SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

<table>
<thead>
<tr>
<th>Product form</th>
<th>Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade name</td>
<td>BRONTIDE</td>
</tr>
<tr>
<td>Chemical name</td>
<td>(R)-(-)-butane-1,3-diol</td>
</tr>
<tr>
<td>IUPAC name</td>
<td>butane-1,3-diol</td>
</tr>
<tr>
<td>EC-No.</td>
<td>228-532-0</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>6290-03-5</td>
</tr>
<tr>
<td>REACH registration No</td>
<td>Registration in progress</td>
</tr>
<tr>
<td>Formula</td>
<td>C4H10O2</td>
</tr>
<tr>
<td>Synonyms</td>
<td>1,3-Butanediol, (R)-; butylene glycol; 1,3-Butanediol, (3R)-; BUTANE-1,3-DIOL, (R)-(-)-</td>
</tr>
</tbody>
</table>

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

1.2.1. Relevant identified uses

Use of the substance/mixture

- Formulation into cosmetic and food products
- Use as intermediate in chemical, pharmaceutical and polymer industry
- Use as monomer in polymer industry
- Use of cosmetic products by professionals
- Use in cosmetics, perfumes/fragrances and personal care products
- Use as components in pharmaceuticals
- Use in washing and cleaning products by consumers and workers

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

Supplier:
Genomatica
4757 Nexus Center Drive
San Diego, CA 92121
(858) 652-5349

Manufacturer:
EW-Biotech
Am Haupttor, Bau 3668
06237 Leuna - Germany
T +(49 (0) 3461 43-8590
info@ew-biotech.com

1.4. Emergency telephone number

Emergency number: 858-362-8580

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]
Not classified

Adverse physicochemical, human health and environmental effects
No additional information available

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]
No labelling applicable

2.3. Other hazards not contributing to the classification

This substance/mixture does not meet the PBT criteria of REACH regulation, annex XIII
This substance/mixture does not meet the vPvB criteria of REACH regulation, annex XIII
**SECTION 3: Composition/information on ingredients**

### 3.1. Substances

<table>
<thead>
<tr>
<th>Name</th>
<th>Product identifier</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>(R)-(-)-Butane-1,3-diol</td>
<td>(CAS-No.) 6290-03-5</td>
<td>99 - 100</td>
</tr>
<tr>
<td></td>
<td>(EC-No.) 228-532-0</td>
<td></td>
</tr>
</tbody>
</table>

### 3.2. Mixtures

Not applicable

**SECTION 4: First aid measures**

### 4.1. Description of first aid measures

- **First-aid measures after inhalation**: Remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical advice/attention.
- **First-aid measures after skin contact**: Wash skin with plenty of water and soap. Seek medical attention if irritation develops.
- **First-aid measures after eye contact**: Check for and remove contact lenses. Immediately flush eyes thoroughly with water for at least 15 minutes. Seek medical attention if irritation develops.
- **First-aid measures after ingestion**: Do not induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth out with water. In all cases of doubt, or when symptoms persist, seek medical attention.

### 4.2. Most important symptoms and effects, both acute and delayed

- **Symptoms/effects**: Not expected to present a significant hazard under anticipated conditions of normal use.

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

Treat symptomatically.

**SECTION 5: Firefighting measures**

### 5.1. Extinguishing media

- **Suitable extinguishing media**: For small fire: Dry powder. For large fire: Water spray. Water fog. Foam.
- **Unsuitable extinguishing media**: Do not use water jet.

### 5.2. Special hazards arising from the substance or mixture

- **Fire hazard**: May be combustible at high temperature.
- **Explosion hazard**: None known.
- **Hazardous decomposition products in case of fire**: Carbon dioxide. Carbon monoxide.

### 5.3. Advice for firefighters

No additional information available

**SECTION 6: Accidental release measures**

### 6.1. Personal precautions, protective equipment and emergency procedures

#### 6.1.1. For non-emergency personnel

- **Protective equipment**: Use personal protective equipment as required.
- **Emergency procedures**: Evacuate unnecessary personnel.

#### 6.1.2. For emergency responders

- **Protective equipment**: Wear recommended personal protective equipment. For further information refer to section 8: “Exposure controls/personal protection”.
- **Emergency procedures**: Ventilate area.

### 6.2. Environmental precautions

Prevent entry to sewers and public waters.

### 6.3. Methods and material for containment and cleaning up

- **Methods for cleaning up**: For small spills: dilute with small amount of water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Large spills: Contain and/or absorb spill with inert material (sand, vermiculite or other appropriate material), then place in suitable container. Flush residue with large amounts of water. Dispose in a safe manner in accordance with local/national regulations.

