1. IDENTIFICATION

1.1. Product identification

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Bio-based succinic acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical name</td>
<td>succinic acid</td>
</tr>
<tr>
<td></td>
<td>butanedioic acid</td>
</tr>
<tr>
<td>CAS number</td>
<td>110-15-6</td>
</tr>
<tr>
<td>EC number</td>
<td>203-740-4</td>
</tr>
</tbody>
</table>

1.2. Relevant identified uses of the substance or mixture and uses advised against

Applications
Intermediate

Identified uses
Manufacture via a fermentation procedure
Industrial distribution
Formulation (chemical products for water treatment)
Formulation (welding products)
Final industrial use (pH regulator, flocculating agent, precipitant, neutralisation agent, other non-specified)
Final industrial use (water treatment)
Final industrial use (welding products)
Final industrial use (monomeric)
Final industrial use (intermediate in a formulation)
Final industrial use (esterification and other synthesis processes)
Final industrial use (hydrogenation)
Final industrial use (food additives)

1.3. Details of the supplier

Name               BIOAMBER Inc.
Manufactured at    Route de Pomacle, 51110 BAZANCOURT, FRANCE
Phone              +1 519-344-0065 #110
Contact email      Sarnia.CustomerService@bio-amber.com

1.4. Emergency phone number

For Hazardous Materials Incidents
Spill, Leak, Fire, Exposure, or Accident:
Call CHEMTREC Day or Night
Within USA and Canada: 1-800-424-9300
Outside USA and Canada: +1 703-527-3887 (collect calls accepted)

2. HAZARD IDENTIFICATION

2.1. Classification of the substance

2.1.1. Classification of the substance according to OSHA HCS 2012

Eye Damage Category 1 Causes serious eye damage

2.1.2. Classification of the substance according to HMIS Classification

Health hazard: 2
2.1.3. Classification of the substance according to NFPA Rating
Health: 2
Flammability: 0
Instability: 0

2.1.4. Classification of the substance according to WHMIS
Class D2B (eye irritation)

2.2. Labelling elements according to OSHA HCS 2012
Symbol

Signal word
Danger

Hazard statement
Causes serious eye damage

Precaution statements
Wear eye protection/face protection.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Immediately call a physician.

2.3. Other dangers
Potential effects on health (not fulfilling the criteria for classification):
Inhalation: May be harmful if inhaled. Causes respiratory tract irritation.
Cutaneous: May cause skin irritation.
Ingestion: May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Common name/Synonyms</th>
<th>CAS number</th>
<th>EC number</th>
<th>[%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Succinic acid</td>
<td>Butanedioic acid/Bio-based succinic acid</td>
<td>110-15-6</td>
<td>203-740-4</td>
<td>98-100</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

4.1. First aid description
General instructions
Consult a doctor. Show this safety data sheet to the doctor to help him/her provide the right assistance. Move away from the danger zone.
If inhaled, get the person in question into fresh air. If they are no longer breathing, perform artificial respiration. Consult a doctor.

Rinse with soap and plenty of water. Consult a doctor.

Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a physician.

Never administer anything by mouth to an unconscious person. Rinse the mouth with water. Consult a doctor.

4.2. Principal symptoms and effects, both acute and delayed

Eye contact will result in strong irritation. No known delayed effects.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

5. FIREFIGHTING MEASURES

5.1. Extinguishing methods

Appropriate: water jet, alcohol-resistant foam, dry chemical products or carbon dioxide.

5.2. Specific hazards from the substance or mixtures

Hazardous decomposition products formed under fire conditions - Carbon oxides

Wear self-contained breathing apparatus if necessary.

6. ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

Use personal protection equipment. Avoid producing dust. Avoid breathing in dust. Ensure that ventilation is adequate.

Do not let the product get into the drains.

Gather and dispose of without creating dust. Store in closed containers that are appropriate for disposal.

7. HANDLING AND STORAGE

7.1. Precautions to be taken for safe handling

Avoid contact with skin and eyes. Avoid producing dust or aerosols. Provide appropriate ventilation in locations where dust is generated. The usual preventive measures for protecting against fire.

