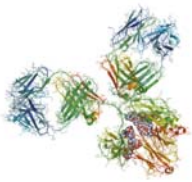

Product Guide for LudgerTag™ AA-Ac (3-(acetylamino)-6-aminoacridine) Glycan Labeling Kit

(Ludger Product Code: LT-KAAAC-A2)

Ludger Document # LT-KAAAC-A2-Guide-v4.0

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Contents

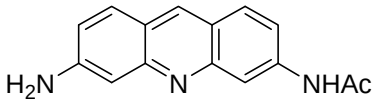
Specifications for LT-KAAAC-A2

Application For labeling of glycans with fluorescent AA-Ac [3-(acetylamino)-6-aminoacridine] dye.

Description he kit contains reagents for the conjugation of AA-Ac dye to the free reducing end of glycans by a reductive amination reaction.

Dye Properties Mass = 251

Fluorescence (λ_{ex} = 382 or 445 nm, λ_{em} = 525)



Number of Samples Typically, up to 15 separate analytical samples per set of labeling reagents.

Amount of Sample From 1 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-AAAC-01	AA-Ac [3-(acetylamino)-6-aminoacridine] Dye	2.5 mg
LT-DMSO-01	DMSO	350 µl
LT-ACETIC-01	Acetic acid	200 µl
LT-CYANOB-01	Sodium cyanoborohydride (Reductant)	12 mg

Additional Reagents and Equipment Required

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

Time Line for Labeling

The LudgerTag™ AA-Ac labeling procedure including the post-labeling sample cleanup typically takes 2.5- 3 hours :

Procedure	Time	Elapsed Time
Transfer samples to reaction tube and dry	0.5 - 1 hour	1 hr
Make up and add labeling reagent	15 min	1 hr 15 min
Incubate samples *	30 hour	1 hr 45 min
Post-labeling cleanup	45 min	2 hr 30 min

* This is the time for an 80°C incubation. An alternative incubation procedure is 70°C for 2 hours.

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.

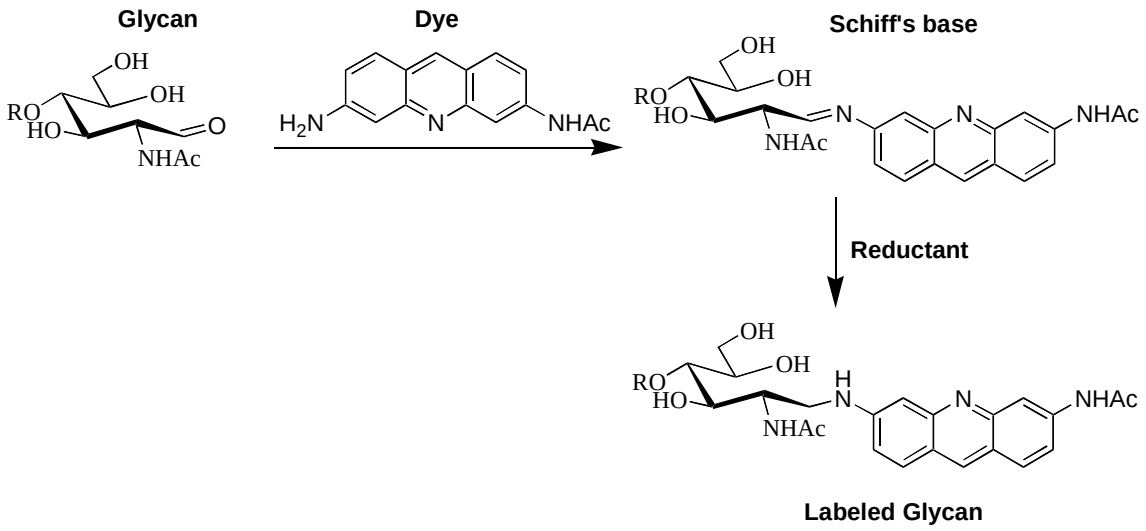


Figure 1: Labeling of a glycan with 3-(acetylamino)-6-aminoacridine (AA-Ac) by reductive amination

