Material Safety Data Sheet
Prepared on: September 13, 2012

MagReSyn® TiO₂

1. PRODUCT AND COMPANY IDENTIFICATION

Product code: MR-TID002 (2 ml); MR-TID005 (5 ml); MR-TID010 (2 x 5 ml)
Product name: MagReSyn® TiO₂
General Use: Magnetic microparticles with immobilized titanium dioxide nanoparticles suspended in a 20% ethanol solution. The product is intended for biomolecule (specifically phosphopeptide) immobilization for a variety of subsequent end-user applications in research and development. This product is for research and development use only. It is not intended for any animal or human therapeutic or diagnostic use unless otherwise stated.

Manufacturer: ReSyn Biosciences (Pty) Ltd
CSIR
Building 20
Meiring Naude Road
Brummeria
Pretoria
0184
South Africa

Contact for additional information: Dr. Isak B. Gerber;
Tel: +2712 841 4153;
Email: igerber@resynbio.com

2. COMPOSITION

Hazardous/Non-hazardous Components

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS #</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>MagReSyn® TiO₂</td>
<td>---------</td>
<td>2.5%</td>
</tr>
<tr>
<td>Ethanol</td>
<td>64-17-5</td>
<td>20%</td>
</tr>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td>75%</td>
</tr>
</tbody>
</table>

Synonyms for Ethanol: Ethyl alcohol, alcohol
3. HAZARDS IDENTIFICATION

GHS Classification for Ethanol:
FLAMMABLE LIQUIDS, Category 2: Highly flammable liquid and vapor
SERIOUS EYE DAMAGE/IRRITATION, Category 2B: Warning
SPECIFIC TARGET ORGAN SYSTEMIC TOXICITY (SINGLE EXPOSURE), Category 3: Warning
Reproductive toxicity, Category 1: Danger

Signal Words for Ethanol: DANGER

GHS Hazard Statements:
PHYSICAL HAZARDS:
Highly flammable liquid and vapor.

HEALTH HAZARDS:
Causes eye irritation.
Reproductive toxicant.
May be harmful if swallowed and enters airways.

ENVIRONMENTAL HAZARDS:
Not classified as an environmental hazard under GHS criteria.

GHS Precautionary Statements for Ethanol:
PREVENTION:
Keep away from heat/sparks/open flames/hot surfaces.
No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting equipment. Use only non-sparking tools.
Take precautionary measures against static discharge.
Avoid breathing dust/fume/gas/mist/vapors/spray.
Wash hands thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.

RESPONSE:
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Induce vomiting only if directed to by medical personnel.
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

IN CASE OF FIRE:
Use dry chemical, foam or other appropriate extinguishing media.

STORAGE:
Store in a well-ventilated place. Keep container tightly closed. Keep cool. Store locked up.

DISPOSAL:
Dispose of contents and container to appropriate waste site or reclaimed in accordance with local and national regulations.

GHS Label Elements Symbol(s)
for Ethanol:

Form Solid in an ethanol aqueous formulation

<table>
<thead>
<tr>
<th>HMIS (for ethanol)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>2</td>
</tr>
<tr>
<td>Flammability</td>
<td>3</td>
</tr>
<tr>
<td>Reactivity</td>
<td>0</td>
</tr>
</tbody>
</table>
4. FIRST AID MEASURES

Skin contact  Wash or flush skin immediately and thoroughly with soap and water, if irritation develops, seek medical attention.

Eye contact  Flush for 15 minutes thoroughly with plenty of water; seek medical attention.

Ingestion If ingested contact a physician; do not give anything by mouth to an unconscious person. Transport to nearest medical facility for additional treatment. Do not induce vomiting.

Inhalation  Move to fresh air. If breathing becomes difficult, seek medical aid.

Notes to physician  Treat symptomatically.

5. FIRE-FIGHTING MEASURES

In the event of fire, responders should follow appropriate protective measures to prevent skin contact and inhalation.

Suitable extinguishing media  Dry chemical, foam or other appropriate extinguishing media. Water may be ineffective.

Special protective equipment for firefighters  Wear self-contained breathing apparatus and protective equipment as appropriate for fire response activities.

Special Considerations:  Highly flammable. Material can burn with an invisible flame.

