Characterization of Regal Cartridges for Electronic Cigarettes

prepared for

inLife LLC
Irvine, CA

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23 September 2009

Client: inLife LLC
2569 McCabe Way
Irvine, CA 92614

Requestor: Tom Kiklas

Study: **Characterization of Regal Cartridges for Electronic Cigarettes**

LIMS #: 20090304

SUMMARY

A liquid formulation used in electronic cigarettes was tested by gas chromatography mass spectrometry (GC-MS) to identify the major ingredients in the mixture and their relative concentrations. In addition, vapor produced from an electronic cigarette containing this product was assayed by GC-MS and gas chromatography with a flame ionization detector (GC-FID) to compare the relative smoke composition to that of the liquid. Propylene glycol, ethylene glycol and nicotine were observed in this product but diethylene glycol was not.

EXPERIMENTAL

One box of smoke cartridges along with an electronic cigarette was submitted for these experiments (Figure 1). The liquid product and vapors generated from the cartridges juice were characterized by GC-MS or GC-FID. The sample was designated as follows:

Table I: Sample Designations

LIMS #	Client ID	Description
20090304-01	inLIfe Regal Cartridges	Smoke Cartridges

For the liquid product analysis, a new unused cartridge was disassembled and the isolated liquid was diluted with MeOH. This solution 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 and the relative intensities used to estimate the relative concentration of the major components.

To capture the vapor emitted from an assembled Regal electronic cigarette containing a Regal cartridge, a 125ml evacuated glass bulb was used to draw air through the Regal device and into the bulb. The white vapor was subsequently dissolved in MeOH for GC-MS or GC-FID (Shimadzu 2010, Phenomenex ZB-624). The GC-FID was calibrated with nicotine, propylene glycol (PPG), ethylene glycol (EG) and diethylene glycol (DEG) to establish the retention times of the components present in the produced vapors.

RESULTS & DISCUSSION

Initial GC-MS chromatograms of the liquid product showed that this contained a large amount of propylene glycol (Figure 2). Since the concentration of PPG was so large, the only other component observed in this run was nicotine which made calculating actual concentrations of both major and minor components impossible. However, based on the peak areas of these 2 major components, the RELATIVE concentrations were estimated to be 98.7% PPG and 1.3% nicotine which was close to the stated nicotine concentration on the package (Table II). Again, this experiment was unable to quantify any of the minor components.

As a result the method was modified slightly to provide a better quantitative measure of PPG, EG and DEG. Using a different column on the GC-FID, these components could be observed simultaneously along with nicotine (Figure 3).

The collected vapors consisted of primarily PPG with nicotine and a small amount of EG (Figure 4). No DEG was observed in the product vapors above 0.01%. An unknown peak in the GC-FID was observed but did not correlate with the retention time of the DEG standard.

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". 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=85085967&loc=es_rss
http://pubchem.ncbi.nlm.nih.gov/summary/summary.cgi?sid=24862741

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

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The analytical method used for this study focused on the determination of relative concentrations of the major ingredients in a smoke juice product and vapor produced by this product. Under the conditions employed in this study, other minor components were not observed. A separate study with different sample dilutions and instrument settings could be used to characterize the sample for minor volatile components that may be present below this method detection limit.

Figure 1: Regal Liquid Cartridge with Electronic Cigarette

Figure 2: GC-MS TIC Chromatogram of Liquid Product

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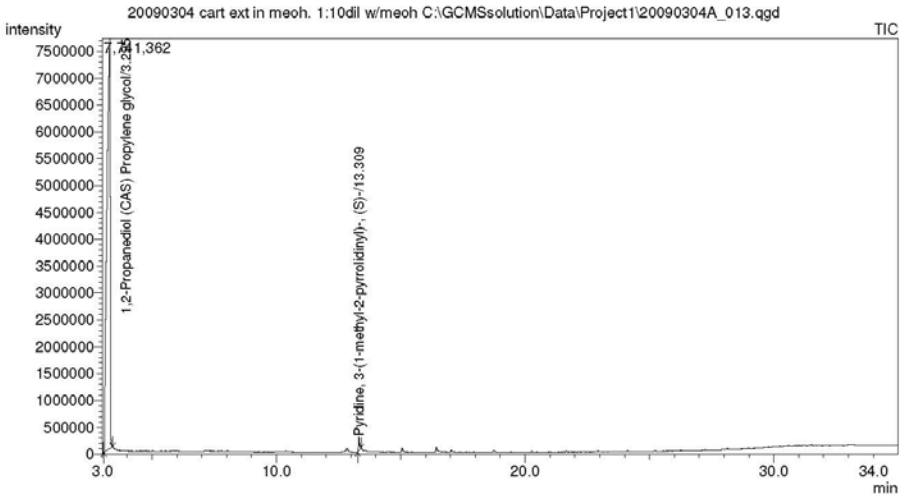
Sample Information

