SAFETY DATA SHEET

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

1.1. Product identifier
   CITROFLEX® 2
   Synonyms: TEC; Triethyl Citrate
   Chemical Abstracts Registry No: 77-93-0
   REACH Registration Number: 01-211980975-17-0000

1.2. Relevant identified uses of the substance or mixture and uses advised against
   Use in formulation of flavors and fragrances; use as a pharmaceutical excipient; plasticizer; personal care

1.3. Details of the supplier of the safety data sheet
   Vertellus LLC
   201 North Illinois Street, Suite 1800,
   Indianapolis, IN 46204
   336-292-1781
   e-mail Address: sds@vertellus.com

   Only Representative for EU REACH Registration:
   Vertellus Specialties UK Ltd.
   Seal Sands Road, Seal Sands
   Middlesbrough, TS2 1UB England
   Phone: +44 1642 546 546

1.4. Emergency telephone number
   Vertellus: 1-336-292-1781
   CHEMTREC (USA): 1-800-424-9300 (collect calls accepted)
   CHEMTREC (International): 1-703-527-3887 (collect calls accepted)
   NRCC (China): +86 532 83889090

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture
   Not Classified as Hazardous Symbol: Not Classified as Hazardous
   Risk Phrases: Not Classified as Hazardous Safety Phrases: Not applicable.

2.2. Label elements
   Hazard Symbols (Pictogram): Not applicable.
   Signal Word: Not applicable.
   Hazard Precautions: Not applicable.
   Prevention Precautionary Statements:
   Note: These precautionary statements are not prescribed by directive 1272/2008 as this product is not classified as hazardous under this directive. Wash hands thoroughly after handling with soap and water. Wear protective gloves, protective clothing, eye protection and face protection. If swallowed, in eyes, on skin or inhaled call a poison center or doctor/physician if you feel unwell. If inhaled, remove victim to fresh air and keep at rest in a comfortable position for breathing. Take off contaminated clothing before reuse. Store in a well-ventilated place. Keep container tightly closed.

2.3. Other hazards
   Other Hazards: Not applicable.
SECTION 3: Composition/information on ingredients

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CAS Number</th>
<th>Concentration (weight %)</th>
<th>EC Number</th>
<th>CLP Inventory/Annex VI</th>
<th>EU DSD Classification (67/548/EEC)</th>
<th>EU CLP Classification (1272/2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triethyl Citrate</td>
<td>77-93-0</td>
<td>~100</td>
<td>201-070-7</td>
<td>Not listed</td>
<td>Non-Hazardous</td>
<td>Non-Hazardous</td>
</tr>
</tbody>
</table>

NOTE: See Section 8 for exposure limit data for these ingredients. See Section 15 for trade secret information (where applicable). See Section 16 for the full text of the R-phrases above.

SECTION 4: First aid measures

4.1. Description of first aid measures

Skin Contact: Immediately flush with water for 15 minutes. Wash the contaminated skin with soap and water. If irritation develops, call a physician.

Eye Contact: Immediately flush eyes with plenty of water. Get medical attention, if irritation persists.

Inhalation: Remove from exposure. If not breathing, give artificial respiration and call a physician.

Ingestion: If swallowed, contact physician or poison control center immediately.

4.2 Most important symptoms and effects, both acute and delayed

Acute: Contact with this material may cause skin irritation. Contact with eyes may cause slight irritation.

Delayed Effects: None known.

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

Note to Physician: No specific indications. Treatment should be based on the judgment of the physician in response to the reactions of the patient.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Appropriate Extinguishing Media: Foam, dry chemical, carbon dioxide, water spray

5.2. Special hazards arising from the substance or mixture

Hazardous Products of Combustion: As with other organic materials, combustion will produce carbon monoxide and carbon dioxide.

Potential for Dust Explosion: Not applicable.

Special Flammability Hazards: Not applicable.

5.3. Advice for firefighters

Basic Fire Fighting Guidance: Wear self-contained breathing apparatus and protective clothing. Normal firefighting procedures may be used.

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SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Evacuation Procedures: Isolate the hazard area and deny entry to unnecessary and unprotected personnel.

Special Instructions: See Section 8 for personal protective equipment recommendations. Remove all contaminated clothing to prevent further absorption. Decontaminate affected personnel using the first aid procedures in Section 4. Leather shoes that have been saturated must be discarded.

6.2. Environmental precautions

Prevent releases to soils, drains, sewers and waterways.