### 6.4. Reference to other sections

For further information refer to section 8: “Exposure controls/personal protection”. For disposal of residues refer to section 13: “Disposal considerations”.

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7 December 2017  EN (English)  2/6
SECTION 7: Handling and storage

7.1. Precautions for safe handling
Precautions for safe handling: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Hygiene measures: Handle in accordance with good industrial hygiene and safety practice. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work.

7.2. Conditions for safe storage, including any incompatibilities
Storage conditions: Store tightly closed in a dry, cool and well-ventilated place.


7.3. Specific end use(s)
Refer to section 1.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters
No additional information available

8.2. Exposure controls
Appropriate engineering controls:
Provide local exhaust or general room ventilation.

Hand protection:
Chemical resistant gloves (according to European standard NF EN 374 or equivalent)

Eye protection:
Use eye protection to EN 166, designed to protect against liquid splashes

Skin and body protection:
Wear suitable protective clothing. Chemical resistant suit.

Respiratory protection:
Not required for normal conditions of use. In case of insufficient ventilation, wear suitable respiratory equipment. Approved organic vapour respirator

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties
Physical state: Liquid
Appearance: Clear.
Colour: Colourless.
Odour: Odourless.
Odour threshold: No data available
pH: No data available
Relative evaporation rate (butylacetate=1): No data available
Melting point: No data available
Freezing point: < -50 °C at 101.3 kPa
Boiling point: 207.5 °C at 101.3 kPa
Flash point: 121 °C at 1013 hPa
Auto-ignition temperature: 395 °C at 1013 hPa
Decomposition temperature: No data available
flammability (solid, gas): Not applicable
Vapour pressure: >8 - <10 Pa at 20 °C
Relative vapour density at 20 °C: No data available
Relative density: ≥1.004 - ≤1.006 g/cm³ at 20 °C
Solubility: Water: ~999800 mg/l at 25 °C
Log Pow: No data available
Log Kow: ≥-0.92 - ≤-0.08 at 25 °C
Viscosity, kinematic: >96 - <98 mm²/s at 25 °C
Viscosity, dynamic: No data available
Explosive properties: Product is not explosive.
Oxidising properties: Not oxidising.
Explosive limits: Not applicable

9.2. Other information
No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity
No dangerous reactions known under normal conditions of use.

10.2. Chemical stability
Stable in use and storage conditions as recommended in item 7.

10.3. Possibility of hazardous reactions
No dangerous reactions known under normal conditions of use.

10.4. Conditions to avoid
No additional information available

10.5. Incompatible materials

10.6. Hazardous decomposition products
On combustion forms: Carbon oxides (CO, CO₂).

SECTION 11: Toxicological information

11.1. Information on toxicological effects

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity (oral)</td>
<td>Not classified (Conclusive but not sufficient for classification)</td>
</tr>
<tr>
<td>Acute toxicity (dermal)</td>
<td>Not classified (Conclusive but not sufficient for classification)</td>
</tr>
<tr>
<td>Acute toxicity (inhalation)</td>
<td>Not classified (Conclusive but not sufficient for classification)</td>
</tr>
</tbody>
</table>

(R)-(-)-butane-1,3-diol (6290-03-5)

LD₅₀ oral rat ≈ 22800 mg/kg bodyweight (results obtained on a similar substance)

Skin corrosion/irritation: Not classified (On basis of test data)
Serious eye damage/irritation: Not classified (On basis of test data)
Respiratory or skin sensitisation: Not classified (Conclusive but not sufficient for classification)
Germ cell mutagenicity: Not classified (Conclusive but not sufficient for classification)
Carcinogenicity: Not classified (Conclusive but not sufficient for classification)

(R)-(-)-butane-1,3-diol (6290-03-5)

NOAEL (chronic, oral, animal/male, 2 years) ≈ 5000 mg/kg bodyweight rat (results obtained on a similar substance)

Reproductive toxicity: Not classified (Conclusive but not sufficient for classification)

(R)-(-)-butane-1,3-diol (6290-03-5)

NOAEL (animal/male, F₀/P) ≈ 5000 mg/kg bodyweight rat (results obtained on a similar substance)
STOT-single exposure: Not classified (Conclusive but not sufficient for classification)
STOT-repeated exposure: Not classified (Conclusive but not sufficient for classification)
Aspiration hazard: Not classified (Conclusive but not sufficient for classification)

(R)-(-)-butane-1,3-diol (6290-03-5)

