SAFETY DATA SHEET

Buprenorphine Solid Formulation

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name: Buprenorphine Solid Formulation

Manufacturer or supplier’s details

Company: MSD
Address: Rua Treze de Maio, 1161
Campinas, São Paulo, Brazil 13106-054
Telephone: 908-740-4000
Emergency telephone: 55 19 3758 2000
E-mail address: EHSDATASTEWARD@msd.com
Telefax: 908-735-1496

Recommended use of the chemical and restrictions on use
Recommended use: Pharmaceutical

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification in accordance with ABNT NBR 14725 Standard
Reproductive toxicity: Category 1A

GHS label elements in accordance with ABNT NBR 14725 Standard

Hazard pictograms:

Signal Word: Danger
Hazard Statements: H360D May damage the unborn child.
Precautionary Statements: Prevention:
P201 Obtain special instructions before use.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response:
P308 + P313 IF exposed or concerned: Get medical advice/ attention.

Storage:
P405 Store locked up.
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Other hazards which do not result in classification
Dust contact with the eyes can lead to mechanical irritation.
Contact with dust can cause mechanical irritation or drying of the skin.
May form explosive dust-air mixture during processing, handling or other means.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Substance / Mixture</th>
<th>Components</th>
<th>Chemical name</th>
<th>CAS-No.</th>
<th>Classification</th>
<th>Concentration (% w/w)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Starch</td>
<td>9005-25-8</td>
<td>Acute toxicity (Oral), Category 3</td>
<td>&gt;= 10 -&lt; 20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buprenorphine Hydrochloride</td>
<td>53152-21-9</td>
<td>Reproductive toxicity, Category 1A Specific target organ toxicity - single exposure, Category 3 Short-term (acute) aquatic hazard, Category 2 Long-term (chronic) aquatic hazard, Category 2</td>
<td>&gt;= 1 -&lt; 2,5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Citric acid</td>
<td>77-92-9</td>
<td>Eye irritation, Category 2A</td>
<td>&gt;= 1 -&lt; 5</td>
</tr>
</tbody>
</table>

SECTION 4. FIRST AID MEASURES

General advice : In the case of accident or if you feel unwell, seek medical advice immediately. When symptoms persist or in all cases of doubt seek medical advice.

If inhaled : If inhaled, remove to fresh air. Get medical attention.
In case of skin contact : In case of contact, immediately flush skin with soap and plenty of water. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
In case of eye contact : If in eyes, rinse well with water. Get medical attention if irritation develops and persists.
If swallowed : If swallowed, DO NOT induce vomiting. Get medical attention. Rinse mouth thoroughly with water.
Most important symptoms and effects, both acute and delayed : May damage the unborn child. Contact with dust can cause mechanical irritation or drying of the skin. Dust contact with the eyes can lead to mechanical irritation.
Protection of first-aiders: First Aid responders should pay attention to self-protection, and use the recommended personal protective equipment when the potential for exposure exists (see section 8).

Notes to physician: Treat symptomatically and supportively.

**SECTION 5. FIRE-FIGHTING MEASURES**

<table>
<thead>
<tr>
<th>Suitable extinguishing media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water spray</td>
</tr>
<tr>
<td>Alcohol-resistant foam</td>
</tr>
<tr>
<td>Carbon dioxide (CO2)</td>
</tr>
<tr>
<td>Dry chemical</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unsuitable extinguishing media</th>
</tr>
</thead>
<tbody>
<tr>
<td>None known.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific hazards during fire fighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure to combustion products may be a hazard to health.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hazardous combustion products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon oxides</td>
</tr>
<tr>
<td>Nitrogen oxides (NOx)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific extinguishing methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.</td>
</tr>
<tr>
<td>Use water spray to cool unopened containers.</td>
</tr>
<tr>
<td>Remove undamaged containers from fire area if it is safe to do so.</td>
</tr>
<tr>
<td>Evacuate area.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Special protective equipment for fire-fighters</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the event of fire, wear self-contained breathing apparatus.</td>
</tr>
<tr>
<td>Use personal protective equipment.</td>
</tr>
</tbody>
</table>

