



Characterization of Liquid “Smoke Juice” for Electronic Cigarettes

prepared for

Johnson Creek Enterprises
Johnson Creek, WI

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Client: Johnson Creek Enterprises
320 N Watertown St. Suite F
Johnson Creek, WI 53038

Requestor: Robert Kieckbush

Study: Characterization of Liquid “Smoke Juice” for Electronic Cigarettes

LIMS #: 20090187

SUMMARY

A liquid “smoke juice” formulation used in electronic cigarettes was tested by gas chromatography mass spectrometry (GC-MS) to identify the ingredients in the mixture and their relative concentrations. In addition, vapor produced from an electronic cigarette containing this smoke juice was assayed to compare the relative smoke composition to that of the liquid.

EXPERIMENTAL

One sample of smoke juice and some blank cartridges were submitted for these experiments. The smoke juice and vapors generated from the cartridges infused with this smoke juice were characterized by gas chromatography mass spectrometry. The samples were designated as follows:

Table I: Sample Designations

LIMS #	Client ID	Description
20090187-01	Blank Mini “103” Premium Cartridges	Johnson Creek Cartridges
20090187-02	Original smoke juice 15 ml	Johnson Creek Smoke Juice

A Liberty Stix brand “smokeless nicotine mist cigarette” (Figure 1) was used as per the product instructions to produce the nicotine mist or vapor while 2 dilutions of the smoke juice were prepared in order to estimate the ingredients of the juice or collected vapors.

To capture the vapor emitted from an assembled Liberty Stix cigarette containing the Johnson Creek smoke juice, a 40ml evacuated gastight vial was used to draw

air through the Liberty Stix device and into the vial. The white vapor produced was captured and diluted with a solvent prior to GC-MS analysis.

Each of the prepared samples was characterized on a Shimadzu 2010S GC-MS instrument equipped with a ZB-5HT (Phenomenex) high temperature capillary column. Observed peaks were identified based on spectral matches with commercial MS libraries. Relative concentrations were estimated from the peak areas.

RESULTS & DISCUSSION

A Total Ion Chromatogram (TIC) of a 1:100 diluted sample of the smoke juice (20090187-01) is shown in Figure 2. Since the concentration of propylene glycol (the first large peak) was significantly higher than the other ingredients, a second dilution was prepared to quantify the propylene glycol. Figure 3 shows the 1:1000 diluted sample overlaid with a 0.1% propylene glycol standard. Spectral library matches identified 3 ingredients - propylene glycol, glycerin, and nicotine - with retention times of about 3 minutes, 7 minutes and 11 minutes respectively.

The captured vapor dissolved in solvent resulted in the chromatogram shown in (Figure 4). Since the concentrations of glycerin and nicotine were much smaller than the propylene glycol and even more dilute in the vapors compared to the liquid smoke juice, single ion monitoring (SIM) was used to enhance the signal of each ingredient and estimate their relative concentrations (Figure 5).

Table II summarizes the estimated relative % of each ingredient in the smoke liquid and the extracted vapors. This analysis assumed that all of the volatile components were observed in the GC-MS analysis and that the sensitivity of the detector to each compound was similar.

General hazard and toxicity data were taken from published literature and a report titled "Analysis of Components from Gamucci Electronic Cigarette Cartridges, Tobacco Flavour Regular Smoking Liquid" provided by the client. MSDS information for each material is provided at the end of this report. Online resources for additional safety or toxicity information can be found for the 3 ingredients here:

<http://pubchem.ncbi.nlm.nih.gov/summary/summary.cgi?sid=24898528#safety>
<http://pubchem.ncbi.nlm.nih.gov/summary/summary.cgi?sid=24895092>
<http://pubchem.ncbi.nlm.nih.gov/summary/summary.cgi?sid=24862741>

or on Toxnet (<http://toxnet.nlm.nih.gov/index.html>).

