

Ludger

**Product Guide for LudgerTag™ 2-AB
(2-aminobenzamide) Glycan Labeling Kit**

(Ludger Product Code: LT-KAB-A2)

Ludger Document # LT-KAB-A2-Guide-v3.0

Ludger Ltd

Culham Science Centre
Oxford OX14 3EB
United Kingdom

Tel: +44 1865 408 554

Fax: +44 870 163 4620

Email: info@ludger.com

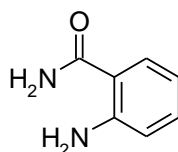
www.ludger.com

Contents

| | Page |
|---|-------------------------------------|
| Contents | 2 |
| Specifications for LT-KAB-A2 | 3 |
| Kit Contents | 4 |
| Additional Reagents and Equipment Required | 4 |
| Time Line for Labeling | 4 |
| The Reductive Amination Reaction | 5 |
| Outline of Labeling Protocol | 6 |
| 1 Prepare the glycans | 6 |
| 2 Dry the glycans | 6 |
| 3 Prepare labeling reagent..... | 6 |
| 4 Add labeling reagent to glycans | 6 |
| 5 Incubate | 6 |
| 6 Post-labeling cleanup..... | 6 |
| 7 Store or analyse the labeled glycans | 6 |
| Sample Preparation | 7 |
| Preparation of Labeling Reagent | 8 |
| Labeling Reaction | 9 |
| LudgerClean™ S Post-Labeling Sample Cleanup | 9 |
| Analysis of LudgerTag™ 2AB-Labeled Glycans | 10 |
| Warranties and Liabilities | 11 |
| Document Revision Number | 11 |
| References | 12 |
| Appendix 1: Troubleshooting Guide | 13 |
| Appendix 2: MSDS..... | 16 |
| Material Safety Data Sheet | Error! Bookmark not defined. |
| Material Safety Data Sheet | Error! Bookmark not defined. |
| Material Safety Data Sheet | Error! Bookmark not defined. |

Specifications for LT-KAB-A2

| | |
|-----------------------|--|
| Application | For labeling of free glycans with 2-aminobenzamide acid (2-AB). |
| Description | The kit contains reagents for the conjugation of dye to the free reducing end of the glycan by a reductive amination reaction. |
| Dye Properties | Mass = 136.15 Fluorescence, $\lambda_{\text{ex}} = 320 \text{ nm}$, $\lambda_{\text{em}} = 420 \text{ nm}$. |



| | |
|-----------------------------|---|
| Number of Samples | Typically, up to 15 separate analytical samples per set of labeling reagents. |
| Amount of Sample | From 25 pmol up to 25 nmol glycans per sample. |
| Suitable Samples | Any purified glycans with free reducing termini can be labeled. |
| Structural Integrity | No detectable (< 2 mole per cent) loss of sialic acid, fucose, sulfate, or phosphate. |
| Labeling efficiency | Typically > 85 % (dependent on sample). |
| Labeling Selectivity | Essentially stoichiometric labeling. |
| Storage: | Store at room temperature in the dark. Protect from sources of heat, light, and moisture. The reagents are stable for at least two years as supplied. |
| Shipping: | The product can be shipped at ambient temperature. |
| Handling: | Ensure that any glass, plasticware or solvents used are free of glycosidases and environmental carbohydrates. Use powder-free gloves for all sample handling procedures and avoid contamination with environmental carbohydrate. All steps involving labeling reagents must be performed in a dry environment with dry glassware and plasticware. Once individual vials of reagents are opened, their contents should be used immediately and excess then discarded according to local safety rules. |
| Safety: | For research use only. Not for human or drug use Please read the Material Safety Data Sheets (MSDS's) for all chemicals used. All processes involving labeling reagents should be performed using appropriate personal safety protection - eyeglasses, chemically resistant gloves (e.g. nitrile), etc. - and where appropriate in a laboratory fume cupboard. |

Kit Contents

Each labeling reaction set consists of one vial of each of the following:

| Cat. # | Item | Quantity |
|--------------|-------------------------------------|----------|
| LT-2AB-01 | 2-AB Dye (2-Aminobenzamide) | 5 mg |
| LT-DMSO-01 | DMSO | 350 µL |
| LT-ACETIC-01 | Acetic acid | 200 µL |
| LT-CYANOB-01 | Sodium cyanoborohydride (Reductant) | 6 mg |

Additional Reagents and Equipment Required

- Heating block, oven, or similar dry heater (a water bath cannot be used) set at 65°C
- Centrifugal evaporator (e.g. Savant, Heto, or similar)
- Reaction vials (e.g. polypropylene microcentrifuge vials)
- Note: Further reagents are required if doing the optional post-labeling sample cleanup (see Section on Sample Cleanup)

Time Line for Labeling

The LudgerTag™ labeling procedure including the optional post-labeling sample cleanup typically takes 4 - 5 hours:

| Procedure | Time | Elapsed Time (hours) |
|---|---------|----------------------|
| Transfer samples to reaction tube and dry | 30 min | 0.5 |
| Make up and add labeling reagent | 15 min | 0.75 |
| Incubate samples with reagent | 3 hours | 3.75 |
| Post-labeling cleanup | 1 hour | 4.75 |

The Reductive Amination Reaction

The labeling reaction involves a two step process (see Figure 1):

1. Schiff's base formation.

This requires a glycan with a free reducing terminus which is equilibrium between the ring closed (cyclic) and ring open (acyclic) forms. The primary amino group of the dye performs a nucleophilic attack on the carbonyl carbon of the acyclic reducing terminal residue to form a partially stable Schiff's base.

2. Reduction of the Schiff's base.

The Schiff's base imine group is chemically reduced to give a stable labeled glycan.

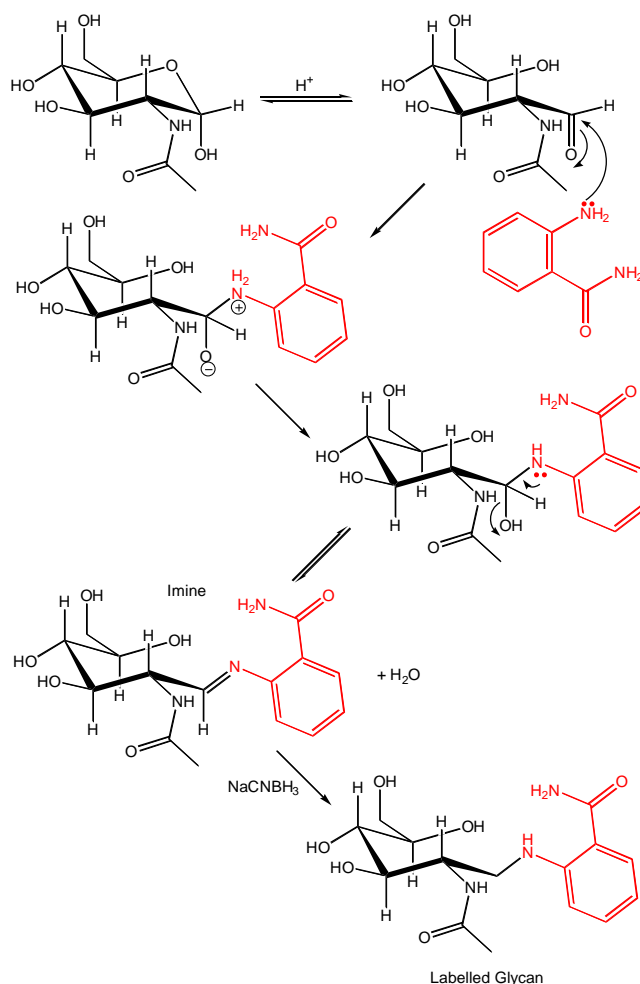


Figure 1: Labeling of a glycan with 2-aminobenzamide acid (2-AB) by reductive amination.