**SECTION 6. ACCIDENTAL RELEASE MEASURES**

<table>
<thead>
<tr>
<th>Personal precautions, protective equipment and emergency procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use personal protective equipment.</td>
</tr>
<tr>
<td>Follow safe handling advice (see section 7) and personal protective equipment recommendations (see section 8).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid release to the environment.</td>
</tr>
<tr>
<td>Prevent further leakage or spillage if safe to do so.</td>
</tr>
<tr>
<td>Retain and dispose of contaminated wash water.</td>
</tr>
<tr>
<td>Local authorities should be advised if significant spillages cannot be contained.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Methods and materials for containment and cleaning up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweep up or vacuum up spillage and collect in suitable container for disposal.</td>
</tr>
<tr>
<td>Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air).</td>
</tr>
<tr>
<td>Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration.</td>
</tr>
<tr>
<td>Local or national regulations may apply to releases and disposal of this material, as well as those materials and items employed in the cleanup of releases. You will need to determine which regulations are applicable.</td>
</tr>
<tr>
<td>Sections 13 and 15 of this SDS provide information regarding certain local or national requirements.</td>
</tr>
</tbody>
</table>

**SECTION 7. HANDLING AND STORAGE**
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Technical measures:

- Static electricity may accumulate and ignite suspended dust causing an explosion. Provide adequate precautions, such as electrical grounding and bonding, or inert atmospheres.

Local/Total ventilation:

- If sufficient ventilation is unavailable, use with local exhaust ventilation.

Advice on safe handling:

- Do not get on skin or clothing.
- Do not breathe dust.
- Do not swallow.
- Avoid contact with eyes.
- Handle in accordance with good industrial hygiene and safety practice, based on the results of the workplace exposure assessment.
- Keep container tightly closed.
- Minimize dust generation and accumulation.
- Keep container closed when not in use.
- Keep away from heat and sources of ignition.
- Take precautionary measures against static discharges.
- Take care to prevent spills, waste and minimize release to the environment.

Hygiene measures:

- If exposure to chemical is likely during typical use, provide eye flushing systems and safety showers close to the working place.
- When using do not eat, drink or smoke.
- Wash contaminated clothing before re-use.
- The effective operation of a facility should include review of engineering controls, proper personal protective equipment, appropriate degowning and decontamination procedures, industrial hygiene monitoring, medical surveillance and the use of administrative controls.

Conditions for safe storage:

- Keep in properly labeled containers.
- Store locked up.
- Keep tightly closed.
- Store in accordance with the particular national regulations.

Materials to avoid:

- Do not store with the following product types:
  - Strong oxidizing agents
  - Organic peroxides
  - Explosives
  - Gases

SECTION 8. EXPOSURE CONTROLS/PERSOANL PROTECTION

Ingredients with workplace control parameters

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS-No.</th>
<th>Value type (Form of exposure)</th>
<th>Control parameters / Permissible concentration</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starch</td>
<td>9005-25-8</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td>ACGIH</td>
</tr>
<tr>
<td>Buprenorphine Hydrochloride</td>
<td>53152-21-9</td>
<td>TWA</td>
<td>0.2 µg/m³ (OEB 5)</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wipe limit</td>
<td>2 µg/100 cm²</td>
<td>Internal</td>
</tr>
</tbody>
</table>

Engineering measures:

- Use closed processing systems or containment technologies to control at source (e.g., glove boxes/isolators) and to
prevent leakage of compounds into the workplace. All engineering controls should be implemented by facility design and operated in accordance with GMP principles to protect products, workers, and the environment. No open handling permitted. Totally enclosed processes and materials transport systems are required. Operations require the use of appropriate containment technology designed to prevent leakage of compounds into the workplace.