Figure 1: Smoke Juice Sample & Cartridge with Electronic Cigarette



Figure 2: TIC of Smoke Juice (1:100 dilution)

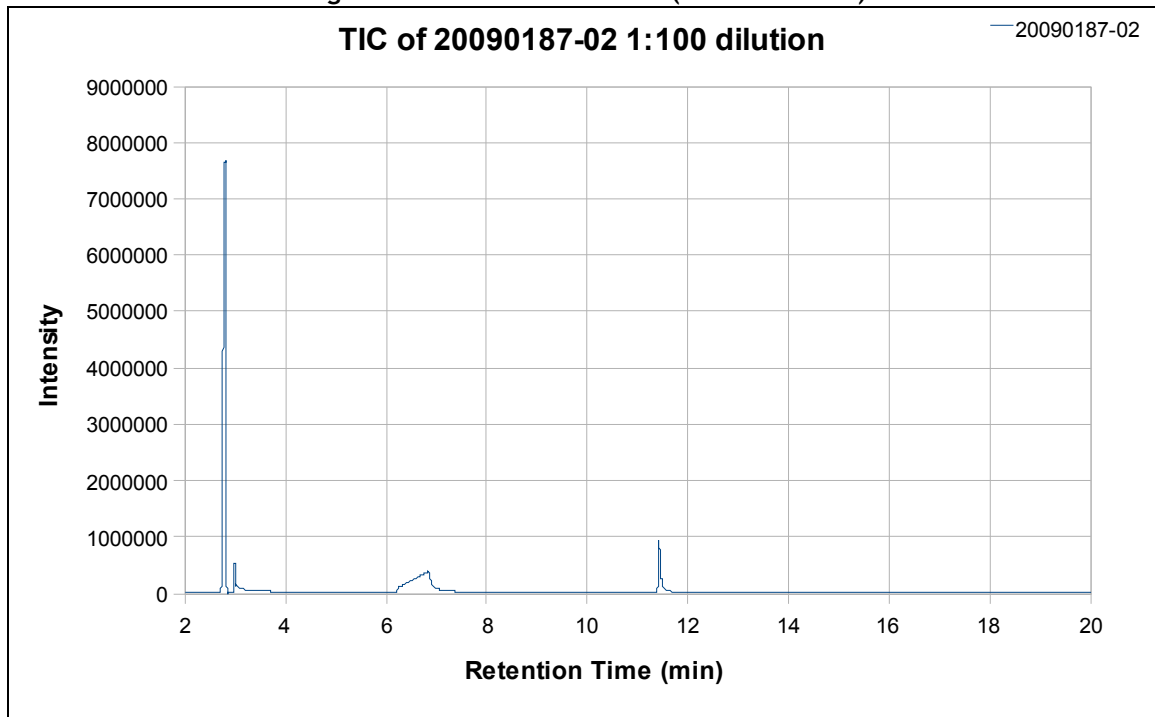


Figure 3: TIC of Smoke Juice (1:1000 dilution) vs. 0.1% Propylene Glycol Standard