Outline of Labeling Protocol

LudgerTag™ glycan labeling kits are designed for the fluorophore or chromophore labeling of glycans with a free reducing terminus. Labeled glycans may be followed by either high-sensitivity fluorescence detection or monitoring of UV-absorbance during various chromatographic and structure sequence analyses. These include chromatography on LudgerSep™ HPLC columns and sequencing using exoglycosidases (See refs 1-5, 7).

The outline of the labeling procedure is as follows:

1 Prepare the glycans.

Prepare the glycan samples by removing contaminants such as salts and detergents that could interfere with the labeling procedure.

2 Dry the glycans

Place the samples in reaction vials and dry down.

3 Prepare labeling reagent

Prepare fresh dye labeling solution by mixing reagents in the kit.

4 Add labeling reagent to glycans

Add a small amount of labeling solution to each sample.

5 Incubate

Incubate the samples to allow the labeling reaction to progress.

6 Post-labeling cleanup

After incubation, if required (depending on the subsequent analysis procedures), remove the excess labeling reagents using a straightforward cleanup procedure.

7 Store or analyse the labeled glycans

The labeled glycans are now ready for analysis.

Sample Preparation

The glycan sample to be labeled, whether a purified glycan or a glycan mixture, must contain a free reducing terminus, be particle and salt-free, and be presented in a volatile solvent system (preferably pure water).

The following may interfere with the labeling reaction and must be removed from the glycan samples prior to LudgerTag™ labeling:

- Non-volatile solvents
- Non-volatile salts, in particular transition metal ions
- Detergents
- Dyes and stains such as Coomassie Blue

A range of LudgerClean™ kits for cleaning glycan samples prior to LudgerTag™ labeling is available from Ludger. These are detailed in the LudgerClean Glycan Cleanup Guide [ref 6].

The standard sample preparation protocol is as follows:

1 Purify the glycans

If necessary, remove non-carbohydrate contaminants from the samples using one of the strategies outlined in the Glycan Cleanup Guide [ref 6].

2 Transfer sample to reaction vial

The amount of sample should be in the range 100 picomoles - 50 nanomoles for a glycan pool obtained from a typical glycoprotein. With a single pure glycan as little as 5 picomoles can be labeled and detected in subsequent HPLC analysis. Suitable reaction vials include small polypropylene microcentrifuge tubes and tubes for PCR work.

3 Dry the samples

Ideally, samples should be dried using a centrifugal evaporator. If this is not possible then freeze drying (lyophilization) can be used with caution (in particular, ensure that the sample dries to a small, compact mass at the very bottom of the vial).

Do not subject samples to high temperatures (> 28°C) or extremes of pH as these conditions will result in acid catalysed loss of sialic acids (high temperatures, low pH) or epimerization of the glycan reducing terminus (at high pH).

Preparation of Labeling Reagent

Prepare fresh labeling reagent as follows:

4 Prepare a DMSO-acetic acid mixture

Add 150 μ L glacial **acetic acid** to the vial of **DMSO** and mix by pipette action.

The Catalog #s for the acetic acid and DMSO are LT-ACETIC-01 and LT-DMSO-01 respectively.

Open the ampoules by carefully tapping or flicking to dislodge any contents in the upper half, then carefully break open the ampoule.

If the DMSO is frozen then gently warm up the vial (before opening) in an oven or heating block to between 30°C and 65°C.

5 Add the dye

Add 100 μ L of the DMSO-acetic acid mixture to a vial of LudgerTag™ **2-AB (2-Aminobenzamide Acid) Dye** and mix until the dye is dissolved.

The Cat. # for the dye is LT-2AB-01.

6 Add the reductant

Add the dissolved dye to a vial of LudgerTag™ **sodium cyanoborohydride** (reductant) and mix by pipette action until the reductant is completely dissolved to make the final **labeling reagent**.

The Catalog. # for the sodium cyanoborohydride reductant is LT-CYANOB-01.

If the reductant is difficult to dissolve then gently warm the vial for up to four minutes in the 65°C incubation oven or stand on a heating block at this temperature then mix by pipette action. If undissolved reductant is still visible add 10 μ L pure water to the vial and mix.

Protect the labeling reagent from exposure to moisture and use within 60 minutes.

Labeling Reaction

7 Add labeling reagent to samples

Add 5 μ L of labeling reagent to each dried glycan sample, cap the microtube, mix thoroughly, and then gently tap to ensure the labeling solution is at the bottom of the vial.

8 Incubate

Place the reaction vials in a heating block, sand tray, or dry oven set at 65°C and incubate for 3 hours.

The incubation must be performed in a dry environment. Use an oven or dry block - please do not use a water bath.

The samples must be completely dissolved in the labeling solution for efficient labeling. To encourage complete dissolution the samples can be vortexed 30 minutes after the start of the 65°C incubation then the incubation continued.

In most cases, the incubation time can be shortened to 2 hours or extended up to 4 hours without significantly changing the outcome of the labeling reaction.

9 Centrifuge and cool

After the incubation period remove the samples, centrifuge the microtubes briefly, then allow them to cool completely to room temperature.

LudgerClean™ S Post-Labeling Sample Cleanup

Post-labeling sample cleanup (to remove excess dye and other labeling reagents) is necessary for certain applications - e.g. subsequent analysis by HPLC. Such cleanup can be achieved using LudgerClean™ S cartridges (Cat # LC-S-Ax, where x denotes the number of cartridges in the kit) using the standard protocol included with the kit.

Post-labeling sample cleanup is not necessary for applications where the excess labeling reagents do not interfere with subsequent sample analysis. These include carbohydrate electrophoresis where free dye runs away from the labeled glycans.

Analysis of LudgerTag™ 2AB-Labeled Glycans

LudgerTag™ 2-AB labeled glycans may be studied by a number of different analytical methods including HPLC, gel electrophoresis, and mass spectrometry. These are covered in detail in reference 8 and overviewed below.

HPLC Analysis

LudgerTag™ 2-AB labeled glycan mixtures may be separated and analysed by a variety of HPLC (high pressure liquid chromatography) methods including LudgerSep™ HPLC:

| Type of Analysis | Column | Cat. No. |
|---|--------------|----------|
| Separation of charged and neutral glycans | LudgerSep™ C | LS-C-01 |
| Profile analysis of neutral and charged glycans | LudgerSep™ N | LS-N-01 |
| Separation of neutral glycans | LudgerSep™ R | LS-R-01 |

The uses of these columns for glycan analysis are overviewed in References 4 and 8.

The LudgerSep™ N column is an especially powerful tool for the purification and analysis of LudgerTag™ labeled oligosaccharides from complex glycan mixtures. Please contact us for advice regarding your particular application.