6. ACCIDENTAL RELEASE MEASURES

Observe all relevant local and international regulations. Avoid contact with spilled or released material.

Personal precautions  In the event of a spill or leak, use personal protective equipment to minimize contact with skin.

Methods for cleaning up  Clean up spill immediately using an inert absorbent material; dispose of according to applicable local, regional, or federal regulations.
7. HANDLING AND STORAGE

Handling
Avoid dust formation; avoid contact with skin and eyes. Avoid breathing vapor; avoid contact with eyes, skin and clothing. Keep away from ignition sources, use only electrically grounded handling equipment and ensure adequate ventilation/fume exhaust hoods. Do not eat, drink or smoke while handling.

Storage
Keep in properly labeled containers. Store in ventilated room or shade below 27°C (80°F) and away from direct sunlight. Follow all precautionary information on container label. Keep away from oxidizing agents, reducing agents, acids, alkalis, and moisture.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>OSHA PEL (TWA)</th>
<th>OSHA PEL (ceiling)</th>
<th>ACGIH TLV</th>
<th>MAK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium Dioxide</td>
<td>15 mg/m³</td>
<td>None</td>
<td>10 mg/m³</td>
<td>None</td>
</tr>
<tr>
<td>Ethanol</td>
<td>1000 ppm</td>
<td>None</td>
<td>1000 ppm</td>
<td>500 ppm</td>
</tr>
</tbody>
</table>

Engineering measures
Ensure adequate fresh air ventilation is available, especially in confined areas; use local exhaust ventilation

Personal protective equipment

Respiratory protection
In case of insufficient ventilation, wear particulate respiratory protection

Hand protection
Use protective gloves to prevent unnecessary skin contact

Eye protection
Use safety glasses with side-shields or safety goggles

Skin and body protection
Lightweight protective clothing

Hygiene measures
Handle in accordance with good laboratory hygiene practices

Environmental exposure controls
Prevent product from entering drains
9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th></th>
<th>MagReSyn® TiO₂ Microparticles</th>
<th>Water</th>
<th>Ethanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical form</td>
<td>Solid in aqueous media</td>
<td>Clear liquid</td>
<td>Clear liquid</td>
</tr>
<tr>
<td>Color</td>
<td>Black</td>
<td>Colorless</td>
<td>Colorless</td>
</tr>
<tr>
<td>Odor</td>
<td>None</td>
<td>None</td>
<td>Mild</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>No data available</td>
<td>100°C / 212°F</td>
<td>78°C / 172°F</td>
</tr>
<tr>
<td>Melting Point</td>
<td>No data available</td>
<td>0°C / 32°F</td>
<td>-114°C / -173 °F</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
<td>Non-flammable</td>
<td>13°C / 55°F</td>
</tr>
<tr>
<td>Auto ignition</td>
<td>No data available</td>
<td>Not applicable</td>
<td>36°C / 97°F (20%)</td>
</tr>
<tr>
<td>Auto ignition temperature</td>
<td></td>
<td>Not applicable</td>
<td>363°C / 685 °F</td>
</tr>
<tr>
<td>Oxidizing properties</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>No data available</td>
<td>Complete</td>
<td>at 20 °C / 68 °F Completely miscible</td>
</tr>
<tr>
<td>pH</td>
<td>Not applicable (for solid spheres)</td>
<td>7.0</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>No data available</td>
<td>1.00 at 20 °C / 68 °F</td>
<td>.790 at 20 °C / 68 °F</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Not applicable</td>
<td>No data available</td>
<td>1.200 cP at 20 °C / 68 °F</td>
</tr>
<tr>
<td>Flammability</td>
<td>No data available</td>
<td>Not applicable</td>
<td>Flammable</td>
</tr>
<tr>
<td>Vapor Density (air =1)</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>1.59 at 20 °C / 68 °F</td>
</tr>
<tr>
<td>Vapor pressure</td>
<td>Not applicable</td>
<td>No data available</td>
<td>44 mmHg at 20°C / 68 °F</td>
</tr>
<tr>
<td>Lower/upper explosive</td>
<td>No data available</td>
<td>Not applicable</td>
<td>3.3% to 19%</td>
</tr>
<tr>
<td>limit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decomposition</td>
<td>No data available</td>
<td>Stable under normal conditions of use</td>
<td>Stable under normal conditions of use</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY