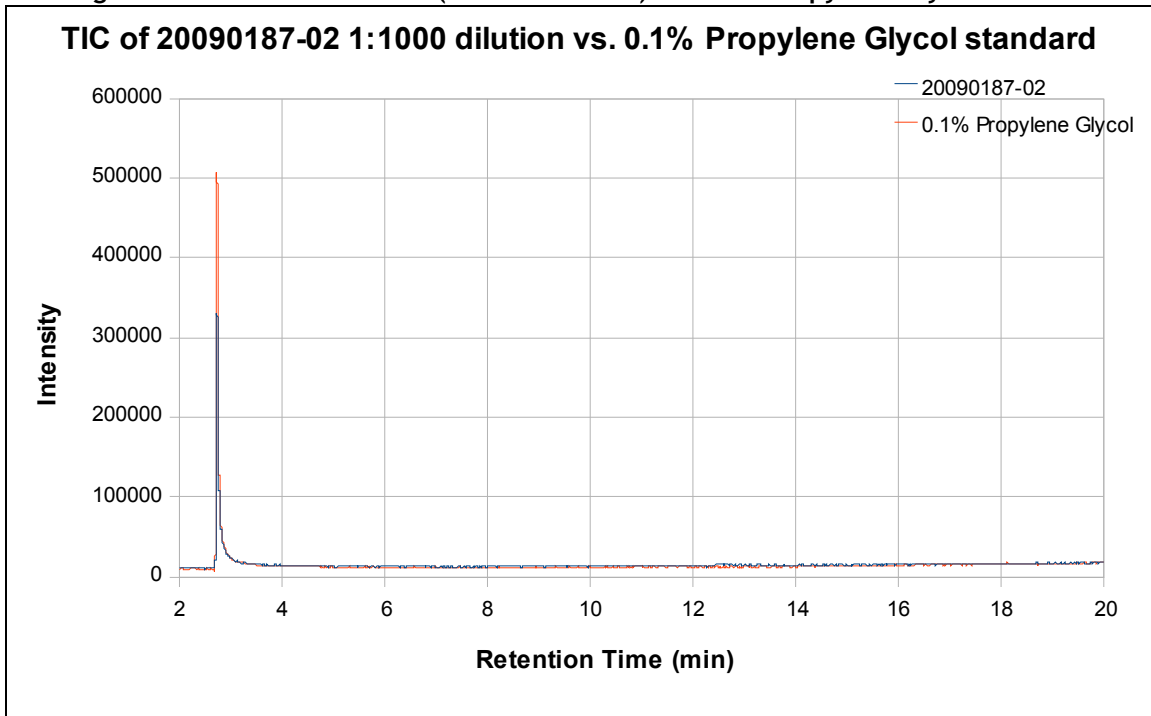


Figure 4: TIC of Captured Vapor from Johnson Creek Smoke Juice

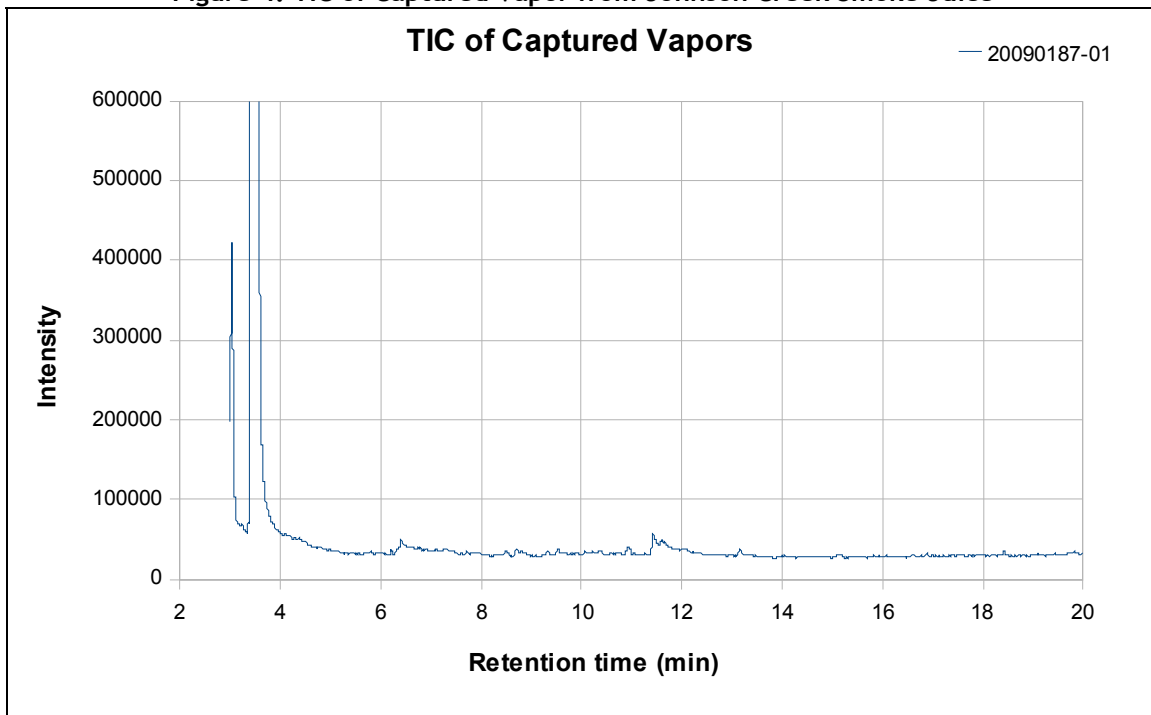


Figure 5: Composite SIM Chromatogram of Captured Vapor from Johnson Creek Smoke Juice.