Enzymatic Analysis

High purity, sequencing grade enzymes (e.g. exoglycosidases) suitable for structural analysis of both N- and O-linked LudgerTag™ labeled glycans are available from a number of companies.

When selecting glycosidases be especially careful to choose those with formulations that are compatible with your particular application. For example, some enzymes and enzyme buffers have components that interfere with certain types of analysis. Please call us for guidance in selecting enzymes and reaction conditions for your work.

Mass Spectrometry and Electrophoresis

LudgerTag™ labeled glycans may also be analysed by mass spectrometry, electrophoresis, and various types of spectroscopy. Please call us for advice on the analysis conditions most suitable for your intended analyses.

Warranties and Liabilities

Ludger warrants that the above product conforms to the attached analytical documents. Should the product fail for reasons other than through misuse Ludger will, at its option, replace free of charge or refund the purchase price. This warranty is exclusive and Ludger makes no other warranties, expressed or implied, including any implied conditions or warranties of merchantability or fitness for any particular purpose.

Ludger shall not be liable for any incidental, consequential or contingent damages.

This product is intended for *in vitro* research only.

Document Revision Number

Document # LT-KAB-A2-Guide-v3.0

References

- 1 Bigge, J.C.; Patel, T.P; Bruce, J.A.; Goulding, P.N.; Charles, S.M; Parekh, R.B. (1995)
'Non-selective and efficient fluorescent labeling of glycans using 2-aminobenzamide and anthranilic acid'.
Analytical Biochemistry **230**: 229-238
- 2 Guile, G.R.; Rudd, P.M.; Wing, D.R.; Prime, S.B.; Dwek, R.A. (1996)
'A rapid and high-resolution high-performance liquid chromatographic method for separating glycan mixtures and analyzing oligosaccharide profiles'.
Analytical Biochemistry **240**: 210-226
- 3 Townsend, R.R.; Lipniunas, P.H.; Bigge, C.; Ventom, A.; Parekh, R. (1996)
'Multimode high-performance liquid chromatography of fluorescently labeled oligosaccharides from glycoproteins'.
Analytical Biochemistry **239**: 200-207
- 4 LudgerSep™ High Resolution HPLC Carbohydrate Profiling Guide (Cat # LS-GUIDE-01)
- 5 Ludger Enzyme Selection Guide (Cat # EZ-GUIDE-01)
- 6 LudgerClean™ Glycan Cleanup Guide (Cat # LC-GUIDE-01)
- 7 Hardy, M.R. (1997)
'Glycan labeling with the fluorophores 2-aminobenzamide and anthranilic acid'
in 'Techniques in Glycobiology', edited by Townsend, R.R and Hotchkiss, A.T.. Marcel Dekker Inc, New York .
- 8 Ludger Technical Note # TN-AB-01: Analysis of 2-AB (2-aminobenzamide acid) labeled glycans

Appendix 1: Troubleshooting Guide

The LudgerTag™ labeling protocol is an efficient, robust method. If problems do arise they can normally be corrected without difficulty. The following is a guide to the most likely problems, possible causes, and solutions.

Poor Incorporation of Dye / Low Labeling Yield

The labeling temperature was incorrect.

Please ensure that the oven or heating block is equilibrated to the incubation temperature and that the reaction tube is subjected to this temperature for the entire labeling period.

The sample was incompletely solubilised.

The glycans must be completely dissolved in the labeling mixture for maximum labeling efficiency. Please ensure that the sample is thoroughly mixed with the labeling reagent prior to the incubation and, as a precaution, carefully mix the samples 15 minutes after the start of the incubation.

The sample contained contaminants that interfered with the labeling.

Please ensure that the glycans are adequately purified before labeling (see protocol step 1 and the LudgerClean™ Glycan Cleanup Guide).

The labeling solution was inactive. Please make up the labeling solution immediately before use - the reagents will lose activity within a few hours of mixing.

There was less starting glycan than was originally estimated.

The glycans did not contain a free reducing terminus.

The 2-AB dye conjugates to the glycan via the aldehyde group of the free reducing terminus. Alditols and glycans already conjugated via their reducing terminus (e.g. glycopeptides, glycolipids, and previously labeled glycans) do not contain a free reducing terminus and so cannot conjugate to the dye.

The glycans were lost during the post-labeling cleanup.

Please ensure that the removal of excess labeling reagents is performed as specified in the cleanup protocol and that the wash reagents are correctly made.

The Labeled Samples Contain Fluorescent Non-Carbohydrate Material

The original glycans contained aldehyde-bearing contaminants.

Please ensure that the glycans are adequately purified before labeling (see protocol step 1 and the LudgerClean Glycan Cleanup Guide).

The post-labeling cleanup step did not work correctly.

Please ensure that the removal of excess labeling reagents is performed as specified in the post-labeling cleanup protocol and that the wash reagents are correctly made.

Selective Loss of Smaller Glycans

The cleanup cartridge was not primed correctly.

Please ensure the cartridge is primed correctly and that the cartridge bed is still wet with acetonitrile when the sample is applied to the disc.

Incorrect wash reagents were used during the post-labeling cleanup.

Please ensure that the wash reagents are correctly prepared.

Selective Loss of Larger Glycans

The sample was incompletely solubilised.

The glycans must be completely dissolved in the labeling mixture for maximum labeling efficiency. Larger glycans tend to be less soluble in the labeling mixture than small sugars. Please ensure that the sample is thoroughly mixed with the labeling reagent prior to the incubation and, as a precaution, carefully mix the samples 15 minutes after the start of the incubation.

Desialylation of the Glycans

The sample was subjected to acidic conditions in aqueous solutions at elevated temperatures

Avoid prolonged periods of exposure of sialylated glycan samples in aqueous solutions to conditions of low pH and elevated temperatures. Note that the reductive amination reaction is carried out in essentially anhydrous conditions under which loss of sialic acids is minimal.

In general, try to keep samples in solutions in the pH range 5 – 8.5 and avoid exposure to temperatures above 30 °C. Samples in pH buffered aqueous solutions (with pH between 5 and 8.5) tend to be resistant to acid catalyzed de-sialylation even at temperatures higher than 30°C. However, even then it is wise to err on the side of caution and keep the samples cool whenever possible.

The samples were not cleaned up correctly after labeling

Make sure that samples undergo the post-labeling cleanup immediately after the reductive amination reaction and that the post-labeling drying and cleanup procedure is conducted reasonably quickly.

Labeled samples that have **not** undergone drying and subsequent cleanup will be prone to acid catalyzed de-sialylation.