**Personal protective equipment**

**Respiratory protection**: If adequate local exhaust ventilation is not available or exposure assessment demonstrates exposures outside the recommended guidelines, use respiratory protection.

| Filter type | Particulates type |

**Hand protection**: Chemical-resistant gloves

**Material**: Consider double gloving.

**Eye protection**: Wear safety glasses with side shields or goggles. If the work environment or activity involves dusty conditions, mists or aerosols, wear the appropriate goggles. Wear a faceshield or other full face protection if there is a potential for direct contact to the face with dusts, mists, or aerosols.

**Skin and body protection**: Work uniform or laboratory coat. Additional body garments should be used based upon the task being performed (e.g., sleevelets, apron, gauntlets, disposable suits) to avoid exposed skin surfaces. Use appropriate degowning techniques to remove potentially contaminated clothing.

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**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>solid</td>
</tr>
<tr>
<td>Color</td>
<td>white</td>
</tr>
<tr>
<td>Odor</td>
<td>No data available</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No data available</td>
</tr>
<tr>
<td>pH</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>No data available</td>
</tr>
<tr>
<td>Initial boiling point and boiling range</td>
<td>No data available</td>
</tr>
<tr>
<td>Flash point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
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SECTION 10. STABILITY AND REACTIVITY

Reactivity : Not classified as a reactivity hazard.
Chemical stability : Stable under normal conditions.
Possibility of hazardous reactions : May form explosive dust-air mixture during processing, handling or other means.
Can react with strong oxidizing agents.

Conditions to avoid : Heat, flames and sparks.
Incompatible materials : Oxidizing agents
Hazardous decomposition products : No hazardous decomposition products are known.

SECTION 11. TOXICOLOGICAL INFORMATION
Information on likely routes of exposure:
- Inhalation
- Skin contact
- Ingestion
- Eye contact

**Acute toxicity**
Not classified based on available information.

**Product:**
Acute oral toxicity: Acute toxicity estimate: > 5.000 mg/kg
Method: Calculation method

**Components:**

**Starch:**
Acute oral toxicity: LD50 (Rat): > 5.000 mg/kg
Acute dermal toxicity: LD50 (Rabbit): > 2.000 mg/kg

**Buprenorphine Hydrochloride:**
Acute oral toxicity: LD50 (Mouse): 261 mg/kg
LD50 (Rat): 600 mg/kg
Acute inhalation toxicity: Remarks: No data available
Acute dermal toxicity: Remarks: No data available
Acute toxicity (other routes of administration): LD50 (Rat): 31 mg/kg
Application Route: Intravenous
LD50 (Mouse): 24 mg/kg
Application Route: Intravenous

**Citric acid:**
Acute oral toxicity: LD50 (Mouse): 5.400 mg/kg
Acute dermal toxicity: LD50 (Rat): > 2.000 mg/kg
Method: OECD Test Guideline 402
Assessment: The substance or mixture has no acute dermal toxicity

**Skin corrosion/irritation**
Not classified based on available information.

**Components:**

**Buprenorphine Hydrochloride:**
Remarks: No data available

**Citric acid:**
Species: Rabbit
**Method**: OECD Test Guideline 404  
**Result**: No skin irritation

**Serious eye damage/eye irritation**
Not classified based on available information.

**Components:**

**Starch:**
- **Species**: Rabbit  
- **Result**: No eye irritation

**Buprenorphine Hydrochloride:**
- **Remarks**: No data available

**Citric acid:**
- **Species**: Rabbit  
- **Result**: Irritation to eyes, reversing within 21 days  
- **Method**: OECD Test Guideline 405

**Respiratory or skin sensitization**

**Skin sensitization**
Not classified based on available information.

**Respiratory sensitization**
Not classified based on available information.

**Components:**

**Starch:**
- **Test Type**: Maximization Test  
- **Routes of exposure**: Skin contact  
- **Species**: Guinea pig  
- **Result**: negative

**Buprenorphine Hydrochloride:**
- **Remarks**: No data available

**Germ cell mutagenicity**
Not classified based on available information.

**Components:**

**Starch:**
- **Genotoxicity in vitro**: Test Type: Bacterial reverse mutation assay (AMES)  
  Result: negative

**Buprenorphine Hydrochloride:**
- **Genotoxicity in vitro**: Test Type: Bacterial reverse mutation assay (AMES)  
  Result: equivocal
Test Type: Chromosomal aberration  
Result: negative

Test Type: DNA damage and repair, unscheduled DNA synthesis in mammalian cells (in vitro)  
Result: positive

Germ cell mutagenicity - Assessment: Weight of evidence does not support classification as a germ cell mutagen.