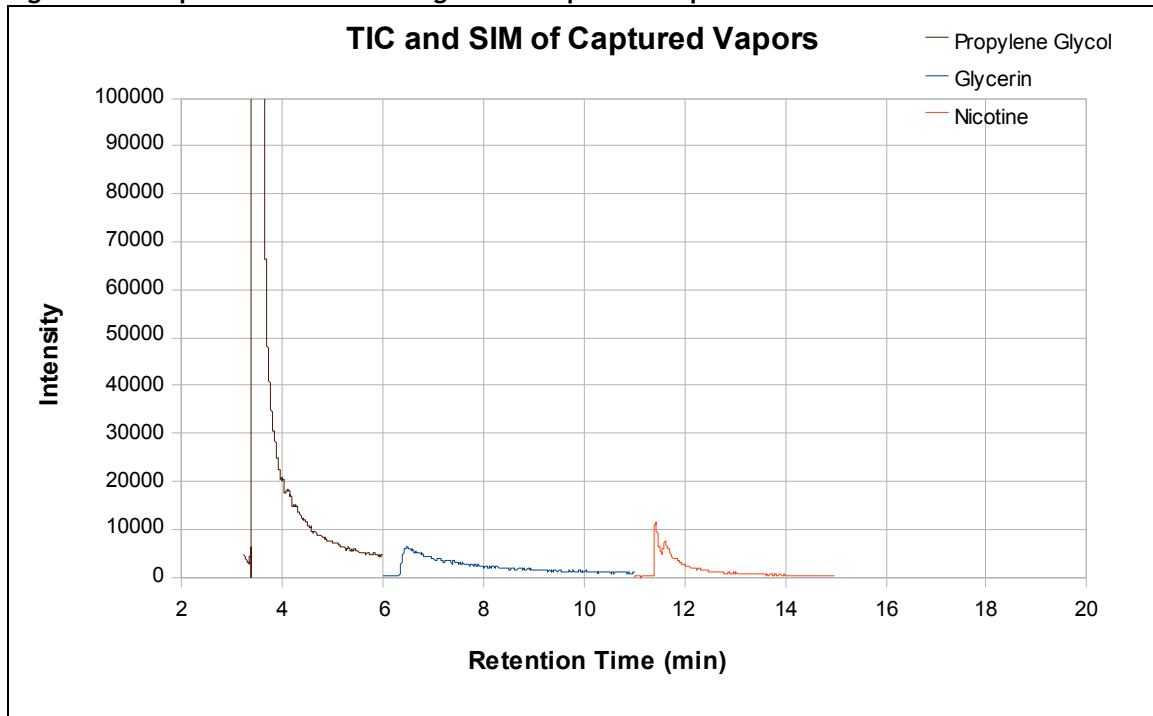


Table II: TIC Peak Report for Sample 20090187-01

#	Name	% in Smoke Juice (Peak Area %)	% in Vapors (Peak Area %)	CAS No.	Comments*
1	Propylene Glycol	72.16	99.1	57-55-6	Not currently recognized as giving any health hazards. Suspected respiratory toxicant, suspected skin or sense organ toxicant, suspected neurotoxicant and immunotoxicant
2	Glycerin	20.87	0.46	56-81-5	Non-hazardous
3	Nicotine	6.97	0.44	23950-04-01	R23 = Toxic by inhalation R24 = Toxic in contact with skin R25 = Toxic if swallowed R51/53 = Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Poison - may be fatal if inhaled

*cf. "Gamucci" report

MATERIAL SAFETY DATA SHEET

Date Printed: 07/15/2009

Date Updated: 01/26/2006

Version 1.4

Section 1 - Product and Company Information

Product Name 1,2-Propanediol, meets USP testing specifications
Product Number P4347
Brand SIAL

Company Sigma-Aldrich
Address 3050 Spruce Street
SAINT LOUIS MO 63103 US

Technical Phone: 800-325-5832
Fax: 800-325-5052
Emergency Phone: 314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
1,2-PROPANEDIOL, MEETS USP TESTING SPECS.	57-55-6	No

Formula C3H8O2
Synonyms 1,2-Dihydroxypropane * Dowfrost * Methylethylene glycol * Monopropylene glycol * PG 12 * Propane-1,2-diol * Propylene Glycol USP * alpha-Propyleneglycol * 1,2-Propylene glycol * 1,2-Propylenglykol (German) * Sirlene * Solargard P * Solar Winter BAN * Ucar 35

RTECS Number: TY2000000

Section 3 - Hazards Identification

HMIS RATING

HEALTH: 0
FLAMMABILITY: 1
REACTIVITY: 0

NFPA RATING

HEALTH: 0
FLAMMABILITY: 1
REACTIVITY: 0

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE

If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE

If inhaled, remove to fresh air. If breathing becomes difficult, call a physician.

DERMAL EXPOSURE

In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE

In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

FLASH POINT

217.4 °F 103 °C Method: closed cup

EXPLOSION LIMITS

Lower: 2.6 % Upper: 12.5 %

AUTOIGNITION TEMP

415 °C

FLAMMABILITY

N/A

EXTINGUISHING MEDIA

Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING

Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

METHODS FOR CLEANING UP

Absorb on sand or vermiculite and place in closed containers for disposal. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING

User Exposure: Avoid inhalation. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE

Suitable: Keep tightly closed.