Appendix 2: SDS

SAFETY DATA SHEET

Version: 1.1

Date written: 17th October 2011

Date reviewed: 09 February 2016

SECTION 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY / UNDERTAKING

| | |
|------------------------|--|
| Product Name | 2-AB Dye |
| Product Catalogue Name | LT-2AB-01 |
| CAS-No. | 88-68-6 |
| Company: | Ludger Ltd Culham Science Centre Abingdon Oxford OX14 3EB |
| Telephone: | 01865 408554 |
| Emergency Telephone: | 01865 408554 |
| Email: | info@ludger.com |

SECTION 2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [EU-GHS/CLP]

Acute toxicity, Oral (Category 4)

Skin irritation (Category 2)

Eye irritation (Category 2)

Respiratory sensitization (Category 1)

Specific target organ toxicity – Single exposure (Category 3)

2.2 Label elements



Signal Word: Danger

Hazard Statement(s)

| | |
|------|--|
| H302 | Harmful if swallowed. |
| H315 | Causes skin irritation. |
| H319 | Causes serious eye irritation. |
| H334 | May cause allergy or asthma symptoms or breathing difficulties if inhaled. |
| H335 | May cause respiratory irritation. |

Precautionary Statement(s)

| | |
|----------------|--|
| P261 | Avoid breathing dust/ fume/gas/mist/vapours/spray. |
| P305+P351+P338 | IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do so. Continue rinsing. |
| P342+P311 | If experiencing respiratory symptoms: Call a POISON CENTRE or a Doctor/Physician. |

2.3 Other hazard information:

May produce an allergic reaction.

No supplemental hazard statements.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

| | |
|-------------------|--|
| Synonyms: | 2-aminobenzamide anthranilic acid amide anthranilamide |
| Formula: | C ₇ H ₈ N ₂ O |
| Molecular Weight: | 136.15g/mol |

| Component | | Concentration |
|-----------|------------------|---------------|
| Name | 2-aminobenzamide | ----- |
| CAS-No. | 88-68-6 | |
| EC-No. | 201-851-2 | |

SECTION 4. FIRST AID MEASURES

4.1 Description of first aid measures

General Advice

Consult a physician if exposure causes ill effects and if in any doubt. Show this safety data sheet to the physician/ first responder in attendance.

If Ingested

Never give anything by mouth to an unconscious person. Rinse mouth well with water.

If skin is exposed

Wash area well with soap and water.

If eyes are exposed

Rinse well with plenty of water for at 15 minutes.

If inhaled

Move the person into fresh air. If not breathing give artificial respiration.

4.2 Most important symptoms and effects, both acute and delayed

To the best of our knowledge, the chemical, physical and toxicological properties have not been thoroughly investigated so cannot be reported.

4.3 Indication of immediate medical attention and special treatment needed

No Data available

SECTION 5. FIRE-FIGHTING MEASURES**5.1 Extinguishing media**

Use a water spray, alcohol resistant foam, dry chemical or carbon dioxide extinguisher.

5.2 Special hazards arising from the substance or mixture

Carbon oxides, nitrogen oxides (NO_x)

5.3 Advice for firefighters

Fire fighters to wear self contained breathing apparatus if necessary.

SECTION 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 in work areas. Evacuate personnel to safe areas to avoid breathing dust.

6.2 Environmental Precautions

Do not let the product enter the drains.

6.3 Methods and material for containment and cleaning up

Carefully sweep up the spill without creating any dust. Contain the collected material in a sealed suitable container, to await disposal.

6.4 Reference to other sections

Please refer to section 13 for disposal of product and spills.

SECTION 7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. Normal measures for fire prevention protection.

7.2 Conditions for safe storage, including any incompatibilities

Store in a cool, dark place. Keep the container tightly closed in a dry well ventilated place.

7.3 Specific end uses

No data available

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good laboratory and safety practice. Wash hands before entering the laboratory and at the end of the workday/ when finished handling the material.

Personal Protective Equipment

Eye / face protection

Safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166 (EU).

Skin protection

Handle wearing gloves. Gloves must be inspected before use. Use proper glove removal technique (without the glove touching the skin) to avoid skin contact with the product. Dispose of contaminated gloves as chemical dry waste in accordance with applicable laws and good laboratory practices. Wash and dry the hands. Gloves must satisfy the specifications of EU directive 89/686/EEC and the standard EN 374 derived from it.

Body Protection

Laboratory coat or other types of body covering suitable for use in a laboratory.

Respiratory protection

When used under an operational fume hood no special protection is required. If required use respirators and components tested and approved under government standards such as NIOSH (US) or CEN (EU). Required level for nuisance exposure P98 (US) or P1 (EU EN 143), higher levels of protection OV/AG/P99 (US) or ABEK-P2 (EU EN 143).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

| | |
|---|--------------------------------|
| Appearance | Form: Crystalline |
| | Colour: Beige |
| Odour | No data available |
| Odour threshold | No data available |
| pH | No data available |
| Freezing/Melting Point | Melting point/range: 111-113°C |
| | Melting point/range: 111-113°C |
| Initial boiling point and boiling range | No data available |
| Flash Point | 198°C – closed cup |
| Evaporation rate | No data available |
| Flammability | No data available |
| Upper/lower flammability or explosive limits | No data available |
| Vapour Pressure | No data available |
| Relative Density | No data available |
| Solubility in water and solvents (mg/l) | No data available |
| Partition coefficient: n- Octanol/water | No data available |
| Auto ignition temperature | No data available |

| | |
|---------------------------|-------------------|
| Decomposition temperature | No data available |
| Viscosity | No data available |
| Explosive properties | No data available |
| Oxidising properties | No data available |

9.2 Other information

No data available

SECTION 10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

No data available

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to Avoid

No data available

10.5 Incompatible materials

Oxidizing agents

10.6 Hazardous decomposition products

Other decomposition products - No data available

SECTION 11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

Skin corrosion/irritation

No data available

Serious eye damage/irritation

No data available

Respiratory or skin sensitisation

No data available. May cause sensitisation by inhalation.

Germ cell mutagenicity

No data available

Carcinogenicity

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

Reproductive toxicity

No data available

STOT-single exposure

Inhalation – May cause respiratory irritation.

STOT-repeated exposure

No data available

Aspiration hazard.

No data available

Potential Health Hazards

| | |
|------------|--|
| Inhalation | May be harmful if inhaled. Causes respiratory tract irritation. |
| Ingestion | Harmful if swallowed. |
| Skin | May be harmful if absorbed through the skin. Causes skin irritation. |
| Eyes | Causes serious eye irritation. |

Signs and symptoms of exposure

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

Additional Information

RTECS: CU8993000

SECTION 12. ECOLOGICAL INFORMATION**12.1 Toxicity**

No data available

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

No data available

12.6. Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS**13.1 Waste treatment methods**

Contact a licensed waste disposal service to collect/dispose of any waste material.

Contaminated packaging

Treat as an unopened/ unused product.

SECTION 14. TRANSPORT INFORMATION**14.1 UN Number**

ADR/RID: - IMDG: - IATA: -

14.2 UN Proper Shipping Name

ADR/RID: Not dangerous goods

IMDG: Not dangerous goods

IATA: Not dangerous goods

14.3 Transport hazard class(es)

ADR/RID: - IMDG: - IATA: -

14.4 Packing group

ADR/RID: - IMDG: - IATA: -

14.5 Environmental hazards

ADR/RID: No

IMDG Marine pollutant: No

IATA: No

14.6 Special precautions for user

No data available

SECTION 15. REGULATORY INFORMATION

This safety data sheet complies with the requirements of Regulation (EC) No. 1907/2006

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

No data available

15.2 Chemical Safety Assessment

No data available

Note that the label elements, the Risk and Safety phrases (now Hazard and Precautionary statements) that used to be in Section 15 are now in Section 2.