Stability: Stable under normal conditions of use
Materials to avoid: None known
Hazardous decomposition products: None expected under normal use conditions.
Polymerization: Hazardous polymerization is not known to occur
11. TOXICOLOGICAL INFORMATION

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>LD50 (oral)</th>
<th>LD50 (dermal)</th>
<th>LC50 (inhalation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MagReSyn® TiO₂ Microparticles</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
<tr>
<td>Water</td>
<td>Low toxicity</td>
<td>Low toxicity</td>
<td>Low toxicity</td>
</tr>
<tr>
<td>Ethanol</td>
<td>Low/moderate toxicity. LD50: 3450-7060 mg/kg (rat)</td>
<td>Low toxicity</td>
<td>Expected to be of low toxicity if inhaled. LC50: 20,000-20,363 mg/kg (rat)</td>
</tr>
</tbody>
</table>

Complete toxicological properties have yet to be determined for nanoparticles.

**Principle Routes of Exposure/ Potential Health effects**

- **Eyes**
  - May cause eye irritation in the event of contact

- **Skin**
  - May cause skin irritation and/or dermatitis on contact; not a skin sensitizer

- **Inhalation**
  - May cause irritation of respiratory tract if vapor is inhaled. Inhalation of high concentrations may cause effects to the central nervous system.

- **Ingestion**
  - Ingestion may cause gastrointestinal irritation, nausea, vomiting, and diarrhea. Causes central nervous system impairment occurs at high doses.

**Specific Effects**

- **Carcinogenic effects**
  - No known significant effects or critical hazards.

- **Mutagenic effects**
  - No known significant effects or critical hazards.

- **Reproductive toxicity**
  - Ethanol has been shown to cause fetotoxicity.

- **Sensitization**
  - No known significant effects or critical hazards.

- **Target Organ Effects**
  - Eyes, Liver, Kidneys, Central Nervous System.

12. ECOLOGICAL INFORMATION

- **Ecotoxicity effects**
  - No known significant effects or critical hazards.

- **Mobility**
  - No known significant effects or critical hazards. If acetone enters soil, it will be mobile and may contaminate groundwater. Dissolves in water.

- **Biodegradation**
  - No known significant effects or critical hazards.

- **Bioaccumulation**
  - No known significant effects or critical hazards.
13. DISPOSAL CONSIDERATIONS

Dispose of in accordance with local, regional, or federal regulations. Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification. Do not dispose into the environment, in drains or in water courses. Waste product should not be allowed to contaminate soil or water.

14. TRANSPORT INFORMATION

<table>
<thead>
<tr>
<th>Proper shipping name</th>
<th>US DOT</th>
<th>IATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Non-hazardous for transport</td>
<td>Non-hazardous for air transport</td>
</tr>
</tbody>
</table>

15. REGULATORY INFORMATION

<table>
<thead>
<tr>
<th>International Inventories</th>
<th>TSCA</th>
<th>PICCS</th>
<th>ENCS</th>
<th>DSL</th>
<th>NDSL</th>
<th>AICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium Dioxide</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Water</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Ethanol</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

International Agency for Research on Cancer
None of the ingredients has been listed

National Toxicology Program
None of the ingredients has been listed

U.S. Federal Regulations

SARA 313
This product is not regulated under SARA

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)
This product does not contain HAPs

California Proposition 65
This product contains ethanol, a chemical known to have reproductive and developmental toxicological effects
16. OTHER INFORMATION

For ethanol: R-phrase(s)
R11  Highly flammable.

For ethanol: S-phrase(s)
S-2   Keep out of the reach of children.
S-7   Keep container tightly closed.
S-9   Keep container in a well-ventilated place.
S-16  Keep away from sources of ignition - No Smoking.

For titanium dioxide: R-phrase(s)
R49   Suspected carcinogen by inhalation route of exposure.

This material is sold for research and development purposes only. It is not intended for food, drug, household, agricultural, or cosmetic use. An individual technically qualified to handle potentially hazardous chemicals must supervise the use of this material.

This information is based on our present knowledge and is subject to revision.