Outline of Labeling Protocol

The LudgerTag™ AA-Ac glycan labeling kit is designed for labeling with AA-Ac [3-(acetylamino)-6-aminoacridine] of glycans with a free reducing terminus. AA-Ac labeled glycans may be followed by high-sensitivity fluorescence detection during various chromatographic and structure sequence analyses. These include chromatography on LudgerSep™ HPLC columns and sequencing using exoglycosidases (See refs 1-5, 7-8). The labeling procedure used here follows the protocol given in reference 8. The outline of the 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 ^{o}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 62 µl 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^{O}C and 65^{O}C.

5 Add the dye

Add 400 µl of the DMSO-acetic acid mixture to a vial of LudgerTag™ **AA-AC Dye** and mix until the dye is dissolved.

The Cat. # for the dye is LT-AAAC-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 Cat. # 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 an incubation oven between 65-80^{O}C or stand on a heating block at this temperature then mix by pipette action.
Protect the labeling reagent from exposure to moisture and use within 60 minutes.

Labeling Reaction

7 Add labeling reagent to samples

Add 20 μl 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 80°C and incubate for 30 minutes.

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 5 minutes after the start of the 80 ^{o}C incubation then the incubation continued.

An alternative incubation regime that gives equivalent results is 70 ^{o}C for 2 hours .

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9 Centrifuge and cool

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

10 Post-labeling purification or storage

The samples are now ready for post-labeling purification (see next section) or can be stored frozen at -20^{o}C or colder for up to 2 weeks before post-labeling purification.

LudgerClean™ Post-Labeling Sample Cleanup

Post-labeling sample cleanup (to remove excess labeling reagents) is achieved using LudgerClean™ D1 cartridges (Catalog # LC-D1-30-Ax where x = pack size). The cleanup protocol is as follows:

11 Prime the D1 cartridge

Prime each cartridge (one per sample) with the following:

- 2 ml acetonitrile
- 2 ml water

12 Load the sample

Add 500 μl of water to the sample, mix by pipette then load onto the cartridge.

13 Wash with water

Wash off non-bound non-carbohydrate contaminants (e.g. salts) with 2 x 0.5 ml of water.

14 Elute the labeled glycans

Elute the AA-Ac labeled glycans with 2 x 0.5 ml of 20% acetonitrile / 80% water (v/v).

15 Dry the sample (Optional)

Dry the eluted glycans by centrifugal evaporation then store frozen -20 ^{o}C or lower.

This step is optional.

Reduce the possibility of de-sialylation by ensuring that the unbuffered samples are kept at temperatures below 30 ^{o}C during drying.

16 Reconstitute the sample and store

If required, reconstitute the dried samples by dissolving in either water or an aqueous buffer.

Store the reconstituted samples at temperatures of –20 ^{o}C or lower.

Take care when choosing the solvent for reconstitution. Samples dissolved in pure water will not be pH buffered and will be susceptible to acid catalyzed desialylation. Such degradation can be minimized by re-dissolving the samples in an aqueous salt or buffer solution (in the pH range 5 – 8.5) compatible with subsequent analysis or workup procedures. Useful general purpose buffers include 50 mM ammonium acetate and 50 mM sodium acetate.

Analysis of LudgerTag™ AA-Ac Labeled Glycans

LudgerTag™ AA-Ac labeled glycans may be studied by a number of different analytical methods including HPLC, capillary electrophoresis, and mass spectrometry. These are covered in detail in references 8 - 9 and overviewed below.

Fluorescence Detection of AA-Ac Labeled Glycans

The fluorescence characteristics of AA-Ac labeled glycans are summarized in reference 8. Typical settings for online fluorescence detection for HPLC are λ_{ex} = 442 nm, λ_{em} = 525 nm.

HPLC Analysis

AA-Ac labeled glycan mixtures may be separated and analysed by a variety of HPLC methods including chromatography on amide and reverse-phase columns [see reference 8].

LudgerSep™ HPLC columns suitable for AA-Ac glycan analysis include the following :

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.