7.2. Safe storage conditions, including any

Use tightly sealed containers and store them in a dry and well-ventilated space.
8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters
Exposure limits
OSHA: Not established
ACGIH: Not established

8.2. Personal protection
Appropriate engineering measures
No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Personal protection equipment
Eye/face protection: Wear eye protection/face protection.

Skin/hand protection: Wear gloves when handling. Select bodily protection measures depending on the quantity and concentration of the hazardous substance in the workplace.

Respiratory protection: If the risk assessment shows that gas masks with air purifying filters are appropriate, use a type N95 mask (US) or a type P3 (EN 143) respirator. Use masks that have been tested and approved to the appropriate standards such as NIOSH (US) or CEN (EU).

Hygiene measures: Handle in accordance with industrial good hygiene and safety practices. Wash hands before breaks and at the end of the day.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information about the essential physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state</td>
<td>Powder</td>
</tr>
<tr>
<td>Colour</td>
<td>White</td>
</tr>
<tr>
<td>Odour</td>
<td>Odourless</td>
</tr>
<tr>
<td>Olfactory threshold</td>
<td>Not determined</td>
</tr>
<tr>
<td>pH</td>
<td>2.4 to 2.8 (1% aqueous solution)</td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>185 to 187°C</td>
</tr>
<tr>
<td>Boiling point</td>
<td>235°C</td>
</tr>
<tr>
<td>Flash point</td>
<td>Not applicable. The flash point is a property that is relevant for liquids and solids with low melting points. Succinic acid has a melting point above 185°C.</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>Not determined</td>
</tr>
</tbody>
</table>
Flammability (solid, gas)  Succinic acid is non-flammable. Practical experience with this substance has shown that succinic acid is not pyrophoric and does not emit flammable gases when it comes into contact with water.

Upper/lower flammability limits or explosive limits  Not determined

Vapour pressure  0.000025 Pa (25°C)
Vapour density  Not determined
Relative density  0.9 (at 20°C)
Solubility in water  83 g/L (at 25°C)
In other solvents  Not determined
Partition coefficient: n-octanol/water  Log K_{ow} = -0.59
Auto-ignition temperature  No auto-ignition temperature could be determined up to 220°C, a temperature that is already above the melting point.
Decomposition temperature  Not determined

Viscosity  Not applicable. Succinic acid is a solid.
Explosive properties  Not applicable. Succinic acid does not contain any chemical groups that are associated with explosiveness. Succinic acid is not expected to be sensitive to static discharge.
Oxidising properties  Not applicable. Succinic acid does not contain any chemical structures that would suggest oxidising properties.

9.2. Other information
Kst, Pmax: Kst = 51 bar.m/s - Pmax = 7.4 bar
Minimum energy for inflammability > 1000 mJ
Inflammability temperature (cloud) min. 620°C

10. STABILITY AND REACTIVITY

10.1. Reactivity  Succinic acid does not become liquid during transport. It is therefore exempt from corrosiveness tests with respect to metals.

10.2. Chemical stability  Stable under the recommended storage conditions.

10.3. Potential for dangerous reactions  Under normal conditions of storage and use, hazardous polymerization will not occur

10.4. Conditions to be avoided  Not available.

10.5. Incompatible materials  Bases, oxidising agents, reducing agents

10.6. Dangerous decomposition products  In the event of a fire: carbon dioxide and carbon monoxide
### 11. TOXICOLOGICAL INFORMATION

