SAFETY DATA SHEET

1. Identification

Product identifier: LEAF ALCOHOL (ETHYL) ACETAL

Other means of identification
- BRI Product Code: 311
- CAS number: 28069-74-1
- FEMA number: 3775
- Synonyms: (Z)-1-(1-Ethoxyethoxy)hex-3-ene * 3-Hexene, 1-(1-ethoxyethoxy)-, (3Z)- * Acetaldehyde ethyl cis-3-hexenyl acetal

Recommended use: Flavors and fragrances

Recommended restrictions: Not for use in Tobacco or Nicotine delivery device applications and/or products.

Manufacturer/Importer/Supplier/Distributor Information

Manufacturer
- Company name: Bedoukian Research
- Address: 6 Commerce Drive, Danbury, CT 06810, United States
- Telephone: 1-203-830-4000
- Website: www.bedoukian.com
- E-mail: customerservice@bedoukian.com
- Contact person: Joseph Bania
- Emergency phone number: Chemtrec (North America) 1-800-424-9300, Chemtrec (International) 1-703-527-3887

2. Hazard(s) identification

Physical hazards: Flammable liquids

Category 4

Health hazards: Not classified.

Environmental hazards: Not classified.

OSHA defined hazards: Not classified.

Label elements
- Hazard symbol: None.
- Signal word: Warning
- Hazard statement: Combustible liquid.

Precautionary statement
- Prevention: Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Wear protective gloves/eye protection/face protection.
- Response: In case of fire: Use appropriate media to extinguish.
- Storage: Store in a well-ventilated place. Keep cool.
- Disposal: Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC): None known.

Supplemental information: None.

3. Composition/information on ingredients

Substances

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Common name and synonyms</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEAF ALCOHOL (ETHYL) ACETAL</td>
<td>(Z)-1-(1-Ethoxyethoxy)hex-3-ene 3-Hexene, 1-(1-ethoxyethoxy)-, (3Z)- * Acetaldehyde ethyl cis-3-hexenyl acetal</td>
<td>28069-74-1</td>
<td>100</td>
</tr>
</tbody>
</table>

Material name: LEAF ALCOHOL (ETHYL) ACETAL
311 Version #: 03 Revision date: 13-September-2018 Issue date: 21-May-2015
Stabilizers

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Common name and synonyms</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>synthetic alpha tocopherol</td>
<td>10191-41-0</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

Composition comments: Occupational Exposure Limits for stabilizers are listed in Section 8.

4. First-aid measures

Inhalation: Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact: Wash off with soap and water. Get medical attention if irritation develops and persists.

Eye contact: Rinse with water. Get medical attention if irritation develops and persists.

Ingestion: Rinse mouth. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed:

Indication of immediate medical attention and special treatment needed:

Provide general supportive measures and treat symptomatically.

General information:

Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures


Unsuitable extinguishing media: Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical: The product is combustible, and heating may generate vapors which may form explosive vapor/air mixtures. During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters: Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Fire fighting equipment/instructions: In case of fire and/or explosion do not breathe fumes. Move containers from fire area if you can do so without risk.

General fire hazards: Combustible liquid.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures: Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Wear appropriate protective equipment and clothing during clean-up. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained.

Methods and materials for containment and cleaning up:

Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Following product recovery, flush area with water.

Small Spills: Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Clean surface thoroughly to remove residual contamination.

Never return spills to original containers for re-use.

Environmental precautions:

Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling: Keep away from open flames, hot surfaces and sources of ignition. When using do not smoke. Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities: Keep away from heat, sparks and open flame. Store in a cool, dry place out of direct sunlight. Store in original tightly closed container. Store in a well-ventilated place. Keep in an area equipped with sprinklers. Recommended Packaging: Glass, Plastic, Aluminum or Phenolic Lined Steel. Store tightly sealed under inert gas in a cool, well-ventilated area.
8. Exposure controls/personal protection

Occupational exposure limits  This substance has no PEL, TLV, or other recommended exposure limit.

Biological limit values  No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls  Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection  Wear safety glasses with side shields (or goggles).

Skin protection  Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.

Hand protection  Wear suitable protective clothing.

Respiratory protection  If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

Thermal hazards  Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations  When using do not smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

  Physical state  Liquid.
  Color  Colorless

Odor  Leafy, green, vegetable-like odor.

Odor threshold  Not available.

pH  Not available.

Melting point/freezing point  Not available.


Flash point  152 °F (67 °C) Closed Cup

Evaporation rate  Not available.

Flammability (solid, gas)  Not applicable.

Upper/lower flammability or explosive limits

  Flammability limit - lower (%)  Not available.
  Flammability limit - upper (%)  Not available.
  Explosive limit - lower (%)  Not available.
  Explosive limit - upper (%)  Not available.

Vapor pressure  0.33 mmHg at 20°C; US EPA. 2014. Estimation Programs Interface Suite™ for Microsoft® Windows, v 4.11. US EPA, Washington, DC, USA.

Vapor density  5.9 Relative to air; air = 1

Relative density  Not available.

Solubility(ies)

  Solubility (water)  Not available.


Auto-ignition temperature  Not available.

Decomposition temperature  Not available.