6.3. Methods and material for containment and cleaning up

Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Remove all ignition sources. Ventilate the area of spill or leak. Wear protective equipment during clean-up. For small spills, use suitable absorbent material and collect for later disposal. For large spills, the area may require diking to contain the spill. Material can then be collected (e.g., suction) for later disposal. After collection of material, flush area with water. Dispose of the material in accordance with standard practice for disposal of potentially hazardous materials as required by applicable federal, state or local laws.

6.4. Reference to other sections

Refer to section 8 for information on selecting personal protective equipment. Refer to section 13 for information on spilled product, absorbent and clean up material disposal instructions.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for Unique Hazards: Not applicable.

Practices to Minimize Risk: Wear appropriate protective equipment when performing maintenance on contaminated equipment. Wash hands thoroughly before eating or smoking after handling this material. Do not eat, drink or smoke in work areas. Prevent contact with incompatible materials. Avoid spills and keep away from drains. Handle in a manner to prevent generation of aerosols, vapors or dust clouds.

Special Handling Equipment: Not applicable.

7.2. Conditions for safe storage, including any incompatibilities

Storage Precautions & Recommendations: This product should be stored at ambient temperature in a dry, well-ventilated location. Keep container closed when not in use.

Dangerous Incompatibility Reactions: Incompatible with oxidizing materials.

Incompatibilities with Materials of Construction: None known

7.3. Specific end use(s)

If a chemical safety assessment has been completed an exposure scenario is attached as an annex to this Safety Data Sheet. Refer to this annex for the specific exposure scenario control parameters for uses identified in subsection 1.2.

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**SAFETY DATA SHEET**

## SECTION 8: Exposure controls/personal protection

### 8.1. Control parameters

<table>
<thead>
<tr>
<th>Country</th>
<th>Occupational Exposure Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not established</td>
</tr>
</tbody>
</table>

**Air Monitoring Method:** Collection media: Charcoal; Analysis Method: GC/FID

**Derived No Effect Levels (DNELs) – Workers:**

<table>
<thead>
<tr>
<th>Route</th>
<th>DNEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute - systemic effects (inhalation)</td>
<td>634.8 mg/m³</td>
</tr>
<tr>
<td>Long-term - systemic effects (dermal)</td>
<td>20 mg/kg bw/day</td>
</tr>
<tr>
<td>Long-term - systemic effects (inhalation)</td>
<td>211.58 mg/m³</td>
</tr>
<tr>
<td>Acute and long-term - local effects (dermal, inhalation)</td>
<td>No hazard identified</td>
</tr>
</tbody>
</table>

**Derived No Effect Levels (DNELs) – General Population:**

<table>
<thead>
<tr>
<th>Route</th>
<th>DNEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute - systemic effects (oral, dermal, inhalation)</td>
<td>No hazard identified</td>
</tr>
<tr>
<td>Acute - systemic effects (inhalation)</td>
<td>208.8 mg/m³</td>
</tr>
<tr>
<td>Long-term - systemic effects (dermal)</td>
<td>20 mg/kg bw/day</td>
</tr>
<tr>
<td>Long-term - systemic effects (inhalation)</td>
<td>69.57 mg/m³</td>
</tr>
<tr>
<td>Long-term - systemic effects (oral)</td>
<td>20 mg/kg bw/day</td>
</tr>
<tr>
<td>Acute and long-term - local effects (dermal, inhalation)</td>
<td>No hazard identified</td>
</tr>
</tbody>
</table>

**Predicted No Effect Concentrations (PNECs):**

<table>
<thead>
<tr>
<th>Route</th>
<th>PNEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNEC aqua (freshwater)</td>
<td>0.024 mg/L</td>
</tr>
<tr>
<td>PNEC aqua (marine water)</td>
<td>0.0024 mg/L</td>
</tr>
<tr>
<td>PNEC aqua (intermittent releases)</td>
<td>0.24 mg/L</td>
</tr>
<tr>
<td>PNEC aqua (STP)</td>
<td>550 mg/L</td>
</tr>
<tr>
<td>PNEC sediment (freshwater)</td>
<td>No exposure anticipated</td>
</tr>
<tr>
<td>PNEC sediment (marine water)</td>
<td>No exposure anticipated</td>
</tr>
<tr>
<td>PNEC soil</td>
<td>No exposure anticipated</td>
</tr>
<tr>
<td>PNEC oral (wildlife exposures)</td>
<td>No potential for bioaccumulation</td>
</tr>
</tbody>
</table>

### 8.2. Exposure controls

Also see the annex to this SDS (if applicable) for specific exposure scenario controls.