Amide HPLC

The LudgerSep™ N column is an especially powerful tool for the purification and analysis of LudgerTag™ labeled oligosaccharides from complex glycan mixtures. The following are typical conditions for analysis of AA-Ac labeled glycans on LudgerSep™ N1 amide HPLC:

Column: LudgerSep™ N1 amide HPLC (Cat. # LS-N1-4.6x250) with N1 guard column (Cat. # LS-N1-4.6x10)

Solvent A: Acetonitrile

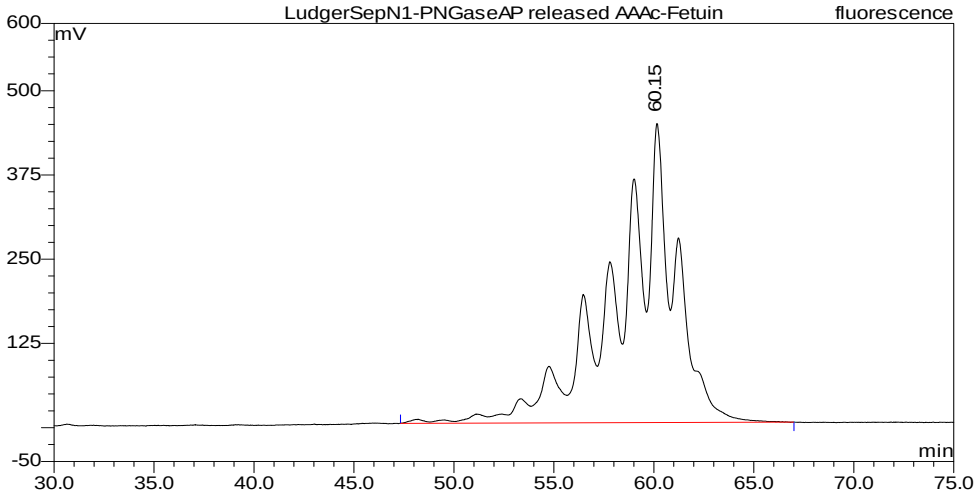
Solvent B: 50 mM ammonium formate pH 4.4

Flow rate: 0.4 ml/min

Detector: Fluorescence λ_{ex} = 442 nm, λ_{em} = 525 nm

Gradient:

Time (min)	% A	%B
0	65	35
75	50	50
80	0	100
83	0	100
85	65	35
115	65	35



LudgerSep™ N1 amide profile of AA-Ac labeled N-glycans from bovine fetuin

Reversed-Phase HPLC

The following are typical conditions for analysis of AA-Ac labeled glycans on reversed phased HPLC.

Column: C18 column (e.g. LudgerSep™ R1 HPLC (Cat. # LS-R1-1-4.6x150)

Solvent A: 100 mM ammonium acetate pH 6.6

Solvent B: acetonitrile

Flow rate: 1 ml/min

Detector: Fluorescence λ_{ex} = 442 nm, λ_{em} = 525 nm

Gradient:

Time (min)	% A	%B	Comments
0	92	8	
5	92	8	
50	84	16	
60	50	50	Wash step
70	50	50	
80	92	8	Back to equilibration

Mass Spectral Analysis

AA-Ac labeled glycans are well-suited for analysis by MALDI-TOF mass spectrometry [reference 8]. To date, the matrix that has proven the most useful is dihydroxybenzoic acid at relatively high concentration (100 mg / ml). This is used with high laser energy to allow study of sialylated species that are normally difficult to analyse by MALDI-MS.

Please contact us for more information on MS analysis of AA-Ac labeled glycans.

Capillary Electrophoresis (CE)

AA-Ac labeled glycans have been studied with success by both free zone capillary electrophoresis and MECC using LIF excitation and detection [reference 8]. The AA-Ac label confers properties on the glycans that make them particularly suitable for capillary electrophoretic analyses. These include retention of fluorescence characteristics at low pH and ionization properties compatible with acidic CE buffers.

