatings, inks, resins, varnishes, lacquers, carpet adhesive, thinners, cleaners, and automotive care products. It is formed in combustion processes. It occurs naturally in plants, trees, volcanic gases, forest fires, and as a product of the breakdown of body fat. It is present in exhaled breath, vehicle exhaust, tobacco smoke, and landfill sites. In indoor air, exhaled breath is a key contributor of acetone.

Odour: Minty chemical, sweet

- **Acetophenone**

Sources: It is used in paint and varnish removers, as a fragrance ingredient in soaps, detergents, cosmetics, and perfumes as well as a flavouring agent in foods, beverages, and tobacco.

Odour: Sweet, almond

- **Cyclohexanone**
Sources: Cyclohexanone is a synthetic organic liquid used primarily as an intermediate in the production of nylon. Other minor applications are as an intermediate, additive, and solvent in a variety of products. It is found in aerosol paint concentrates, wood office work, insecticides, fungicides, markers, synthetic resin, and rubber adhesives.
Odour: Sweet, pepperminty, sharp
- **2-Hydroxy-2-methyl-1-phenylpropan-1-one**
Sources: This compound is used in ink, toner and colorant product as well as in paint and coating

Nitrogen-Containing Compounds

- **Methenamine**
Sources: Also known as hexamethylenetetramine, methenamine has many uses. Industrially, it is used in adhesives, coatings, dyes, rubber, resins, as well as in the manufacturing of explosives, medications, and antiseptics. It can decompose under various conditions to form formaldehyde and is the raw material used in the manufacturing and curing of phenolic resins to harden the resins. For pharmacology, it is used as an antibiotic in the treatment of urinary tract infections and to prevent the recurrence of infections..
Odour: Mild ammonia odour

Organic Acids

- **Formic acid**
Sources: The main industrial applications for formic acid include coagulant for rubber latex, nickel plating baths, production of wire-stripping compounds needed for soldering bare wire, and dyeing and finishing of textile, paper, and treatment of leather. Formic acid is also used in household products such as liquid hand soaps, body wash lotions, toilet bowl cleaners, and multi-surface cleaners.
Odour: Pungent, penetrating
- **Acetic acid**
Sources: Acetic acid is found in the atmosphere, ocean water, and rain and formed in the air by reaction of hydrocarbons with ozone. It is formed in the air by reaction of hydrocarbons with ozone. Acetic acid is widely used to make other chemicals such as manufacturing of vinyl acetate monomer, which in turn is used to produce base resins for water-based paints, hot melt adhesives, paper coatings, and textile finishes. It is found in caulks and sealants, wood products, rubber, and food additives. Acetic acid has also been found in adhesives used in archival boxes. In consumer products, it is used in glass window cleaning preparations, household detergents and surface cleaners, laundry aids, disinfectants, polishes, and varnish removers. Other sources of acetic acid include burning heating and combustion processes. It is also found to be an oxidation product of coal.
Odour: Sour, vinegar-like
- **Benzoic acid**
Sources: Benzoic acid is used as a food preservative and as an anti-microbial agent. It is found in toothpastes, mouthwashes, cosmetics, and deodorants. It is also used in disinfectant, mosquito repellents, and is a polyunsaturated fat found in many foods such as milk and cranberries. Benzoic acid is also used as a preservative in surface coatings, emulsions, polishes, waxes, and liquid detergents. It is also used in the production of diethylene and dipropylene glycol dibenzoate plasticizers in adhesive formulations.
Odour: Pleasant, aromatic
- **Propanoic acid**
Sources: Propanoic acid is a short chain saturated fatty acid. It can be produced by human through microbial fermentation of dietary fibers to give rise to various metabolites, which includes short chain fatty acids such as acetic, propanoic and butanoic acid. Industrially, it is used as preservative and flavoring agent for foods, a mold inhibitor for wood chips and grains, and a pesticide for households. It is also found in perfumes, flavours, and drugs.
Odour: Sharp rancid resembling body odour

Organic Phosphates

- **Triethyl phosphate**

Sources: It is used in the plastics industry as a flame retardant and plasticizer, as an anti-wear additive in lubricants; and in other industries as a catalyst in the production of ketene. It is also used as a solvent, as a car paint repairing product, and as an industrial intermediate for the production of pesticides and other chemicals.

Odour: Mild

Phthalate Esters

- **Diethyl Phthalate**

Sources: Often used as a binding agent for cosmetics and fragrances, also used as a plasticizer, detergent base, and aerosol.

Odour: Faint, disagreeable

Siloxanes/Silanes

- **Cyclopentasiloxane, decamethyl-**

Sources: Decamethylcyclopentasiloxane is used in personal care products such as lotion, cosmetics, and hair spray. It is also used in sealant materials, carpet, ceiling tiles, floor and furniture polish, lubricants, silicone adhesive, and elastomers in ceiling light gaskets and as a dry cleaning solvent replacing perchloroethylene. It is often found with ethanol when used in personal care products or with limonene if used with cleaning or polishing products.

Odour: Mild

Sulphur-Containing Compounds

Common Sources: Industrial sources of sulphur-containing compounds include fugitive emissions from petroleum refineries, steel industry, pulp and paper mills that use the Kraft pulping process, unrefined petroleum products, natural gas plants, and sewage treatment facilities. Natural sources of these compounds include swamps, bogs, and marshes whereas rubber products, natural gas leak, and sewer gas are indoor sources. Sulphur-containing compounds are also formed as by-products of microbial activities.