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Other Engineering Controls: All operations should be conducted in well-ventilated conditions. Local exhaust ventilation should be provided.

Personal Protective Equipment: Wear impervious gloves (i.e., latex rubber), boots, work uniform and safety glasses. Where overexposures are a concern, use NIOSH-approved dust/mist respirator as necessary.


Thermal Hazards: Not applicable.

Environmental Exposure Controls: The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

- **Appearance, State & Odor (ambient temperature):** Clear, oily liquid, little to no odor
- **Molecular Formula:** C₁₂H₂₀O₇
- **Molecular Weight:** 276.30
- **Vapor Pressure:** 0.00189 mm Hg @ 25°C
- **Evaporation Rate:** < 1 (Butyl Acetate = 1)
- **Specific Gravity or Density:** 1.137 @ 20°C
- **Vapor Density (air = 1):** 9.7
- **Boiling Point:** 294°C (561°F)
- **Freezing / Melting Point:** -55°C (-49°F)
- **Solubility in Water:** 6.5 g/L @ 22°C
- **Octanol / Water Coefficient:** 0.71
- **pH:** No data available.
- **Odor Threshold:** No data available.
- **Viscosity:** 35.2 mPa @ 25°C
- **Autoignition Temperature:** 394 - 397°C
- **Flammable Limits:** Not available
- **Decomposition Temperature:** No data available.
- **Explosive Properties:** Not explosive
- **Oxidizing Properties:** Not an oxidizer

SECTION 10: Stability and reactivity

10.1. Reactivity

- Not classified as dangerously reactive.

10.2. Chemical stability

- Stable

10.3. Possibility of hazardous reactions

- Will not occur.

10.4. Conditions to avoid

- Avoid static discharge and uncontrolled exposure to high temperatures.

10.5. Incompatible materials

- Incompatible with oxidizing materials.

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10.6. Hazardous decomposition products

As with other organic materials, combustion will produce carbon monoxide and carbon dioxide.

11. Information on toxicological effects

11.1. Acute Oral LD₅₀:

4000 mg/kg (cat) - Finkelstein & Gold 1959 [KEY]

11.2. Acute Dermal LD₅₀:

> 5000 mg/kg (rabbit) - CIR Expert Panel 2012 [Weight of Evidence]

> 1000 mg/kg (rabbit) - Fitzgerald 1991 [Weight of Evidence]

11.3. Acute Inhalation LC₅₀:

No data available.

11.4. Skin Irritation:

Non-irritating to skin.

11.5. Eye Irritation:

Non-irritating to eyes.

11.6. Skin Sensitization:

Negative in Human Repeat Insult Patch test.

11.7. Mutagenicity:

In bacterial and mammalian in vitro mutation assays, triethyl citrate (TEC) and an analogue substance, acetyl tributyl citrate (ATBC) were nonmutagenic. Another analogue, citric acid, was not clastogenic in a guideline chromosomal aberrations assay. Taken together in a weight of evidence approach, triethyl citrate can be considered non-mutagenic and non-clastogenic.

11.8. Reproductive / Developmental Toxicity:

A repeated dose dietary toxicity study was undertaken for a structural analogue, acetyl tributyl citrate (ATBC), in Wistar rats. Parental animals were exposed in the diet at doses up to 1000 mg/kg bw/d for 4 weeks, and during mating. There were no adverse effects observed in reproductive indices or in gross pathology/histopathology in the P generation, including reproductive organs, including reproductive organs. Animals delivered from the exposed females were randomly selected to continue on the diet throughout 13 weeks. No adverse effects were seen. The NOAEL for developmental toxicity and for effects on fertility was 1000 mg/kg bw/d.

11.9. Carcinogenicity:

No carcinogenic effect found in rats after a lifetime of dietary exposure to the substance. (LaWall 1954)

11.10. Target Organs:

Triethyl Citrate was administered to rats in a 6-8 week feeding study, in varying doses up to 50% of the LD₅₀ value. No gross effects were observed, nor were any changes noted in histological examination and blood counts.