SECTION 16. OTHER INFORMATION

The advice offered is derived from the current available information on the hazardous materials in this product and its component(s). Consideration has been made regarding the quantities offered in the pre-dispensed container. The advice offered is, therefore, not all-inclusive nor should it be taken as the descriptive of the compound generally.

SAFETY DATA SHEET

Version: 1.1

Date written: 19th October 2011

Date reviewed: 09 February 2016

SECTION 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY / UNDERTAKING

Product Name **acetic acid**

Product Catalogue Name **LT-ACETIC-01**

CAS-No. **64-19-7**

Company: Ludger Ltd
 Culham Science Centre
 Abingdon
 Oxfordshire
 OX14 3EB

Telephone: 01865 408554

Emergency Telephone: 01865 408554

Email: info@ludger.com

SECTION 2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [EU-GHS/CLP].

Flammable liquids (Category 3)

Skin corrosion (Category 1A)

2.2 Label elements



Signal Word: Danger

Hazard Statement(s)

H314 Causes severe burns and eye damage.
H226 Flammable liquid and vapour.

Precautionary Statement(s)

| | |
|----------------|--|
| P280 | Wear protective gloves/protective clothing/ face protection. |
| P305+P351+P338 | IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do so. |
| P310 | Immediately call a POISON CENTRE or doctor/ physician. |

2.3 Other hazard information:

None

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

| | |
|-------------------|--|
| Synonyms: | glacial acetic acid |
| Formula: | C ₂ H ₄ O ₂ |
| Molecular Weight: | 60.05g/mol |

| Component | Classification | Concentration |
|-----------------------|---|---------------|
| Name: acetic acid | Flam. Liq. 3; Skin Corr. 1A; H314, H226 | - - |
| CAS-No. 64-19-7 | | |
| EC-No. 200-580-7 | | |
| Index-No 607-002-00-6 | | |

For the full text of the Hazard statements mentioned above, see Section 16.

SECTION 4. FIRST AID MEASURES

4.1 Description of first aid measures

General Advice

Consult a physician if exposure causes ill effects and if in any doubt. Show this safety data sheet to the physician/ first responder in attendance.

If Ingested

Rinse mouth well with water, do not induce vomiting. Never give anything by mouth to an unconscious person.

If skin is exposed

Remove any contaminated clothing immediately. Wash effected area with plenty of soap and water.

If eyes are exposed

Rinse thoroughly with plenty of water or eye wash solution for at least 15 minutes.

If inhaled

Move person to fresh air supply. If not breathing give artificial respiration.

4.2 Most important symptoms and effects, both acute and delayed

No data available.

SECTION 5. FIRE-FIGHTING MEASURES**5.1 Extinguishing media**

For small fires use extinguishing media such as dry chemical, carbon dioxide or “alcohol” foam.

For large fires apply water from as far away as possible, use large amounts of water, applied as mist or spray: solid streams of water may not be as effective. Cool all affected containers with large amounts of water.

5.2 Special hazards arising from the substance or mixture

No data available.

5.3 Advice for firefighters

Wear self contained breathing apparatus, if necessary. Use water spray to cool unopened containers if near the fire.

SECTION 6. ACCIDENTAL RELEASE MEASURES**6.1 Personal precautions, protective equipment and emergency procedures**

Wear personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Unnecessary staff to leave the immediate area of spillage.

6.2 Environmental Precautions

Do not let the chemical enter the drains.

6.3 Methods and material for containment and cleaning up

Contain the spill and collect with non-combustible absorbent material (such as sand, earth, diatomaceous earth and vermiculite) and place in a container for disposal. Keep in suitable, closed containers when waiting for disposal.

6.4 Reference to other sections

See Section 13 for suitable means of disposal of waste.

SECTION 7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid inhalation of vapour or mist. Keep away from any sources of ignition- No smoking.

Take measures to prevent electrostatic charge near/in the work area when handling the chemical.

7.2 Conditions for safe storage, including any incompatibilities

Store in a cool, dry place. Keep the container tightly closed in a dry and well ventilated place. Containers once opened must be carefully re sealed and kept upright. This chemical is moisture sensitive.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

ACETIC ACID

| CAS-No. | Value | Control Parameters | Update | Basis |
|---------|------------|------------------------------|------------|---|
| 64-19-7 | TWA | 10ppm 25mg/m ³ | 1991-07-05 | Europe. Commission Directive 91/322/EEC on establishing indicative limit on values. |
| Remarks | Indicative | | | |

8.3 Exposure controls

Appropriate engineering controls

Handle in accordance with good laboratory and safety practice. Wash hands when leaving the lab and before entering the laboratory.

Personal Protective Equipment

Eye / face protection

Laboratory Safety Glasses.

Skin/Body protection

Laboratory Gloves and coat or similar covering over clothes. Gloves to satisfy the specifications of EU directive 89/686/EEC and the standard EN 374 derived from it.

Respiratory protection

Chemical should be handled when open, under an operational fume hood.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

| | |
|---|--|
| Appearance | Form: Liquid Colour: Colourless |
| Odour | pungent |
| pH | 2.4 at 60.05g/l |
| Melting Point | 16.2°C |
| Initial boiling point and boiling range | 117-118°C |
| Flash Point | 40.0°C – closed |
| Evaporation rate | No data available |
| Flammability | High |
| Upper/lower explosive limits | Lower = 4% (V) Upper = 19.9% (V) |
| Vapour Pressure | 73.3hPa at 50.0°C 15.2hPa at 20.0°C |
| Relative Density | 1.049g/ml at 25°C |
| Solubility in water and solvents (mg/l) | Completely miscible |
| Partition coefficient: n-octanol/water | log Pow: - 0.17 |
| Auto ignition temperature | 485°C |
| Decomposition temperature | No data available |
| Viscosity | No data available |
| Explosive properties | No data available |
| Oxidising properties | No data available |

9.2 Other information

No data available

SECTION 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

Heat, flames and sparks

10.5 Incompatible materials

Oxidising agents, soluble carbonates and phosphates, Hydroxides, Metals, Peroxides, Permanganates, e.g. Potassium permanganate, Amines, Alcohols.

10.6 Hazardous decomposition products

Hazardous decomposition products formed under fire conditions (Carbon oxides).

SECTION 11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral – Rat – 3,310 mg/kg

LC50 Inhalation – Mouse – 1h - 5620ppm

Remarks: Sense Organs and Special Senses (Nose, Eyes, Ears and Taste): Eyes: Conjunctive irritation. Eyes: Other. Blood: Other changes.

LD50 Dermal – Rabbit – 1,112 mg/kg

Skin corrosion/irritation

Skin – Rabbit – Mild skin irritation – 24h

Serious eye damage/irritation

Eyes – Rabbit – Corrosive to eyes.

Respiratory or skin sensitisation

May cause sensitization by skin contact.

Germ cell mutagenicity

No data available.

Carcinogenicity

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

Reproductive toxicity

No data available.

STOT-single exposure

No data available.

STOT-repeated exposure

No data available.

Aspiration hazard.

No data available.

Potential Health Hazards

Inhalation May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.

Ingestion May be harmful if swallowed. Causes severe burns.

Skin May be harmful if absorbed through skin. Causes severe skin burns.

Eyes Causes severe eye burns.

Signs and symptoms of exposure

Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract, eyes and skin, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, burning sensation, cough, wheezing, laryngitis, shortness of breath, headache, nausea, vomiting.