Enzymatic Analysis

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

When selecting glycosidases be especially careful to chose 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 chosing enzymes and reaction conditions for your work.

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 warrants, 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-KAAAC-A2-Guide-v4.0

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'A rapid and high-resolution high-performance liquid chromatographic method for separating glycan mixtures and analyzing oligosaccharide profiles'.
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'Multimode high-performance liquid chromatography of fluorescently labeled oligosaccharides from glycoproteins'.
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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)

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Rapid Commun Mass Spectrom 15: 1141-1151

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 AA-Ac 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, vortex the samples 5 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 AA-Ac 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 water 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, vortex the samples 5 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 ^{o}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^{o}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: MSDS

Manufacturer	Ludger Ltd, Culham Science Centre, Oxford OX14 3EB, UK Tel: +44 870 085 7011, Fax: +44 870 163 4620, www.ludger.com
Identification of the substance	Acetic Acid (Cat. # LT-ACETIC-01)
Composition	Solution of acetic acid. Chemical name: Acetic Acid. CAS no. 64-19-7
Hazard identification	Corrosive.
First aid measures	Eyes: irrigate with plenty of water for at least 15 minutes. Skin: wash with soap and water. Ingestion: drink plenty of water. Inhalation: move to a well ventilated area and clear nose and throat. If in doubt seek medical advice.
Fire fighting measures	Water spray, dry chemical powder or appropriate foam according to surrounding fire conditions.
Accidental release measures	Wash spill site with copious amounts of water.
Handling and storage	Store at room temperature. Handle in accordance with Good Laboratory Practice.
Exposure Controls / Personal protection	Wear appropriate protective clothing (safety spectacles, gloves, laboratory coat) in accordance with Good Laboratory Practice.
Physical and chemical properties	Colourless liquid.
Stability and reactivity	Avoid contact with bases, oxidising agents and metals.
Toxicological information	Toxic if swallowed, inhaled or absorbed though the skin. High concentrations destructive to upper respiratory tract and eyes.
Ecological information	Data not available.
Disposal considerations	Dilute with excess water, mop up with absorptive material and dispose of according to local regulations.
Transport information	Contact Ludger for transportation information.
Regulatory information	Risk phrases : R35-R21 Safety phrases : S16-S45-S26-S36/37/39

Other information

The advice offered is derived from the currently available information on the hazardous materials in this product or component. 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 descriptive of the compound generally.

Material Safety Data Sheet

Manufacturer	Ludger Ltd, Culham Science Centre, Oxford OX14 3EB, UK Tel: +44 870 085 7011, Fax: +44 870 163 4620, www.ludger.com
Identification of the substance	DMSO (Cat # LT-DMSO-01)
Composition	Dimethyl sulfoxide. Chemical name: Dimethyl sulfoxide (DMSO). CAS no. 67-68-5
Hazard identification	Irritant.
First aid measures	Eyes: irrigate with plenty of water for at least 15 minutes. Skin: wash with soap and water. Ingestion: drink plenty of water. OBTAIN MEDICAL ATTENTION. Inhalation: move to a well ventilated area and clear nose and throat. If in doubt seek medical advice.
Fire fighting measures	Water spray or appropriate foam according to surrounding fire conditions. Emits toxic fumes under fire conditions.
Accidental release measures	Wear appropriate protective clothing. As quantities are small absorb with sand or vermiculite and sweep up. Place in bag and hold for disposal. Wash spill site after material pick up is complete.
Handling and storage	Store at room temperature. Handle in accordance with Good Laboratory Practice.
Exposure Controls / Personal protection	Wear appropriate protective clothing (safety spectacles, gloves, laboratory coat) in accordance with Good Laboratory Practice.
Physical and chemical properties	Colourless liquid.
Stability and reactivity	Avoid contact with acids, oxidising and reducing agents, acid chlorides and phosphorus halides.
Toxicological information	May be harmful if swallowed, inhaled or absorbed through skin. May cause irritation, complete toxicological information not available.
Ecological information	Data not available.
Disposal considerations	No special requirements. Dispose of according to local requirements.
Transport information	Contact Ludger for transportation information.
Regulatory information	Risk phrases : R36/37/38 Safety phrases : S26-S36-S23

Other information

The advice offered is derived from the currently available information on the hazardous materials in this product or component. 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 descriptive of the compound generally.