SPECIAL REQUIREMENTS

Hygroscopic.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS

Safety shower and eye bath. Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT

Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Respiratory protection is not required. Where protection is desired, use multi-purpose combination (US) or type ABEK (EN

14387) respirator cartridges.
Hand: Protective gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES

Wash thoroughly after handling.

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Clear viscous liquid Color: Colorless	
Property	Value	At Temperature or Pressure
Molecular Weight	76.1 AMU	
pH	N/A	
BP/BP Range	185.0 - 189.0 °C	
MP/MP Range	- 60.0 °C	
Freezing Point	N/A	
Vapor Pressure	0.08 mmHg	20 °C
Vapor Density	2.62 g/l	
Saturated Vapor Conc.	N/A	
SG/Density	1.036 g/cm ³	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	< 0.1 %	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Surface Tension	N/A	
Partition Coefficient	N/A	
Decomposition Temp.	N/A	
Flash Point	217.4 °F 103 °C	Method: closed cup
Explosion Limits	Lower: 2.6 % Upper: 12.5 %	
Flammability	N/A	
Autoignition Temp	415 °C	
Refractive Index	1.433	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	N/A	

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Stable: Stable.

Conditions to Avoid: Moisture.

Materials to Avoid: Acid chlorides, Acid anhydrides, Oxidizing agents, Chloroformates, Reducing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

HAZARDOUS POLYMERIZATION

Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE

Skin Contact: May cause skin irritation.
Skin Absorption: May be harmful if absorbed through the skin.
Eye Contact: May cause eye irritation.
Inhalation: May be harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.
Ingestion: May be harmful if swallowed.

SIGNS AND SYMPTOMS OF EXPOSURE

Exposure can cause: Gastrointestinal disturbances. Nausea, headache, and vomiting. CNS depression.

TOXICITY DATA

Oral
Rat
20000 mg/kg
LD50

Intraperitoneal
Rat
6660 MG/KG
LD50

Subcutaneous
Rat
22500 MG/KG
LD50

Intravenous
Rat
6423 MG/KG
LD50

Intramuscular
Rat
14 GM/KG
LD50

Oral
Mouse
22000 mg/kg
LD50

Intraperitoneal
Mouse
9718 MG/KG
LD50

Remarks: Blood:Changes in spleen. Lungs, Thorax, or Respiration:Chronic pulmonary edema. Kidney, Ureter, Bladder:Changes in both tubules and glomeruli.

Subcutaneous
Mouse
17370 MG/KG
LD50

Remarks: Lungs, Thorax, or Respiration:Cyanosis. Behavioral:Change in motor activity (specific assay). Behavioral:Muscle contraction or spasticity.

Intravenous
Mouse

6630 MG/KG
LD50

Oral
Dog
22000 mg/kg
LD50

Intravenous
Dog
26 GM/KG
LD50

Oral
Rabbit
18500 mg/kg
LD50

Skin
Rabbit
20800 mg/kg
LD50

Intravenous
Rabbit
6500 MG/KG
LD50

Oral
Guinea pig
18350 mg/kg
LD50

Oral
Quail
> 2080 mg/kg
LD50

IRRITATION DATA

Skin
Human
500 mg
7D
Remarks: Mild irritation effect

Skin
Human
104 mg
3D
I
Remarks: Moderate irritation effect

Skin
Man
10 %
2D

Eyes
Rabbit
100 mg
Remarks: Mild irritation effect

Eyes
Rabbit
500 mg
24H
Remarks: Mild irritation effect

CHRONIC EXPOSURE - TERATOGEN

Species: Mouse
Dose: 100 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (15D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

CHRONIC EXPOSURE - MUTAGEN

Species: Mouse
Route: Subcutaneous
Dose: 8000 MG/KG
Mutation test: DNA inhibition

Species: Mouse
Route: Subcutaneous
Dose: 8000 MG/KG
Mutation test: Cytogenetic analysis

Species: Hamster
Dose: 32 GM/L
Cell Type: fibroblast
Mutation test: Cytogenetic analysis

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD

Species: Mouse
Dose: 100 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (11D PREG)
Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Section 12 - Ecological Information

No data available.

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION

Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT

Proper Shipping Name: None
Non-Hazardous for Transport: This substance is considered to be non-hazardous for transport.

IATA

Non-Hazardous for Air Transport: Non-hazardous for air transport.

Section 15 - Regulatory Information

UNITED STATES REGULATORY INFORMATION

SARA LISTED: No

TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION

WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.