Citric acid:
Genotoxicity in vitro: Test Type: Bacterial reverse mutation assay (AMES)  
Result: negative

Test Type: in vitro micronucleus test  
Result: positive

Test Type: Bacterial reverse mutation assay (AMES)  
Result: negative

Genotoxicity in vivo: Test Type: Mutagenicity (in vivo mammalian bone-marrow cytogenetic test, chromosomal analysis)  
Species: Rat  
Application Route: Ingestion  
Result: negative

Carcinogenicity
Not classified based on available information.

Components:
Buprenorphine Hydrochloride:
Species: Rat  
Application Route: Oral  
Exposure time: 27 Months  
LOAEL: 56 mg/kg body weight  
Result: positive  
Target Organs: Testes  
Remarks: The significance of these findings for humans is not certain.

Species: Mouse  
Application Route: Oral  
Exposure time: 86 weeks  
NOAEL: 100 mg/kg body weight  
Result: negative  
Carcinogenicity - Assessment: Weight of evidence does not support classification as a carcinogen

Reproductive toxicity
May damage the unborn child.
Components:

**Buprenorphine Hydrochloride**:

**Effects on fertility**
- Test Type: Fertility
  - Species: Rat
  - Application Route: Oral
  - Fertility: NOAEL: 80 mg/kg body weight
  - Result: No effects on fertility.

- Test Type: Fertility
  - Species: Rat
  - Application Route: Subcutaneous
  - Fertility: NOAEL: 5 mg/kg body weight
  - Result: No effects on fertility.

- Test Type: Fertility
  - Species: Rabbit
  - Application Route: Oral
  - Fertility: LOAEL: 1 mg/kg body weight
  - Result: Preimplantation loss.

- Test Type: Fertility
  - Species: Rabbit
  - Application Route: Intravenous
  - Fertility: LOAEL: 0.2 mg/kg body weight
  - Result: Postimplantation loss.

**Effects on fetal development**
- Test Type: Development
  - Species: Rat
  - Application Route: Subcutaneous
  - Developmental Toxicity: LOAEL: 5 mg/kg body weight
  - Result: Embryo-fetal toxicity., No teratogenic effects., Skeletal malformations.

- Test Type: Development
  - Species: Rat
  - Application Route: Oral
  - Developmental Toxicity: NOAEL: 160 mg/kg body weight
  - Result: No effects on fetal development.

- Test Type: Development
  - Species: Rat
  - Application Route: Subcutaneous
  - Developmental Toxicity: LOAEL: 0.1 mg/kg body weight
  - Result: Effects on newborn.

- Test Type: Development
  - Species: Rabbit
  - Application Route: Intramuscular
  - Developmental Toxicity: LOAEL: 5 mg/kg body weight
Developmental Toxicity: LOAEL: 1 mg/kg body weight
Result: Embryo-fetal toxicity., Skeletal malformations.

Reproductive toxicity - Assessment:
May damage the unborn child. Suspected of damaging fertility.

Citric acid:
Effects on fetal development:
Test Type: One-generation reproduction toxicity study
Species: Rat
Application Route: Ingestion
Result: negative

STOT-single exposure
Not classified based on available information.

Components:

Buprenorphine Hydrochloride:
Assessment: May cause drowsiness or dizziness.

STOT-repeated exposure
Not classified based on available information.

Repeated dose toxicity

Components:

Starch:
Species: Rat
NOAEL: >= 2.000 mg/kg
Application Route: Skin contact
Exposure time: 28 Days
Method: OECD Test Guideline 410

Citric acid:
Species: Rat
NOAEL: 4.000 mg/kg
LOAEL: 8.000 mg/kg
Application Route: Ingestion
Exposure time: 10 Days

Aspiration toxicity
Not classified based on available information.