#### 11.1. Information about toxicological effects

<table>
<thead>
<tr>
<th>Routes of Entry</th>
<th>Inhalation, ingestion, and dermal and eye contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity</td>
<td>The acute toxicity of succinic acid is low:</td>
</tr>
<tr>
<td></td>
<td>- <strong>oral</strong>:</td>
</tr>
<tr>
<td></td>
<td>Results of studies into rats by Fisher 344 (Guideline OECD 401)</td>
</tr>
<tr>
<td></td>
<td>LD$_{50}$ (rat, oral): 6740 mg/kg bw</td>
</tr>
<tr>
<td></td>
<td>- <strong>cutaneous</strong>:</td>
</tr>
<tr>
<td></td>
<td>Not determined</td>
</tr>
<tr>
<td></td>
<td>- <strong>inhalation</strong>:</td>
</tr>
<tr>
<td></td>
<td>Results of studies into rats by Sprague-Dawley (Guideline OECD 403)</td>
</tr>
<tr>
<td></td>
<td>LC$_{50}$ (rat, inhalation): 1284 mg/m³ air</td>
</tr>
<tr>
<td>Skin corrosion/skin irritation</td>
<td>Results of studies into rabbits (Guideline OECD 404, EU B.4): not irritant.</td>
</tr>
<tr>
<td>Severe eye injuries/eye irritation</td>
<td>Results of studies into rabbits (Guideline OECD 405, EU B.5): strong irritant.</td>
</tr>
<tr>
<td>Respiratory or cutaneous sensitisation</td>
<td>Respiratory:</td>
</tr>
<tr>
<td></td>
<td>Comparative reading of the results for fumaric acid indicates that there will be no topical effects on the respiratory system.</td>
</tr>
<tr>
<td></td>
<td><strong>Cutaneous</strong>:</td>
</tr>
<tr>
<td></td>
<td>Local lymph node assay (LLNA): non-sensitising</td>
</tr>
<tr>
<td></td>
<td>Guinea pig maximisation test (GPMT): non-sensitising</td>
</tr>
</tbody>
</table>

| Stem cell mutagenicity   | Result of the Ames test: negative                 |
|                          | Result of the chromosomal aberration test: negative |

| Carcinogenicity          | Results of studies into rats by Fisher 344 (Guideline OECD 451): comparative reading of the results for succinate indicates there will be neither toxicity nor carcinogenic activity. |
|                          | NOAEL$_{oral}$: 860 mg/kg bw/day                  |
|                          | NTP: Not listed                                   |
|                          | IARC: Not listed                                  |
|                          | OSHA: Not listed                                  |

| Reproductive toxicity    | There are no indications of any toxicity in terms of reproduction or development. |

| Teratogenicity/Embryotoxicity | There are no indications of any toxicity in terms of teratogenicity or embryotoxicity. |

| Specific toxicity for various target organs - single exposure | Not determined |

| Specific toxicity for various target organs - repeated exposure | Oral: Results of studies into rats (Guideline OECD 408): NOAEL: 860 mg/kg bw/day (chronic; rat) |
Hazards due to aspiration: Not applicable. Succinic acid is a solid.
Toxicologically Synergistic Materials: Not available

11.2. Potential health effects
- Inhalation: May be harmful if inhaled. Causes respiratory tract irritation.
- Ingestion: May be harmful if swallowed.
- Cutaneous: May cause skin irritation.
- Eye: Strong irritant. Causes serious eye damage.

12. ECOLOGICAL INFORMATION

12.1. Toxicity
No dangers have been identified at biologically relevant concentrations.

Aquatic toxicity
- Acute toxicity, fish (Guideline OECD 203): 
  LC_{50} fresh water (Danio rerio) 96h >100 mg/L.
- Acute toxicity, invertebrates (Guideline OECD 202): 
  EC_{50} 48h fresh water (Daphnia magna) in a test with pH adjustment >100 mg/L.
- Acute toxicity, algae (Guideline OECD 201): 
  EC_{50} 72h fresh water (Pseudokirchnerella subcapitata) >100 mg/L.
  NOEC 100 mg/L.
- Toxicity to micro-organisms (Guideline OECD 209): 
  EC_{50} 3h fresh water (activated sludge) >300 mg/L.