Ingestion or inhalation of concentrated acetic acid causes damage to tissue of the respiratory and digestive tracts. Symptoms include: Hematemesis, bloody diarrhoea, edema and/or perforation of the esophagus and pylorus, pancreatitis, hematuria, anuria, uremia, albuminuria, hemolysis, convulsions, bronchitis, pulmonary edema, pneumonia, cardiovascular collapse, shock and death.

Direct contact or exposure to high concentrations of vapour with skin or eyes can cause: erythema, blisters, tissue destruction with slow healing, skin blacking, hyperkeratosis, fissures, corneal erosion, opacification, iritis, conjunctivitis and possible blindness.

To the best of our knowledge, the chemical, physical and toxicological properties have not been fully investigated.

Additional Information

RTECS: AF1225000

SECTION 12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to Fish

LC50 – *Leuciscus idus* (Golden Orfe) – 410.00mg/l – 48h

LC50 – *Cyprinus carpio* (Carp) – 49.00mg/l – 48h

LC50 – *Pimephales promelas* (Fathead minnow) – 79.00 - 88.00mg/l – 96h

LC50 – *Lepomis macrochirus* – 75mg/l – 96h

Toxicity to *Daphnia* and other aquatic invertebrates.

EC50 – *Daphnia magna* (Water flea) – 65.00mg/l – 48h

12.2 Persistence and degradability

Biodegradability

Remarks: Expected to be biodegradable.

12.3 Bio accumulative potential

No data available

12.4. Mobility in soil

No data available

12.5. Results of PBT and vPvB assessment

No data available

12.6. Other adverse effects

Biochemical Oxygen Demand (BOD) - 880mg/g

SECTION 13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

This chemical is combustible and may be burned in a chemical incinerator equipped with an afterburner and scrubber. If not practical, use a licensed waste disposal service.

Contaminated packaging

Disposed of the packaging as unused/ waste product.

SECTION 14. TRANSPORT INFORMATION

14.1 UN Number

ADR/RID: 2789

IMDG: 2789

IATA: 2789

14.2 UN Proper Shipping NameADR/RID: ACETIC ACID, GLACIAL
ACETIC ACID, GLACIAL

IMDG: ACETIC ACID, GLACIAL

IATA:

14.3 Transport hazard class(es)

ADR/RID: 8 (3)

IMDG: 8 (3)

IATA: 8 (3)

14.4 Packing group

ADR/RID: II

IMDG: II

IATA: II

14.5 Environmental hazards

ADR/RID: -

IMDG Marine pollutant: No

IATA: -

14.6 Other information

IMDG: EMS-No: F-E, S-C

SECTION 15. REGULATORY INFORMATION

This safety data sheet complies with the requirements of Regulation (EC) No. 1907/2006.

Please note that the label elements, hazard and precautionary statements that used to be Section 15 are now in Section 2.

SECTION 16. OTHER INFORMATION

The advice offered is derived from the current available information on the hazardous materials in this product and its component(s). Consideration has been made regarding the quantities offered in the pre-dispensed container. The advice offered is, therefore, not all-inclusive nor should it be taken as the descriptive of the compound generally.

SAFETY DATA SHEET

Version: 1.1

Date written: 28th September 2011

Date reviewed: 09 February 2016

SECTION 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product Name **sodium cyanoborohydride**

Product Catalogue Name **LT-CYANOB-01**

CAS-No. **25895-60-7**

Company: Ludger Ltd
 Culham Science Centre
 Abingdon
 Oxford OX14 3EB

Telephone: 01865 408554

Emergency Telephone: 01865 408554

Email: info@ludger.com

SECTION 2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification according to the Regulation (EC) No. 1272/2008 [EU-GHS/CLP]

Flammable solids (category 1)

Substances, which in contact with water emit flammable gases (category 1)

Acute toxicity, Oral (category 2)

Acute toxicity, Inhalation (category 2)

Acute toxicity, Dermal (category 2)

Skin corrosion (category 1B)

Acute aquatic toxicity (category 1)

Chronic aquatic toxicity (category 1)

2.2 Label elements



Signal Word: DANGER

Hazard Statement(s)

- H228 Flammable solid
- H260 In contact with water releases flammable gases which may ignite spontaneously.
- H300 Fatal if swallowed.
- H310 Fatal in contact with skin.
- H314 Causes severe burns and eye damage.
- H330 Fatal if inhaled.
- H410 Very toxic to aquatic life with long lasting effects.

Precautionary Statement(s)

- P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
- P223 Keep away from any possible contact with water, because of violent reaction and possible flash fire.
- P231+P232 Handle under inert gas. Protect from moisture.
- P260 Do not breathe dust/fume/gas/mist/vapours/spray.
- P370+P378 In case of Fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
- P422 Store contents under inert gas.

2.3 Other hazard information

(EU)

- EUH032 Contact with acids liberates very toxic gas.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

3. 1 Substances

Synonyms: sodium cyanotrihydridoborate

Formula: CH₃BNNa

| Component | Concentration |
|----------------------------------|---------------|
| Name: sodium cyanotrihydroborate | |
| CAS-No. 25895-60-7 | - |
| EC-No. 247-317-2 | |

SECTION 4. FIRST AID MEASURES

4.1 Description of first aid measures

General Advice

Consult a physician if exposure causes ill effects and if in any doubt. Show this safety data sheet to the doctor/ first responder in attendance.

If Ingested

Do NOT induce vomiting. Rinse mouth well with water, unless person(s) is unconscious.

If skin is exposed

Remove contaminated clothing/shoes immediately. Wash affected area(s) with water and soap.

If eyes are exposed

Wash eye(s) with plenty of water for at least 15 minutes, if unsure seek medical advice.

If inhaled

Move into a source of fresh air, if not breathing give artificial respiration.

4.2 Most important symptoms and effects, both acute and delayed

Burning sensation, coughing, wheezing, laryngitis, shortness of breath, head ache, nausea, vomiting. To the best of our knowledge the chemical, physical and toxicological properties have not been thoroughly investigated. Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed two to four hours or longer.

4.3 Indication of immediate medical attention and special treatment needed

No Data available

SECTION 5. FIRE-FIGHTING MEASURES

5.1 Extinguishing media

Dry powder

5.2 Special hazards arising from the substance or mixture

Carbon oxides, Nitrogen oxides, Hydrogen cyanide (Hydrocyanic acid), Borane/boron oxides.

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

SECTION 6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures.

Wear respiratory protection; gently sweep up to avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation, remove all sources of ignition. Evacuate personnel to a safe area; avoid breathing in dust/gas or mist.

6.2 Environmental Precautions

Prevent further leakage or spillage if safe to do so. Do not let the chemical enter the drainage system and further discharge into the environment must be avoided.

6.3 Methods and material for containment and cleaning up

Contain the spill with matting if necessary and then collect using either an electrically protected vacuum cleaner or by damp brushing (not wet) and putting the collected waste into a secure dry container, do not flush with water. Dispose according to local regulations.

6.4 Reference to other sections

For disposal regulations see section 13.

SECTION 7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes, avoid formation of dust when handling. Provide appropriate exhaust ventilation in work areas where dust could be formed. Keep away from sources of ignition (No Smoking) and take measures to prevent the build up of electrostatic charge.