Material Safety Data Sheet

Manufacturer	Ludger Ltd, Culham Science Centre, Oxford OX14 3EB, UK Tel: +44 870 085 7011, Fax: +44 870 163 4620, www.ludger.com
Identification of the substance	AA-Ac Dye (Cat # LT-AAAC-01)
Composition	3-(Acetylamino)-6-aminoacridine Chemical name: 3-(Acetylamino)-6-aminoacridine
Hazard identification	Irritant.
First aid measures	Eyes: irrigate with plenty of water for at least 15 minutes. Skin: wash with soap and water. Ingestion: drink plenty of water. OBTAIN MEDICAL ATTENTION. Inhalation: move to a well ventilated area and clear nose and throat. If in doubt seek medical advice.
Fire fighting measures	Water spray or appropriate foam according to surrounding fire conditions.
Accidental release measures	Wear appropriate protective clothing. As quantities are small sweep up but avoid raising dust. Place in bag and hold for disposal. Wash spill site after material has been removed.
Handling and storage	Store desiccated at room temperature, avoid exposure to light. Handle in accordance with Good Laboratory Practice.
Exposure Controls / Personal protection	Wear appropriate protective clothing (safety spectacles, gloves, laboratory coat) in accordance with Good Laboratory Practice.
Physical and chemical properties	Off-white powder.
Stability and reactivity	Avoid contact with strong oxidising agents.
Toxicological information	May be harmful if swallowed, inhaled or absorbed through skin. May cause skin and eye irritation. Complete toxicological information not available.
Ecological information	Data not available.
Disposal considerations	Dilute with excess water, mop up with absorptive material and dispose of according to local regulations.
Transport information	Contact Ludger for transportation information.
Regulatory information	Risk phrases : R36/37/38 Safety phrases : S26-S36

Other information

The advice offered is derived from the currently available information on the hazardous materials in this product or component. 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 descriptive of the compound generally.

Material Safety Data Sheet

Manufacturer	Ludger Ltd, Culham Science Centre, Oxford OX14 3EB, UK Tel: +44 870 085 7011, Fax: +44 870 163 4620, www.ludger.com
Identification of the substance	Sodium Cyanoborohydride (Cat # LT-CYANOB-02)
Composition	Sodium cyanoborohydride. Chemical name: Sodium cyanoborohydride. CAS no. 25895-607
Hazard identification	Flammable, toxic.
First aid measures	Eyes: irrigate with plenty of water for at least 15 minutes. Skin: wash with soap and water. Ingestion: drink plenty of water. Inhalation: move to a well ventilated area and clear nose and throat. If in doubt seek medical advice.
Fire fighting measures	Water spray, dry chemical powder or appropriate foam according to surrounding fire conditions.
Accidental release measures	Wash spill site with copious amounts of water.
Handling and storage	Store at room temperature. Handle in accordance with Good Laboratory Practice.
Exposure Controls / Personal protection	Wear appropriate protective clothing (safety spectacles, gloves, laboratory coat) in accordance with Good Laboratory Practice.
Physical and chemical properties	Off-white powder.
Stability and reactivity	Avoid contact with bases, oxidising agents. Decomposes if exposed to moisture.
Toxicological information	May be *fatal* if swallowed, inhaled or absorbed though the skin. There is less than 10 mg per vial, complete toxicological information not available.
Ecological information	Data not available.
Disposal considerations	Dissolve or mix material with water in a fume cabinet and dispose of according to local regulations.
Transport information	Contact Ludger for transportation information.
Regulatory information	Risk phrases : R23/24/25-R34-R19 Safety phrases : S16-S45-S26-S36/37/39

Other information

The advice offered is derived from the currently available information on the hazardous materials in this product or component. 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 descriptive of the compound generally.