1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name : Titanium(IV) oxide
Product Number : 14021
Brand : Sigma-Aldrich
CAS-No. : 13463-67-7

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet
Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Carcinogenicity (Category 2), H351
For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
Pictogram

Signal word Warning
Hazard statement(s)
H351 Suspected of causing cancer.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none
3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Synonyms</th>
<th>Titanium dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Titania</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Formula</th>
<th>TiO$_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular weight</td>
<td>79.87 g/mol</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>13463-67-7</td>
</tr>
<tr>
<td>EC-No.</td>
<td>236-675-5</td>
</tr>
</tbody>
</table>

Hazardous components

| Component                                               | Classification    | Concentration
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium dioxide, nanoparticles range in size from 1 to 150 nm</td>
<td>Carc. 2; H351</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Move out of dangerous area. Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.
6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Keep in a dry place.
Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium dioxide, nanoparticles range in size from 1 to 150 nm</td>
<td>13463-67-7</td>
<td>TWA</td>
<td>10.000000 mg/m3</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>Remarks</td>
<td>Lower Respiratory Tract irritation</td>
<td>Adopted values or notations enclosed are those for which changes are proposed in the NIC</td>
<td>See Notice of Intended Changes (NIC)</td>
<td>Not classifiable as a human carcinogen</td>
</tr>
<tr>
<td></td>
<td>Potential Occupational Carcinogen</td>
<td>See Appendix A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TWA</td>
<td>15.000000 mg/m3</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TWA</td>
<td>15.000000 mg/m3</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
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<td></td>
</tr>
</tbody>
</table>

Lower Respiratory Tract irritation
Adopted values or notations enclosed are those for which changes are proposed in the NIC
See Notice of Intended Changes (NIC)
Not classifiable as a human carcinogen

TWA | 10.000000 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |

Lower Respiratory Tract irritation
Adopted values or notations enclosed are those for which changes are proposed in the NIC
See Notice of Intended Changes (NIC)
Not classifiable as a human carcinogen
8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N99 (US) or type P2 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or EN 14387 (EU).
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: nano particles
   Colour: white

b) Odour
   No data available
c) Odour Threshold  No data available

d) pH  No data available

e) Melting point/freezing point  Melting point/range: > 350 °C (> 662 °F)

f) Initial boiling point and boiling range  No data available

g) Flash point  No data available

h) Evaporation rate  No data available

i) Flammability (solid, gas)  No data available

j) Upper/lower flammability or explosive limits  No data available

k) Vapour pressure  No data available

l) Vapour density  No data available

m) Relative density  4.26 g/mL at 25 °C (77 °F)

n) Water solubility  No data available

o) Partition coefficient: n-octanol/water  No data available

p) Auto-ignition temperature  No data available

q) Decomposition temperature  No data available

r) Viscosity  No data available

s) Explosive properties  No data available

t) Oxidizing properties  No data available

9.2 Other safety information  No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity  No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions  No data available

10.4 Conditions to avoid  No data available

10.5 Incompatible materials
Strong acids

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - > 10,000 mg/kg
Inhalation: No data available

LD50 Dermal - Rabbit - > 10,000 mg/kg

No data available

**Skin corrosion/irritation**

Skin - Human
Result: Mild skin irritation - 3 h

**Serious eye damage/eye irritation**

Eyes - Rabbit
Result: No eye irritation

**Respiratory or skin sensitisation**

Will not occur

**Germ cell mutagenicity**

Hamster
ovary
Micronucleus test

Hamster
Lungs
DNA inhibition

Hamster
ovary
Sister chromatid exchange

Mouse
Micronucleus test

**Carcinogenicity**

Suspected human carcinogens

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**

No data available

No data available

**Specific target organ toxicity - single exposure**

No data available

**Specific target organ toxicity - repeated exposure**

No data available

**Aspiration hazard**

No data available

**Additional Information**

RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish  
LC50 - other fish - > 1,000 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates  
EC50 - Daphnia magna (Water flea) - > 1,000 mg/l - 48 h
EC0 - Daphnia magna (Water flea) - 1,000 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product  
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging  
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)  
Not dangerous goods

IMDG  
Not dangerous goods

IATA  
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components
Titanium dioxide, nanoparticles range in size from 1 to 150 nm  
CAS-No. 13463-67-7  Revision Date 1994-04-01

Pennsylvania Right To Know Components  
CAS-No. Revision Date
Titanium dioxide, nanoparticles range in size from 1 to 150 nm 13463-67-7 1994-04-01

New Jersey Right To Know Components
Titanium dioxide, nanoparticles range in size from 1 to 150 nm CAS-No. Revision Date

California Prop. 65 Components
WARNING! This product contains a chemical known to the State of California to cause cancer.
Titanium dioxide, nanoparticles range in size from 1 to 150 nm CAS-No. Revision Date

16. OTHER INFORMATION
Full text of H-Statements referred to under sections 2 and 3.
Carc. Carcinogenicity
H351 Suspected of causing cancer.

HMIS Rating
Health hazard: 1
Chronic Health Hazard: *
Flammability: 0
Physical Hazard 0

NFPA Rating
Health hazard: 2
Fire Hazard: 0
Reactivity Hazard: 0

Further information
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Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956
Version: 4.14 Revision Date: 02/27/2015 Print Date: 10/29/2015