DSL: Yes

NDSL: No

Section 16 - Other Information

DISCLAIMER

For R&D or manufacturing use. Not for prescription compound or other uses.

WARRANTY

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2009 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.

MATERIAL SAFETY DATA SHEET

Date Printed: 07/15/2009

Date Updated: 02/16/2009

Version 1.8

Section 1 - Product and Company Information

Product Name GLYCERIN, MEETS USP TESTING SPECIFICATIONS
Product Number G2289
Brand SIAL
Company Sigma-Aldrich
Address 3050 Spruce Street
SAINT LOUIS MO 63103 US
Technical Phone: 800-325-5832
Fax: 800-325-5052
Emergency Phone: 314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
GLYCEROL, MEETS USP TESTING SPECS.	56-81-5	No

Formula C3H8O3
Synonyms Glycerol * Citifluor AF 2 * Glycerin * Glycerin, anhydrous * Glycerine * Glycerin mist (ACGIH, OSHA) * Glycerin, synthetic * Glyceritol * Glycyl alcohol * Clyzerin, wasserfrei (German) * Grocolene * MOON * 1,2,3-Propanetriol * Osmoglyn * Star * Synthetic glycerin * 90 Technical glycerine * Trihydroxypropane * 1,2,3-Trihydroxypropane
RTECS Number: MA8050000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Caution: Avoid contact and inhalation. Target organ(s): Kidneys.

HMIS RATING

HEALTH: 1*
FLAMMABILITY: 0
REACTIVITY: 1

NFPA RATING

HEALTH: 1
FLAMMABILITY: 0
REACTIVITY: 1

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE

If swallowed, wash out mouth with water provided person is

conscious. Call a physician.

INHALATION EXPOSURE

If inhaled, remove to fresh air. If breathing becomes difficult, call a physician.

DERMAL EXPOSURE

In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE

In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

FLASH POINT

320 °F 160 °C Method: closed cup

EXPLOSION LIMITS

Lower: 0.9 %

AUTOIGNITION TEMP

370 °C

FLAMMABILITY

N/A

EXTINGUISHING MEDIA

Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING

Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

METHODS FOR CLEANING UP

Absorb on sand or vermiculite and place in closed containers for disposal. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING

User Exposure: Avoid inhalation. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE

Suitable: Keep tightly closed.

SPECIAL REQUIREMENTS

Hygroscopic.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS

Safety shower and eye bath. Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT

Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Respiratory protection is not required. Where protection is desired, use multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges.
Hand: Protective gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES

Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS

Country	Source	Type	Value
USA USA	ACGIH ACGIH	TWA TWA	10 MG/M3 10 MG/M3
Remarks: inhalable particulate			
USA USA	MSHA Standard	MSHA	
Remarks: Nuisance Particulates (mist). Nuisance			
USA USA	OSHA. OSHA.	PEL PEL	8H TWA 15 MG/M3, TOTAL DUST 8H
New Zealand	OEL OEL		
Remarks: check ACGIH TLV check ACGIH TLV			

EXPOSURE LIMITS

Country	Source	Type	Value
Poland		NDS	10 mg/m3
Poland		NDSch	-
Poland		NDSP	
Remarks: {OELS ARE VALID FOR AEROSOLS} AEROZOLE			

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Clear viscous liquid Color: Colorless		
Property	Value	At Temperature or Pressure	
Molecular Weight	92.1 AMU		
pH	5.5 - 8.0		
BP/BP Range	182 °C	20 mmHg	
MP/MP Range	20 °C		
Freezing Point	N/A		
Vapor Pressure	< 1 mmHg	20 °C	
Vapor Density	3.1 g/l		
Saturated Vapor Conc.	N/A		
SG/Density	1.262 g/cm3		
Bulk Density	N/A		
Odor Threshold	N/A		
Volatile%	N/A		
VOC Content	N/A		
Water Content	< 0.1 %		
Solvent Content	N/A		
Evaporation Rate	N/A		
Viscosity	N/A		
Surface Tension	N/A		
Partition Coefficient	N/A		
Decomposition Temp.	N/A		
Flash Point	320 °F 160 °C	Method: closed cup	
Explosion Limits	Lower: 0.9 %		
Flammability	N/A		
Autoignition Temp	370 °C		
Refractive Index	1.474		
Optical Rotation	N/A		

Miscellaneous Data N/A
Solubility Solubility in Water: 5 M in H₂O, 20°C
 complete, colorless

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Stable: Stable.

Conditions to Avoid: Moisture.

