SAFETY DATA SHEET

1. Identification

Product identifier NOOTKATONE (CRYSTALS 98+%)  
Other means of identification  
BRI Product Code 801  
FEMA number 3166  
Synonyms 2(3H)-Naphthalenone, 4,4a,5,6,7,8-hexahydro-4,4a-dimethyl-6-(1-methyleneyl)-, (4R,4aS,6R)-  
Recommended use flavors and fragrances  
For Manufacturing Use Only  
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 21 Finance Drive  
Company name 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 Not classified.  
Health hazards Not classified.  
Environmental hazards Not classified.  
OSHA defined hazards Not classified.  

Label elements  
Hazard symbol None.  
Signal word None.  
Hazard statement The substance does not meet the criteria for classification.  

Precautionary statement  
Prevention Observe good industrial hygiene practices.  
Response Wash hands after handling.  
Storage Store away from incompatible materials.  
Disposal Dispose of waste and residues in accordance with local authority requirements.  

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>NOOTKATONE (CRYSTALS 98+%)</td>
<td>2(3H)-Naphthalenone, 4,4a,5,6,7,8-hexahydro-4,4a-dimethyl-6-(1-methyleneyl)-, (4R,4aS,6R)-</td>
<td>4674-50-4</td>
<td>100</td>
</tr>
</tbody>
</table>

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.
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**
Direct contact with eyes may cause temporary irritation.

**Indication of immediate medical attention and special treatment needed**
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

**Suitable extinguishing media**
Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).

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

**Specific hazards arising from the chemical**
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**
Use water spray to cool unopened containers.

**Specific methods**
Use standard firefighting procedures and consider the hazards of other involved materials.

**General fire hazards**
No unusual fire or explosion hazards noted.

6. Accidental release measures

**Personal precautions, protective equipment and emergency procedures**
Keep unnecessary personnel away. For personal protection, see section 8 of the SDS.

**Methods and materials for containment and cleaning up**
Stop the flow of material, if this is without risk. Following product recovery, flush area with water.
For waste disposal, see section 13 of the SDS.

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

7. Handling and storage

**Precautions for safe handling**
Observe good industrial hygiene practices.

**Conditions for safe storage, including any incompatibilities**
Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS). Recommended Packaging: Glass, Plastic, Aluminum or Phenolic Lined Steel. Store tightly sealed under inert gas below 0 deg. C

8. Exposure controls/personal protection

**Occupational exposure limits**
No exposure limits noted for ingredient(s).

**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**

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

**Other**
Wear suitable protective clothing.

**Respiratory protection**
In case of insufficient ventilation, wear suitable respiratory equipment.

**Thermal hazards**
Wear appropriate thermal protective clothing, when necessary.
9. Physical and chemical properties

Appearance
- Physical state: Solid.
- Color: White
- Odor: citrus, grapefruit odor.
- Odor threshold: Not available.
- pH: Not available.
- Melting point/freezing point: 89.6 °F (32 °C)
- Flash point: 230 °F (110 °C) Pensky-Martens or Grabner Miniflash
- Evaporation rate: Not available.
- Flammability (solid, gas): Not available.
- 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: 0.000666 mmHg at 20°C; US EPA. 2014. Estimation Programs Interface Suite™ for Microsoft® Windows, v 4.11. US EPA, Washington, DC, USA.
- Vapor density: 7.5 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:
  - Flammability class: Combustible IIIB estimated
  - Molecular formula: C15H22O
  - Molecular weight: 218.34

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: 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</th>
<th>Species</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOOTKATONE (CRYSTALS 98+) (CAS 4674-50-4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dermal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Liquid</td>
<td></td>
</tr>
<tr>
<td>LD50</td>
<td>Rabbit</td>
<td>&gt; 5000 mg/kg</td>
</tr>
<tr>
<td></td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Liquid</td>
<td></td>
</tr>
<tr>
<td>LD50</td>
<td>Rat</td>
<td>&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.

<table>
<thead>
<tr>
<th>Irritation Corrosion - Skin</th>
<th>10 % Patch test, Vehicle Petrolatum. Result for 98% pure Nootkatone. Result: No irritation observed. Species: Human Organ: Skin Notes: RIFM</th>
</tr>
</thead>
</table>

**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.

<table>
<thead>
<tr>
<th>Skin sensitization</th>
<th>10 % Patch test, Vehicle Petrolatum. Result for 98% pure Nootkatone. Result: Not sensitizing. Species: Human Organ: Skin Notes: RIFM</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th>Germ cell mutagenicity: Ames test</th>
<th>&lt; 150 µg/plate, Strains TA 1535, TA 1537 or TA 97, TA 98, TA 100, TA 102 with metabolic activation. Vehicle DMSO. Result: Not mutagenic. Species: Salmonella typhimurium Notes: RIFM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 50 µg/plate, Strains TA 1535, TA 1537 or TA 97, TA 98, TA 100, TA 102 without metabolic activation. Vehicle DMSO. Result: Not mutagenic. Species: Salmonella typhimurium Notes: RIFM</td>
</tr>
</tbody>
</table>

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

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.

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 applicable.

15. Regulatory information

US federal regulations  This product is not known to be 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.


Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories  Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No
SARA 302 Extremely hazardous substance
Not listed.
SARA 311/312 Hazardous chemical
No
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.

US state regulations
US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)
Not listed.
US. Massachusetts RTK - Substance List
Not regulated.
US. New Jersey Worker and Community Right-to-Know Act
Not listed.
US. Pennsylvania Worker and Community Right-to-Know Law
Not listed.
US. Rhode Island RTK
Not regulated.
US. California Proposition 65
California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

<table>
<thead>
<tr>
<th>Country(s) or region</th>
<th>Inventory name</th>
<th>On inventory (yes/no)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Australian Inventory of Chemical Substances (AICS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
<td>Domestic Substances List (DSL)</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
<td>Non-Domestic Substances List (NDSL)</td>
<td>No</td>
</tr>
<tr>
<td>China</td>
<td>Inventory of Existing Chemical Substances in China (IECSC)</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe</td>
<td>European Inventory of Existing Commercial Chemical Substances (EINECS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe</td>
<td>European List of Notified Chemical Substances (ELINCS)</td>
<td>No</td>
</tr>
<tr>
<td>Japan</td>
<td>Inventory of Existing and New Chemical Substances (ENCS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Korea</td>
<td>Existing Chemicals List (ECL)</td>
<td>No</td>
</tr>
<tr>
<td>New Zealand</td>
<td>New Zealand Inventory</td>
<td>Yes</td>
</tr>
<tr>
<td>Philippines</td>
<td>Philippine Inventory of Chemicals and Chemical Substances (PICCS)</td>
<td>Yes</td>
</tr>
<tr>
<td>United States &amp; Puerto Rico</td>
<td>Toxic Substances Control Act (TSCA) Inventory</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*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).

IFRA restriction
There is an IFRA guideline regarding this product. Please visit www.ifraorg.org for the full text of the guideline, or contact Bedoukian Research, Inc. for more information.

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

Issue date 05-20-2015
Version # 01

Disclaimer
BRI 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.