12.2. Persistence and degradability
Results of a study into biodegradability in water (Guideline OECD 301 E): easily biodegradable

12.3. Bioaccumulation potential
Log Kow < 4.5: non-bioaccumulating

12.4. Mobility in the soil
The substance only has a weak adsorption potential

12.5. Results of PBT and vPvB evaluations
The substance is neither persistent, nor bioaccumulating, nor toxic

12.6. Other undesirable effects
None known.

13. DISPOSAL CONSIDERATIONS

13.1. Waste handling methods
Respect the regulations in force. Contact an accredited service professional for disposal of this product.
Contaminated packaging: dispose of with unused product
14. INFORMATION FOR TRANSPORT

<table>
<thead>
<tr>
<th>Transport by land (ADR/RID)</th>
<th>Transport by river (ADN)</th>
<th>Transport by sea (IMDG)</th>
<th>Transport by air (ICAO-TI / IATA-DGR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.1. UN number</td>
<td>Not regulated for transport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.2. UN shipping name</td>
<td>Not regulated for transport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.3. Hazard class or classes</td>
<td>Not regulated for transport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.4. Packaging group</td>
<td>Not regulated for transport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.5. Environmental hazards:</td>
<td>Not regulated for transport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.6. Classification</td>
<td>Non-hazardous goods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.7. Additional information</td>
<td>Not regulated for transport</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14.8. Specific precautions to be taken by the user
Not Available

14.9. Bulk transport in accordance with Appendix II of MARPOL 73/78 and the IBC Code
Not Applicable

15. REGULATORY INFORMATION

15.1 Regulations/legislation specific to the substance or mixture regarding safety, health and the environment

International regulations
This product is found on the following international chemical substances lists:

<table>
<thead>
<tr>
<th>Countries</th>
<th>Lists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>AICS</td>
</tr>
<tr>
<td>Canada</td>
<td>DSL</td>
</tr>
<tr>
<td>China</td>
<td>IECS</td>
</tr>
<tr>
<td>European Union</td>
<td>EINECS</td>
</tr>
<tr>
<td>Japan</td>
<td>ENCS</td>
</tr>
<tr>
<td>Korea</td>
<td>ECL</td>
</tr>
<tr>
<td>Philippines</td>
<td>PICCS</td>
</tr>
<tr>
<td>United States</td>
<td>TSCA</td>
</tr>
<tr>
<td>New Zealand</td>
<td>NZIoC</td>
</tr>
</tbody>
</table>

Canada:
WHMIS: Class D2B (Eye irritation)
- DSL Status: All the components of this product can be found on the Canadian DSL list
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

USA:
This product has been classified in accordance with the 2012 hazard criteria of the Occupational Safety and Health Administration’s (OSHA) Hazard Communication Standard (HCS) and the SDS contains all the information required by the 29 CFR § 1910.1200.

- SARA 302: None of the chemical components of this material are subject to the reporting requirements of SARA Title III, Section 302.
- SARA 313: This material does not contain any CAS chemical constituents that are known to exceed the threshold established by SARA Title III, Section 313.
- SARA 311/312 Hazards: Acute Health Hazard
  - Massachusetts Right To Know Components: None of the chemical components of this material are subject to the requirements of the Massachusetts Right to Know Act.
- Pennsylvania Right To Know Components
  - Succinic acid: CAS number 110-15-6
    Revision Date
- New Jersey Right To Know Components:
  - Succinic acid: CAS number 110-15-6
    Revision Date
- California Prop. 65 Components:
  This product does not contain any chemical substances known in the state of California to cause cancer, congenital malformations or any other reproductive damage.

16. OTHER INFORMATION

16.1. Information about the revision
  SDS created on July 3 2012.

16.2. Meanings of the abbreviations and acronyms used
  ACGIH: American conference of Governmental Industrial Hygienists
  ADN/ADNR: regulations relating to the transportation of hazardous substances in barges on navigable waterways
  ADR/RID: European agreement relating to international transport of hazardous goods by road/regulations relating to the international transport of hazardous goods by rail
  CAS number: Chemical Abstract Service number
  CEN: European Committee for Standardisation
  CLP: classification, labelling and packaging
  DSL: Domestic Substances List
  EC number: European Commission number
  EC_{50}: Effective Concentration – 50%
  EU: European Union
  HCS: Hazard Communication Standard
  HMIS: Hazardous Material Information System
  IARC: International Agency for Research on Cancer
  IATA-DGR: International Air Transport Association – Dangerous Goods Regulations
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