Viscosity, kinematic: 96 - 98 mm²/s at 25 °C

SECTION 12: Ecological information

12.1. Toxicity

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute aquatic toxicity</td>
<td>Not classified</td>
</tr>
<tr>
<td>Chronic aquatic toxicity</td>
<td>Not classified</td>
</tr>
</tbody>
</table>

(R)-(-)-butane-1,3-diol (6290-03-5)

LC₅₀ fish 1 > 100 mg/l (based on mortality) (results obtained on a similar substance)
EC₅₀ Daphnia 1 > 1000 mg/l (based on mobility) (results obtained on a similar substance)
EC₅₀ 72h algae (1) > 1070 mg/l Selenastrum sp. (based on growth rate) (results obtained on a similar substance)
NOEC chronic crustacea 85 mg/l 21 d - Daphnia magna (based on reproduction) (results obtained on a similar substance)

12.2. Persistence and degradability

(R)-(-)-butane-1,3-diol (6290-03-5)

Persistence and degradability: Readily biodegradable.
12.3. Bioaccumulative potential

<table>
<thead>
<tr>
<th>(R)-(-)-butane-1,3-diol (6290-03-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log Kow</td>
</tr>
<tr>
<td>Bioaccumulative potential</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

No additional information available

12.5. Results of PBT and vPvB assessment

<table>
<thead>
<tr>
<th>(R)-(-)-butane-1,3-diol (6290-03-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results of PBT assessment</td>
</tr>
</tbody>
</table>

12.6. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste treatment methods : Disposal must be done according to official regulations.
Product/Packaging disposal recommendations : Handle uncleaned empty containers as full ones.

SECTION 14: Transport information

In accordance with ADR / RID / IMDG / IATA / ADN

<table>
<thead>
<tr>
<th>ADR</th>
<th>IMDG</th>
<th>IATA</th>
<th>ADN</th>
<th>RID</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.1. UN number</td>
<td>Not regulated</td>
<td>Not regulated</td>
<td>Not regulated</td>
<td>Not regulated</td>
</tr>
<tr>
<td>14.2. UN proper shipping name</td>
<td>Not regulated</td>
<td>Not regulated</td>
<td>Not regulated</td>
<td>Not regulated</td>
</tr>
<tr>
<td>14.3. Transport hazard class(es)</td>
<td>Not regulated</td>
<td>Not regulated</td>
<td>Not regulated</td>
<td>Not regulated</td>
</tr>
<tr>
<td>14.4. Packing group</td>
<td>Not regulated</td>
<td>Not regulated</td>
<td>Not regulated</td>
<td>Not regulated</td>
</tr>
<tr>
<td>14.5. Environmental hazards</td>
<td>Not regulated</td>
<td>Not regulated</td>
<td>Not regulated</td>
<td>Not regulated</td>
</tr>
</tbody>
</table>

14.6. Special precautions for user

- Overland transport
  Not regulated
- Transport by sea
  Not regulated
- Air transport
  Not regulated
- Inland waterway transport
  Not regulated
- Rail transport
  Not regulated

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

Not applicable
SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1. EU-Regulations

No REACH Annex XVII restrictions
(R)-(-)-butane-1,3-diol is not on the REACH Candidate List
(R)-(-)-butane-1,3-diol is not on the REACH Annex XIV List

15.1.2. National regulations

Germany
12th Ordinance Implementing the Federal Immission Control Act - 12.BImSchV : Is not subject of the 12. BImSchV (Hazardous Incident Ordinance)

Netherlands
SZW-lijst van kankerverwekkende stoffen : The substance is not listed
SZW-lijst van mutagene stoffen : The substance is not listed
NIET-limitatieve lijst van voor de voortplanting giftige stoffen – Borstvoeding : The substance is not listed
NIET-limitatieve lijst van voor de voortplanting giftige stoffen – Vruchtbaarheid : The substance is not listed
NIET-limitatieve lijst van voor de voortplanting giftige stoffen – Ontwikkeling : The substance is not listed

15.2. Chemical safety assessment

A chemical safety assessment has been carried out

SECTION 16: Other information

Abbreviations and acronyms:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBT</td>
<td>Persistent, Bioaccumulative and Toxic substance</td>
</tr>
<tr>
<td>vPvB</td>
<td>Very Persistent and Very Bioaccumulative</td>
</tr>
</tbody>
</table>

Sources of Key data : CSR - Chemical Safety Report.

SDS EU (REACH Annex II)

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product. BRONTIDE is the subject of Genomatica’s EU and US trademark applications.