7.2 Conditions for safe storage, including any incompatibilities

Store in a cool place. Keep the container tightly closed in a dry and well ventilated place. Never allow the product to get into contact with water during storage as it is moisture sensitive. Do not store near acids. Handle and open the container with care. Hygroscopic. Handle when open under an inert gas.

7.3 Specific end uses

No data available

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/Face protection

Safety glasses to be worn following good laboratory practice. Eye protection should be tested and approved under appropriate government standards such as EN 166 (EU) or NIOSH (US).

Skin protection

Handle with gloves at all times following good laboratory practice. Gloves must be inspected before use and to be removed in proper glove removal technique (without touching the gloves outer surface) to avoid skin contact. Dispose of contaminated gloves after use as contaminated waste, in accordance with local regulations. Wash and dry hands.

Gloves to be within the specifications of EU directive 89/686/EEC and the standard EN 374 derived from it.

Body protection

Laboratory coat or other protective laboratory clothing should be worn when handling the product.

Respiratory protection

Use extraction unit/fume hood when using the product.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

| | |
|---|---|
| Appearance | Form: Powder |
| | Colour: Beige |
| Odour | No data available |
| Odour threshold | No data available |
| pH | No data available |
| Freezing/Melting Point | Melting point/range :> 242°C |
| Initial boiling point and boiling range | No data available |
| Flash Point | No data available |
| Evaporation rate | No data available |
| Flammability (solids and gases) | The substance or mixture is a flammable solid |

| | |
|--|-------------------------|
| | with the subcategory 1. |
| Upper/lower flammability or explosive limits | No data available |
| Vapour Pressure | No data available |
| Relative Density | No data available |
| Solubility in water and solvents | No data available |
| Partition coefficient | No data available |
| Autoignition temperature | No data available |
| Decomposition temperature | No data available |
| Viscosity | No data available |
| Explosive properties | No data available |
| Oxidising properties | No data available |

9.2 Other information

None available

SECTION 10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

No data available

10.3 Possibility of hazardous reactions

Reacts violently with water.

10.4 Conditions to Avoid

Do not allow water to enter container because of violent reaction.

Heat, flames and sparks. Extremes of temperature and direct sunlight. Exposure to sunlight.

10.5 Incompatible materials

Do not store near acids, oxidising agents.

10.6 Hazardous decomposition products

Reacts with water to form: - Hydrogen gas

SECTION 11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No Data available

Skin corrosion/irritation

No data available

Serious eye damage/irritation

No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

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

Reproductive toxicity

No data available

STOT (specific target organ toxicity) -single exposure

No data available

STOT (specific target organ toxicity) -repeated exposure

No data available

Aspiration hazard.

No data available

Potential health effects**Inhalation**

of the

May be fatal if inhaled. Material is extremely destructive to the tissue of the mucus membranes and upper respiratory tract.

Ingestion

May be fatal if swallowed. Causes burns.

Skin

May be fatal if absorbed through the skin. Causes skin burns.

Eyes

Causes burns to the eyes.

As there is less than 10mg per vial, complete toxicological information is not available.

Signs and symptoms of Exposure

Burning sensation, coughing, wheezing, laryngitis, shortness of breath, head ache, nausea, vomiting. To the best of our knowledge the chemical, physical and toxicological properties have not been thoroughly investigated. Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed two to four hours or longer.

SECTION 12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

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

No data available

12.6. Other adverse effects

Very toxic to aquatic life with long lasting effects.

SECTION 13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product or/and collected waste from spillage.

Burn in a chemical incinerator equipped with an afterburner and scrubber but take extra precautions when igniting as this material is highly flammable. Or to contact a licensed disposal company and arrange disposal, inform the company of the nature of the waste.

Contaminated packaging

Dispose of as the unused product, with a licensed disposal company.

SECTION 14. TRANSPORT INFORMATION

14.1 UN Number

ADR/RID: 3179

IMDG: 3179

IATA: 3179

14.2 UN Proper Shipping Name

ADR/RID: FLAMMABLE SOILD, TOXIC, INORGANIC, N.O.S. (Sodium cyanotrihydroborate)

IMDG: FLAMMABLE SOILD, TOXIC, INORGANIC, N.O.S. (Sodium cyanotrihydroborate)

IATA: Flammable solid, toxic, inorganic, n.o.s. (Sodium cyanotrihydroborate)

14.3 Transport hazard class (es)

ADR/RID: 4.1 (6.1)

IMDG: 4.1 (6.1)

IATA: 4.1 (6.1)

14.4 Packing group

ADR/RID: II

IMDG: II

IATA: II

14.5 Environmental hazards

ADR/RID: No

IMDG Marine pollutant: No

IATA: No

14.6 Special precautions for user

No data available

SECTION 15. REGULATORY INFORMATION

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

No data available

15.2 Chemical Safety Assessment

No data available

SECTION 16. OTHER INFORMATION

The advice offered is derived from the current available information on the hazardous materials in this product and its component(s). Consideration has been made regarding the quantities offered in the pre-dispensed container. The advice offered is, therefore, not all-inclusive nor should it be taken as the descriptive of the compound generally.

SAFETY DATA SHEET

Version: 1.1

Date written: 5th October 2011

Date reviewed: 09 February 2016

SECTION 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY / UNDERTAKING

Product Name **dimethyl sulfoxide**

Product Catalogue Name **LT-DMSO-01**

CAS-No. **67-68-5**

Company: Ludger Ltd
Culham Science Centre
Abingdon
Oxford OX14 3EB

Telephone: 01865 408554

Emergency Telephone: 01865 408554

Email: info@ludger.com

SECTION 2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [EU-GHS-CLP]

Not a hazardous substance or mixture according to Regulation (EC) No. 1272/2008 [EU-GHS-CLP].

2.2 Label elements

The product does not require to be labelled in accordance with EC directives or respective national laws.

Signal Word: None

Hazard Statement(s)

None

Precautionary Statement(s)

None

2.3 Other hazard information:

None

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms: DMSO
 methyl sulfoxide
 dimethyl sulfoxide

Formula: C₂H₆OS

Molecular Weight: 78.13g/mol

| Component | | Concentration |
|-----------|--------------------|---------------|
| Name | dimethyl sulfoxide | - |
| CAS-No. | 67-68-5 | |
| EC-No. | 200-664-3 | |

SECTION 4. FIRST AID MEASURES

4.1 Description of first aid measures

General Advice

Consult a physician if exposure causes ill effects and if in any doubt. Show this safety data sheet to the physician/ first responder in attendance.

If Ingested

Do NOT induce vomiting. Rinse mouth well with water. Never give anything by mouth to an unconscious person.

If skin is exposed

Wash off with plenty of soap and water.

If eyes are exposed

Flush eyes with plenty of water/ eye wash solution as a precaution.

If inhaled

Move effect person to fresh air. If not breathing give artificial respiration.

4.2 Most important symptoms and effects, both acute and delayed

Effects due to ingestion may include: Nausea, Fatigue and Headache.

4.3 Indication of immediate medical attention and special treatment needed

No data available.

SECTION 5. FIRE-FIGHTING MEASURES

5.1 Extinguishing media

Small fires: Use extinguishing media such as “alcohol” foam, dry chemical or carbon dioxide.