Materials to Avoid: Strong bases, Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

HAZARDOUS POLYMERIZATION

Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE

Skin Contact: May cause skin irritation.

Skin Absorption: May be harmful if absorbed through the skin.

Eye Contact: May cause eye irritation.

Inhalation: May be harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.

Ingestion: May be harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)

Kidneys.

SIGNS AND SYMPTOMS OF EXPOSURE

Nausea, headache, and vomiting. Prolonged exposure can cause:

TOXICITY DATA

Oral

Rat

12600 mg/kg

LD50

Remarks: Liver:Other changes. Behavioral:Muscle weakness.

Behavioral:General anesthetic.

Inhalation

Rat

> 570 mg/m³

LC50

Intraperitoneal

Rat

4420 MG/KG

LD50

Remarks: Cardiac:Other changes. Behavioral:Toxic psychosis.

Kidney, Ureter, Bladder:Other changes.

Subcutaneous

Rat

100 MG/KG

LD50

Intravenous

Rat
5566 MG/KG
LD50

Oral
Mouse
4090 mg/kg
LD50

Intraperitoneal
Mouse
8700 MG/KG
LD50

Remarks: Behavioral:Altered sleep time (including change in righting reflex).

Subcutaneous
Mouse
91 MG/KG
LD50

Intravenous
Mouse
4250 MG/KG
LD50

Oral
Rabbit
27000 mg/kg
LD50

Skin
Rabbit
> 10000 mg/kg
LD50

Intravenous
Rabbit
53 GM/KG
LD50

Oral
Guinea pig
7750 mg/kg
LD50

IRRITATION DATA

Skin
Rabbit
500 mg
24H
Remarks: Mild irritation effect

Eyes
Rabbit
126 mg
Remarks: Mild irritation effect

Eyes
Rabbit
500 mg

24H

Remarks: Mild irritation effect

CHRONIC EXPOSURE - MUTAGEN

Species: Human
Dose: 200 MMOL/L
Cell Type: lymphocyte
Mutation test: DNA inhibition

Species: Rat
Route: Oral
Dose: 1 GM/KG
Mutation test: Cytogenetic analysis

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD

Species: Rat
Dose: 100 MG/KG
Route of Application: Oral
Exposure Time: (1D MALE)
Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Species: Rat
Dose: 280 MG/KG
Route of Application: Intratesticular
Exposure Time: (2D MALE)
Result: Paternal Effects: Testes, epididymis, sperm duct.
Paternal Effects: Spermatogenesis (including genetic material, sperm morphology, motility, and count).

Species: Rat
Dose: 1600 MG/KG
Route of Application: Intratesticular
Exposure Time: (1D MALE)
Result: Effects on Fertility: Male fertility index (e.g., # males impregnating females per # males exposed to fertile nonpregnant females).

Species: Rat
Dose: 862 MG/KG
Route of Application: Intratesticular
Exposure Time: (1D MALE)
Result: Paternal Effects: Spermatogenesis (including genetic material, sperm morphology, motility, and count).

Species: Monkey
Dose: 119 MG/KG
Route of Application: Intratesticular
Exposure Time: (1D MALE)
Result: Paternal Effects: Testes, epididymis, sperm duct.
Paternal Effects: Spermatogenesis (including genetic material, sperm morphology, motility, and count).

Section 12 - Ecological Information

No data available.

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION

Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT

Proper Shipping Name: None
Non-Hazardous for Transport: This substance is considered to be non-hazardous for transport.

IATA

Non-Hazardous for Air Transport: Non-hazardous for air transport.

Section 15 - Regulatory Information

US CLASSIFICATION AND LABEL TEXT

US Statements: Caution: Avoid contact and inhalation. Target organ(s): Kidneys.

UNITED STATES REGULATORY INFORMATION

SARA LISTED: No
TSCA INVENTORY ITEM: Yes Yes

CANADA REGULATORY INFORMATION

WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER

For R&D or manufacturing use. Not for prescription compound or other uses.