Viscosity  Not available.
Other information
- Density: 0.846 - 0.853 g/cm³
- Flammability class: Combustible IIIA estimated
- Molecular formula: C₁₀H₂₀O₂
- Molecular weight: 172.26
- Specific gravity: 0.846 - 0.853 at 25°C

10. Stability and reactivity
Reactivity: The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability: Material is stable under normal conditions.
Possibility of hazardous reactions: No dangerous reaction known under conditions of normal use.
Conditions to avoid: Avoid heat, sparks, open flames and other ignition sources. Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials: Strong oxidizing agents.
Hazardous decomposition products: No hazardous decomposition products are known.

11. Toxicological information
Information on likely routes of exposure
- Inhalation: No adverse effects due to inhalation are expected.
- Skin contact: No adverse effects due to skin contact are expected.
- Eye contact: Direct contact with eyes may cause temporary irritation.
- Ingestion: Expected to be a low ingestion hazard.

Symptoms related to the physical, chemical and toxicological characteristics
- Direct contact with eyes may cause temporary irritation.

Information on toxicological effects
Acute toxicity
<table>
<thead>
<tr>
<th>Product: LEAF ALCOHOL (ETHYL) ACETAL (CAS 28069-74-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute</strong></td>
</tr>
<tr>
<td>Dermal Liquid</td>
</tr>
<tr>
<td>LD50 Rabbit</td>
</tr>
<tr>
<td>Oral Liquid</td>
</tr>
<tr>
<td>LD50 Rat</td>
</tr>
<tr>
<td>Test Results:</td>
</tr>
<tr>
<td>Acute Dermal Liquid LD50 Rabbit &gt; 5000 mg/kg</td>
</tr>
<tr>
<td>Acute Oral Liquid LD50 Rat &gt; 5000 mg/kg</td>
</tr>
</tbody>
</table>

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation
- Prolonged skin contact may cause temporary irritation.

Irritation Corrosion - Skin
- LEAF ALCOHOL (ETHYL) ACETAL 10 % Patch test, Vehicle Petrolatum.
- Result: No irritation observed.
- Species: Human
- Organ: Skin
- Notes: RIFM

Serious eye damage/eye irritation
- Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization
- Respiratory sensitization: Not a respiratory sensitizer.
- Skin sensitization: This product is not expected to cause skin sensitization.
Skin sensitization
LEAF ALCOHOL (ETHYL) ACETAL 10 % Patch test, Vehicle Petrolatum.
Result: Not sensitizing.
Species: Human
Organ: Skin
Notes: RIFM

Germ cell mutagenicity
No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Germ cell mutagenicity: Ames test
LEAF ALCOHOL (ETHYL) ACETAL < 5000 µg/plate, Strains TA 1535, TA 1537, TA 98, TA 100 and TA 102 with and without metabolic activation. Result for similar material (E)-1-(1-Methoxypropoxy)hex-3-ene.
Result: Not mutagenic.
Species: Salmonella typhimurium
Notes: RIFM

Carcinogenicity
This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity
Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)
Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens
Not listed.

Reproductive toxicity
This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure
Not classified.

Specific target organ toxicity - repeated exposure
Not classified.

Aspiration hazard
Not an aspiration hazard.

12. Ecological information

Ecotoxicity
The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Persistence and degradability
No data is available on the degradability of this product.

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)

Mobility in soil
No data available.

Other adverse effects
No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions
Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations
Dispose in accordance with all applicable regulations.

Hazardous waste code
The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products
Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging
Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT
Not regulated as dangerous goods.
IATA
Not regulated as dangerous goods.

IMDG
Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not established.

15. Regulatory information

US federal regulations
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)
Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)
Not listed.

SARA 304 Emergency release notification
Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)
Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)
Hazard categories
Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - Yes
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance
Not listed.

SARA 311/312 Hazardous chemical
Yes

SARA 313 (TRI reporting)
Not regulated.

Other federal regulations
Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List
Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)
Not regulated.

Safe Drinking Water Act (SDWA)
Not regulated.

International Inventories

Country(s) or region  Inventory name  On inventory (yes/no)*
Australia  Australian Inventory of Chemical Substances (AICS)  Yes
Canada  Domestic Substances List (DSL)  Yes
Canada  Non-Domestic Substances List (NDSL)  No
China  Inventory of Existing Chemical Substances in China (IECSC)  Yes
Europe  European Inventory of Existing Commercial Chemical Substances (EINECS)  Yes
Europe  European List of Notified Chemical Substances (ELINCS)  No
Japan  Inventory of Existing and New Chemical Substances (ENCS)  Yes
Korea  Existing Chemicals List (ECL)  No
New Zealand  New Zealand Inventory  Yes
Philippines  Philippine Inventory of Chemicals and Chemical Substances (PICCS)  Yes
Taiwan  Taiwan Toxic Chemical Substances (TCS)  Yes

Material name: LEAF ALCOHOL (ETHYL) ACETAL
Version #: 03  Revision date: 13-September-2018  Issue date: 21-May-2015
SDS US 6 / 7
Country(s) or region: United States & Puerto Rico
Inventory name: Toxic Substances Control Act (TSCA) Inventory
On inventory (yes/no)*: Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s). A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date: 21-May-2015
Revision date: 13-September-2018
Version #: 03

Disclaimer: Bedoukian Research cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user’s responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

Revision information: Identification: Recommended restrictions
GHS: Listing