- **Diphenyl sulfide**

Odour: Burnt, rubbery

Terpenes/Terpenoids

- **D-Longifolene**

Sources: Longifolene is the common chemical name of a naturally-occurring, oily liquid hydrocarbon found primarily in the high-boiling fraction of certain pine resins. It is used in natural essential oil, pine resins, synthetic perfumes, flotation oils, and as a synthetic organic chemical. It is also used in soap, cleaning products, laundry and dishwashing products.

Odour: Woody, rose, medical

- **Menthol**

Sources: Menthol and menthone are ingredients from peppermint oil or other mint oils or made synthetically. They are used for chewing gums, mouth rinses, toothpastes, medicines (e.g. decongestants and cough medicine), and teas and also serve as a cooling or anti-itching agent for the skin.

Odour: Mint and peppermint odour

Notes:

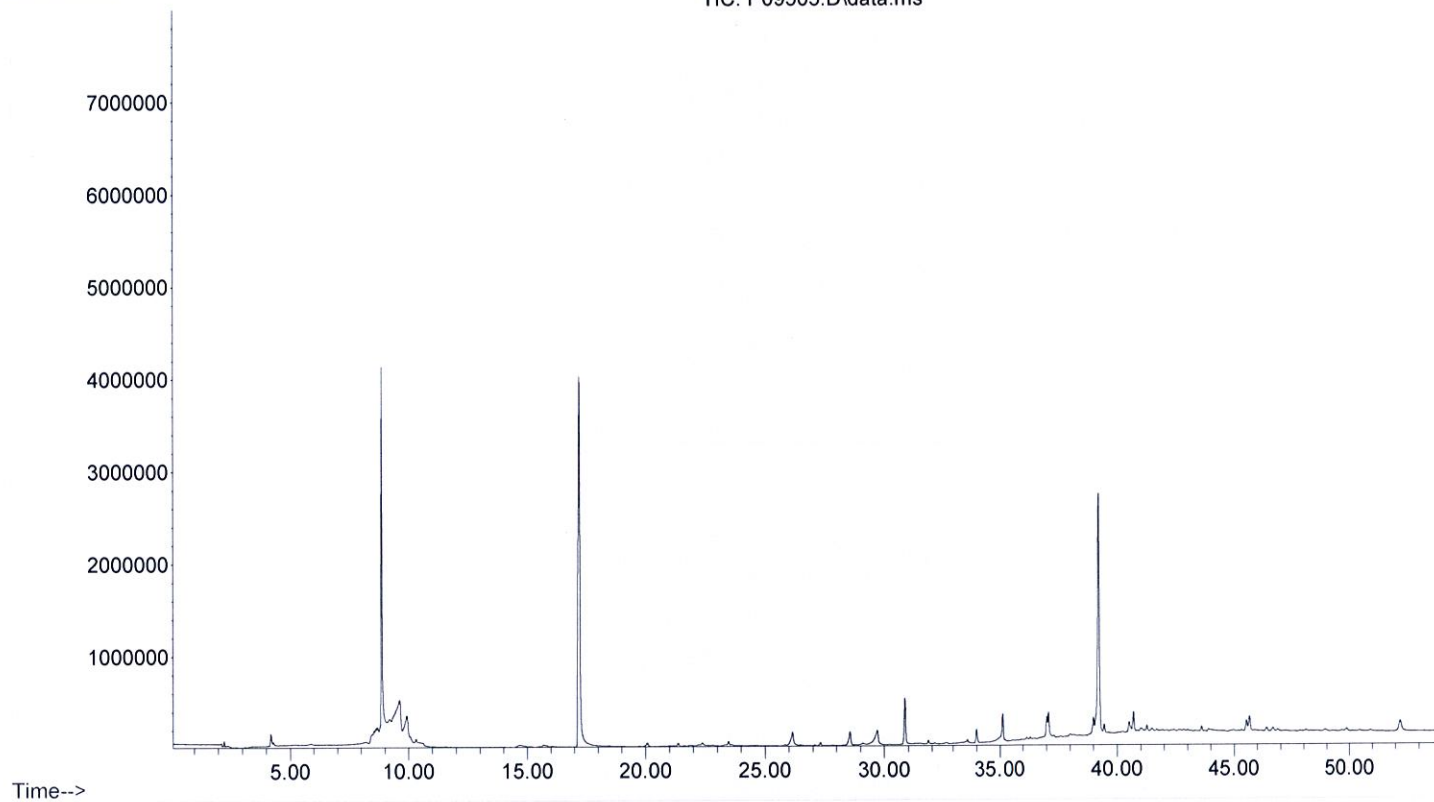
This report summarizes the results of the open characterization analysis completed through the semi-quantitative determination of the concentrations of the VOCs only. The VOCs categorized in this report are only based on the top major compounds. The sources of VOCs provided are not exhaustive or intended to be complete. Please note that this report is strictly focused on VOCs or compounds that can be detected using this method (mass scanning range from 33 amu to 450 amu). Unstable/reactive compounds as well as those outside of this range would not be detected.

File :Y:\GCData\GC-MS-5\P09505.D
Operator :
Acquired : 29 Nov 2021 16:03 using AcqMethod TVOCSC4_td.M
Instrument : GCMS5
Sample Name: 86364-Woden
Misc Info :
Vial Number: 16

1001

Abundance

TIC: P09505.D\data.ms



File :Y:\GCData\GC-MS-5\P09506.D
Operator :
Acquired : 29 Nov 2021 17:28 using AcqMethod TVOCSC4_td.M
Instrument : GCMS5
Sample Name: 86365-Woden
Misc Info :
Vial Number: 17

1002

Abundance

TIC: P09506.D\data.ms