WARRANTY

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2009 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : (-)-Nicotine
Product Number : 36733
Brand : Fluka
Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052
Emergency Phone # : (314) 776-6555

2. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : (-)-1-Methyl-2-(3-pyridyl)pyrrolidine
Formula : C₁₀H₁₄N₂
Molecular Weight : 162.24 g/mol

CAS-No.	EC-No.	Index-No.	Concentration
Nicotine			
54-11-5	200-193-3	614-001-00-4	-

3. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Target Organ Effect, Highly toxic by ingestion, Highly toxic by skin absorption, Teratogen

Target Organs

Peripheral nervous system, Central nervous system, Skeletal muscle., Gastro-intestinal system

HMIS Classification

Health Hazard: 3

Chronic Health Hazard: *

Flammability: 1

Physical hazards: 0

NFPA Rating

Health Hazard: 3

Fire: 1

Reactivity Hazard: 0

Potential Health Effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Skin	May cause skin irritation. May be fatal if absorbed through skin.
Eyes	May cause eye irritation.
Ingestion	May be fatal if swallowed.

4. FIRST AID MEASURES

General advice

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

If inhaled

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

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

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

5. FIRE-FIGHTING MEASURES

Flammable properties

Flash point 101 °C (214 °F) - closed cup

Ignition temperature 244 °C (471 °F)

Suitable extinguishing media

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

Special protective equipment for fire-fighters

Wear self contained breathing apparatus for fire fighting if necessary.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods for cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Handling

Avoid inhalation of vapour or mist.
Normal measures for preventive fire protection.

Storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Store under inert gas. hygroscopic Air and light sensitive.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Update	Basis
Nicotine	54-11-5	TWA	0.5 mg/m ³	1994-09-01	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Skin contact does contribute to exposure.				
		TWA	0.5 mg/m ³	1989-03-01	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
	Skin contact does contribute to exposure.				
		TWA	0.5 mg/m ³	1993-06-30	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Skin contact does contribute to exposure.				

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves.

Eye protection

Safety glasses

Skin and body protection

Choose body protection according to the amount and concentration of the dangerous substance at the work place.

Hygiene measures

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

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form clear, liquid

Colour dark brown

Safety data

pH 10.2

Melting point -79 °C (-110 °F)

Boiling point 247 °C (477 °F) at 993 hPa (745 mmHg)

Flash point	101 °C (214 °F) - closed cup
Ignition temperature	244 °C (471 °F)
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	0.051 hPa (0.038 mmHg) at 25 °C (77 °F)
Density	1.010 g/cm ³
Water solubility	completely miscible
Partition coefficient: n-octanol/water	log Pow: 1.17
Relative vapour density	5.6 - (Air = 1.0)

10. STABILITY AND REACTIVITY

Storage stability

Stable under recommended storage conditions.

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, nitrogen oxides (NO_x)

11. TOXICOLOGICAL INFORMATION

Acute toxicity

LD50 Oral - rat - 50 mg/kg

LD50 Dermal - rabbit - 50 mg/kg

Remarks: Behavioral:Convulsions or effect on seizure threshold. Respiratory disorder

Irritation and corrosion

no data available

Sensitisation

no data available

Chronic exposure

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

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

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

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

Possible risk of congenital malformation in the fetus.

Signs and Symptoms of Exposure

prolonged or repeated exposure can cause: Vomiting, Diarrhoea, Convulsions, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Potential Health Effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Skin	May cause skin irritation. May be fatal if absorbed through skin.
Eyes	May cause eye irritation.
Ingestion	May be fatal if swallowed.
Target Organs	Peripheral nervous system, Central nervous system, Skeletal muscle., Gastro-intestinal system,

Additional Information

RTECS: QS5250000

12. ECOLOGICAL INFORMATION

Elimination information (persistence and degradability)

no data available

Ecotoxicity effects

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 4 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates.	EC50 - Daphnia magna (Water flea) - 0.24 mg/l - 48 h

Further information on ecology

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

13. DISPOSAL CONSIDERATIONS

Product

Observe all federal, state, and local environmental regulations. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN-Number: 1654 Class: 6.1 Packing group: II
Proper shipping name: Nicotine
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN-Number: 1654 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: NICOTINE
Marine pollutant: No

IATA

UN-Number: 1654 Class: 6.1 Packing group: II
Proper shipping name: Nicotine

15. REGULATORY INFORMATION

OSHA Hazards

Target Organ Effect, Highly toxic by ingestion, Highly toxic by skin absorption, Teratogen

DSL Status

All components of this product are on the Canadian DSL list.

SARA 302 Components

	CAS-No.	Revision Date
Nicotine	54-11-5	1991-07-01

SARA 313 Components

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

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Nicotine	54-11-5	1991-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Nicotine	54-11-5	1991-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Nicotine	54-11-5	1991-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known in the State of California to cause birth defects or other reproductive harm. Nicotine	54-11-5	1990-04-01

16. OTHER INFORMATION

Further information

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