In cats treated with daily doses of 5 cc/kg for 8 weeks, no changes were observed in general appearance, behavior, urine or blood chemistry or blood count; body weight declines may be attributable to diarrhea effects observed during treatment. Triethyl citrate administration in cats at 6 and 9 cc/kg (well above the LD₅₀) was found to cause progressive lowering of blood pressure to shock levels and slowing of the heart rate; however these effects were determined not to be due to any material interference with neuromuscular transmission.

11.11. Aspiration Hazard:

No data available.

11.12. Primary Route(s) of Exposure:

Skin contact and absorption, eye contact, and inhalation. Ingestion is not likely to be a primary route of exposure.

11.13. Most important symptoms and effects, both acute and delayed:

Contact with this material may cause skin irritation. Contact with eyes may cause slight irritation.

Delayed Effects: None known.

11.14. Additive or Synergistic effects:

None known.

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SECTION 12: Ecological information

12.1. Toxicity
LC₅₀ (96h) Fish = 327 mg/L (approx) USEPA 2004 [KEY]
LC₅₀ (48h) Daphnia = 7262 mg/L (approx) USEPA 2004 [KEY]
EC₅₀ (96h) Algae = 25 mg/L (approx) USEPA 2004 [KEY]

12.2. Persistence and degradability
Triethyl Citrate has been shown to be readily biodegradable, based upon a half-life of 9.4 days at 30°C as reported in a soil simulation test, and by QSAR modeling predictions. Supporting studies showed rapid degradation of the substance in sewage column and soil tests.

12.3. Bioaccumulative potential
Screening-level data indicate that the substance is not bioaccumulative.

12.4. Mobility in soil
The substance exhibits low sorption into soil and sediment

12.5. Results of PBT and vPvB assessment
This substance is not a PBT or vPvB.

12.6. Other adverse effects
Not applicable

SECTION 13: Disposal considerations

13.1. Waste treatment methods
US EPA Waste Number: Non-Hazardous
Waste Classification: (per US regulations) The waste may be classified as "special" or hazardous per State regulations.
Waste Disposal:
NOTE: Generator is responsible for proper waste characterization. State hazardous waste regulations may differ substantially from federal regulations. Dispose of this material responsibly, and in accordance with standard practice for disposal of potentially hazardous materials as required by applicable international, national, regional, state or local laws, and environmental protection duty of care principles. Do NOT dump into any sewers, on the ground, or into any body of water. For disposal within the EC, the appropriate classification code according to the European Community List of Wastes should be used. Note that disposal regulations may also apply to empty containers and equipment rinsates.

SECTION 14: Transport information

The following information applies to all shipping modes (DOT/IATA/ICAO/IMDG/ADR/RID/ADN), unless otherwise indicated:

14.1. UN number Non-Hazardous
14.2. UN proper shipping name Chemicals, n.o.s. (Triethyl Citrate)
14.3. Transport hazard class(es) Not applicable
14.4. Packing group Not applicable
14.5. Environmental hazards Not applicable
14.6. Special precautions for user Not applicable
14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture
Chemical Inventory Lists:
TSCA: Listed
EINECS: 201-070-7

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Canada(DSL/NDSL): DSL
Korea: KE-20840
China: Listed
Taiwan: Listed

WHMIS Classification: Non-Hazardous

German Water Hazard Classification: WGK 1 (Kenn-Number: 5227 (Triethylcitrat))

SARA 311: Not listed.

Reportable Quantities: Not listed.

State Regulations: Not applicable.

HMIS: HEALTH 0  FLAMMABILITY 1  REACTIVITY 0

Classification Method: On basis of test data; expert judgment
Training Advice: Not applicable.

Legend of Abbreviations:
- ACGIH = American Conference on Governmental Industrial Hygienists.
- CAS = Chemical Abstracts Service.
- LD = Lethal Dose.
- NIOSH = National Institute of Occupational Safety and Health.

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15.2. Chemical safety assessment
Not required due to non-hazardous classification.

SECTION 16: Other information

Full text of R phrases in Section 3: Not applicable.

Key Data Sources:

Classification Method: On basis of test data; expert judgment

Training Advice: Not applicable.
Important Note: Please note that the information contained herein is furnished without warranty of any kind. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use and disposal of these materials and the safety and health of employees and customers. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances. The information contained herein may change without prior notice. THIS SAFETY DATA SHEET SUPERSEDES ALL PREVIOUS EDITIONS.

Revision Date: 21 Oct 2014
Issued by: Regulatory Management Department
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Original Date of Issue: December 1999
Email: SDS@Vertellus.com