Large fires: Use extinguishing media such as water, from a far away distance as possible. Use very large quantities of water as mist or spray to flood the fire and the combustible material. Cool all affected containers with large quantities of water.

5.2 Special hazards arising from the substance or mixture

Carbon oxides, Sulphur oxides

5.3 Advice for fire fighters

Wear self contained breathing apparatus for fire fighting if necessary, to spray cool water on any unopened containers near the fire.

SECTION 6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Avoid breathing vapours, gas or mist. Remove all sources of ignition. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

6.4 Environmental Precautions

Prevent further leakage or spillage if safe to do so, e.g. with spill mats. Do not let the product enter drains.

6.5 Methods and material for containment and cleaning up

Contain the spillage and put the collected material into a suitable container with a secure lid. Wash the area well, do not let run off into the drains, collect as waste.

6.4 Reference to other sections

See section 13 for disposal of waste material(s).

SECTION 7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid inhalation of vapour or mist. Keep away from sources of ignition- No smoking.

Take measures to prevent the build up of electrostatic charge.

7.2 Conditions for safe storage, including any incompatibilities

Store in a cool place. Keep container closed in a dry well ventilated place.

7.3 Specific end uses

No data available

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters.

Contains no substances with occupational exposure limit values.

8.4 Exposure controls

Appropriate engineering controls

Handle in accordance with good laboratory hygiene and safety practice. Wash hands before breaks and at the end of the day.

Personal Protective Equipment

Eye / face protection

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, which should be inspected before use. Use proper glove removal technique (removal without the outside of the glove touching the skin) to avoid contact with the skin/chemical. Dispose of contaminated gloves as Laboratory waste in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Gloves should be of the standard that will stratify the specifications of EU directive 89/696/EEC and the standard EN 374 derived from it.

Body Protection

The type of protective clothing must be selected according to the amount of substance at the specific workplace being used. Impervious coats or laboratory coats.

Respiratory protection

Use substance in an operation fume hood/ outside venting extraction cupboard. Wear full face respirator if appropriate to use, must be tested and approved under appropriate government

standards such as NIOSH (US) or CEN (EU).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

| | |
|--|---|
| Appearance | Form: Liquid, clear Colour: Colourless |
| Odour | No data available |
| Odour threshold | No data available |
| pH | No data available |
| Freezing/Melting Point | Melting point/range: 16-19°C |
| Initial boiling point and boiling range | 189°C |
| Flash Point | 87°C – Closed cup |
| Evaporation rate | No data available |
| Flammability | No data available |
| Upper/lower flammability or explosive limits | Upper explosion limit: 42% (V) Lower explosion limit: 3.5% (V) |
| Vapour Pressure, Pa at temperature degree C | 0.55hPa at 20°C |
| Relative Density | 1.1g/mL |
| Solubility in water and solvents | Completely miscible |
| Partition coefficient: n-octanol/water | log Pow: - 2.03 |
| Auto ignition temperature | No data available |
| Decomposition temperature | No data available |
| Viscosity | No data available |
| Explosive properties | No data available |
| Oxidising properties | No data available |

9.2 Other information

No data available

SECTION 10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

No data available

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to Avoid

Heat, flames and sparks

10.5 Incompatible materials

Acid chlorides, Phosphorus halides, Strong acids, Strong oxidizing agents and strong reducing agents.

10.6 Hazardous decomposition products

Other decomposition products – No data available

SECTION 11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral – Rat – 14,500mg/kg

LC50 Inhalation – Rat – 4h – 40250ppm

LD50 Dermal – Rabbit - > 5,000mg/kg

Skin corrosion/irritation

Skin – Rabbit – No skin irritation – 4h

Serious eye damage/irritation

Eyes – Rabbit – Mild eye irritation

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

Genotoxicity in vitro – Mouse – lymphocyte

Cytogenetic analysis

Genotoxicity in vitro – Mouse – lymphocyte

Mutation in mammalian somatic cells

Genotoxicity in vivo – Rat – Intraperitoneal

Cytogenetic analysis

Genotoxicity in vivo - Mouse – Intraperitoneal
DNA damage

Carcinogenicity

Carcinogenicity – Rat – Oral

Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Skin and Appendages: Others: Tumors.

Carcinogenicity – Mouse – Oral

Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Lukaemia skin and appendages: Other: Tumors.

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

Reproductive toxicity

Reproductive toxicity – Rat – Intraperitoneal

Effects on fertility: Abortion

Reproductive toxicity – Rat – Intraperitoneal

Effects on fertility: Post – implantation mortality (e.g. dead and/or resorbed implants per total number of implants).

Reproductive toxicity – Rat – Subcutaneous

Effects on fertility: Post – implantation mortality (e.g. dead and/or resorbed implants per total number of implants). Effects on fertility: Litter size (e.g. # fetuses per litter; measured before birth).

Reproductive toxicity – Mouse – Oral

Effects on fertility: Pre-implantation mortality (e.g. reduction in number of implants per female; total number of implants per corpora lutea). Effects on Embryo or fetus: Fetotoxicity (except death, e.g. stunted fetus). Specific developmental abnormalities: Musculoskeletal system.

Reproductive toxicity – Mouse – Intraperitoneal

Effects on embryo or fetus: Fetotoxicity (except death, e.g. stunted fetus). Specific developmental abnormalities: Musculoskeletal system.

STOT-single exposure

No data available

STOT-repeated exposure

No data available

Aspiration hazard.

No data available

Potential Health Hazards

| | |
|-------------------------------------|--|
| Inhalation | May be harmful if inhaled. May cause respiratory tract irritation. |
| Ingestion | May be harmful if swallowed. |
| Skin | May be harmful if absorbed through skin. May cause skin irritation. |
| Eyes | May cause eye irritation. |
| Aggravated Medical Condition | Avoid contact with DMSO solutions containing toxic materials or materials with unknown toxicological properties. Dimethyl sulfoxide is readily absorbed through the skin and may carry such materials into the body. |

Signs and symptoms of exposure

Effects due to ingestion may include; Nausea, Fatigue, Headache.

Additional Information

RTECS: PV6210000

SECTION 12. ECOLOGICAL INFORMATION

12.1 Toxicity

| | |
|--|---|
| Toxicity to Fish 96h | LC50-Pimephales promelas (fathead minnow) – 34,000mg/l - LC50-Oncorhynchus mykiss (rainbow trout) – 34,000mg/l- 96h |
| Toxicity to daphnia and other Aquatic invertebrates | EC50-Daphnia pulex (water fleas) – 27,500mg/l |
| Toxicity to algae | EC50-Lepomis macrochirus (bluegill) - >400,000mg/l-96h |

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

No data available

14.6 Special precautions for user

No data available

SECTION 15. REGULATORY INFORMATION

This safety data sheet complies with the requirements of Regulation (EC) No. 1907/2006

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

No data available

15.2 Chemical Safety Assessment

No data available

Please note that the label elements that used to go in Section 15 are now in Section 2.

SECTION 16. OTHER INFORMATION

The advice offered is derived from the current available information on the hazardous materials in this product and its component(s). Consideration has been made regarding the quantities offered in the pre-dispensed container. The advice offered is, therefore, not all-inclusive nor should it be taken as the descriptive of the compound generally.