Experience with human exposure

Components:

Buprenorphine Hydrochloride:
Inhalation: Target Organs: Central nervous system
Symptoms: Drowsiness, sedation, Headache, Nausea, Vomiting, Dizziness, Vertigo, Sweating, constipation, insomnia, Pain, respiratory depression, constriction of pupils, decrease
in heart rate, Lowered blood pressure
Remarks: May cause neonatal withdrawal

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Components:

Buprenorphine Hydrochloride:
Toxicity to algae/aquatic plants:
 EC50 (Pseudokirchneriella subcapitata (green algae)): 6,25 mg/l
 Exposure time: 72 h
 Method: OECD Test Guideline 201

 NOEC (Pseudokirchneriella subcapitata (green algae)): 0,319 mg/l
 Exposure time: 72 h
 Method: OECD Test Guideline 201

Toxicity to fish (Chronic toxicity):
 NOEC (Pimephales promelas (fathead minnow)): 0,137 mg/l
 Exposure time: 28 d
 Method: OECD Test Guideline 210

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity):
 NOEC (Daphnia magna (Water flea)): 0,883 mg/l
 Exposure time: 21 d
 Method: OECD Test Guideline 211

 LOEC (Daphnia magna (Water flea)): 1,95 mg/l
 Exposure time: 21 d
 Method: OECD Test Guideline 211

Toxicity to microorganisms:
 EC50: 588 mg/l
 Exposure time: 3 h
 Test Type: Respiration inhibition
 Method: OECD Test Guideline 209

 NOEC: 135 mg/l
 Exposure time: 3 h
 Test Type: Respiration inhibition
 Method: OECD Test Guideline 209

Citric acid:

Toxicity to fish:
 LC50 (Pimephales promelas (fathead minnow)): > 100 mg/l
 Exposure time: 96 h

Toxicity to daphnia and other aquatic invertebrates:
 EC50 (Daphnia magna (Water flea)): 1.535 mg/l
 Exposure time: 24 h

Persistence and degradability

Components:

Buprenorphine Hydrochloride:
Biodegradability:
Result: Not readily biodegradable.

Citric acid:
Biodegradability:
Result: Readily biodegradable.
Biodegradation: 97 %
Exposure time: 28 d
Method: OECD Test Guideline 301B

Bioaccumulative potential

Components:
Buprenorphine Hydrochloride:
Bioaccumulation:
Species: Oncorhynchus mykiss (rainbow trout)
Bioconcentration factor (BCF): 0.4
Method: OECD Test Guideline 305

Partition coefficient: n-octanol/water
: log Pow: 3,11

Citric acid:
Partition coefficient: n-octanol/water
: log Pow: -1,72

Mobility in soil

Components:
Buprenorphine Hydrochloride:
Distribution among environmental compartments
: log Koc: 4,11

Other adverse effects
No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods
Waste from residues:
Dispose of in accordance with local regulations.
Contaminated packaging:
Empty containers should be taken to an approved waste handling site for recycling or disposal.
If not otherwise specified: Dispose of as unused product.

SECTION 14. TRANSPORT INFORMATION

International Regulations

UNRTDG
Not regulated as a dangerous good

IATA-DGR
Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable for product as supplied.

Domestic regulation

ANTT
Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

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

National List of Carcinogenic Agents for Humans - (LINACH)
: Not applicable

Brazil. List of chemicals controlled by the Federal Police
: Not applicable

International Regulations

The ingredients of this product are reported in the following inventories:

AICS : not determined
DSL : not determined
IECSC : not determined

SECTION 16. OTHER INFORMATION

Further information
Sources of key data used to compile the Material Safety Data Sheet

Full text of other abbreviations
ACGIH : USA. ACGIH Threshold Limit Values (TLV)
ACGIH / TWA : 8-hour, time-weighted average

AICL - Australian Inventory of Industrial Chemicals; ANTT - National Agency for Transport by Land of Brazil; ASTM - American Society for the Testing of Materials; bw - Body weight; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International
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