Analyzed by	: Admin
Analyzed	: 9/11/2009 3:01:36 PM
Sample Name	: 20090304 cart ext in meoh. 1:10dil w/meoh
Sample ID	: 20090304 cart ext in meoh. 1:10
Tray	: Tray2
Vial #	: 6
Inj. Volume	: 1
Data File	: C:\GCMSsolution\Data\Project1\20090304A_013.qgd
Method File	: C:\GCMSsolution\Data\Project1\ZB5-HT_Survey_1_100.qgm
Tuning File	: C:\GCMSsolution\System\Tune1\QP2010S.qgt
[Comment]	

> 20090304 cart ext in meoh. 1:10dil w/meoh

20090304 cart ext in meoh. 1:10dil w/meoh C:\GCMSsolution\Data\Project1\20090304A_013.qgd



Peak Report TIC

Peak#	R.Time	Area	Area%	Height	Height%	Base m/z	Name
1	3.295	70728708	98.71	7644065	96.66	45.05	1,2-Propanediol (CAS) Propylene glycol
2	13.309	923026	1.29	263814	3.34	84.10	Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-
		71651734	100.00	7907879	100.00		

C:\GCMSsolution\Data\Project1\20090304A_013.qgd 1 / 5

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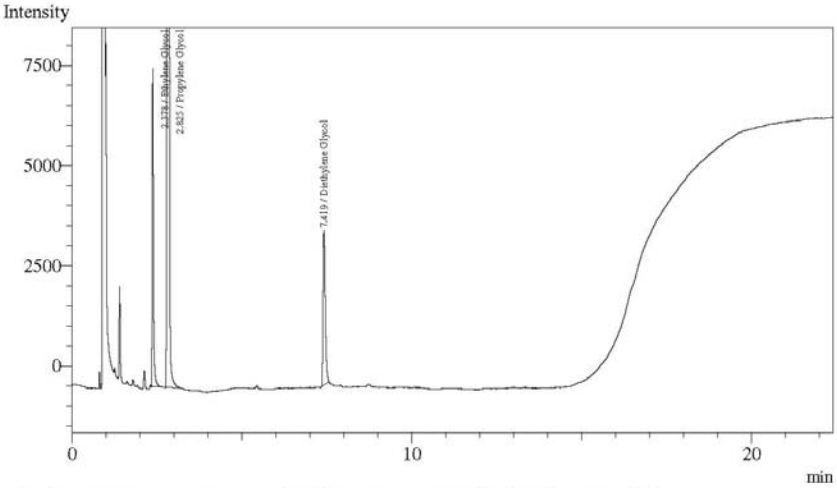
Figure 3: GC-FID Chromatogram of PPG, EG, & DEG Standards

Analysis Date & Time : 9/16/2009 11:30:15 AM
User Name : Admin
Vial# : 5
Sample Name : PPG+DEG+PPG
Sample ID : PPG+DEG+PPG
Sample Type : Unknown
Injection Volume : 1.00
ISTD Amount :

Data Name : C:\GCsolution\Data\split_splitless\glyc-05.gcd
Method Name : C:\GCsolution\Data\split_splitless\ZB624(2)_USP propylene glycol.gcm



Peak#	Ret.Time	Area	Height	Conc.	Unit	Mark	ID#	Cmpd Name
1	2.378	20094	7915	4.470	%		1	Ethylene Glycol
2	2.825	411882	148749	91.627	%		2	Propylene Glycol
3	7.419	17543	3866	3.903	%		3	Diethylene Glycol
Total		449519	160530					

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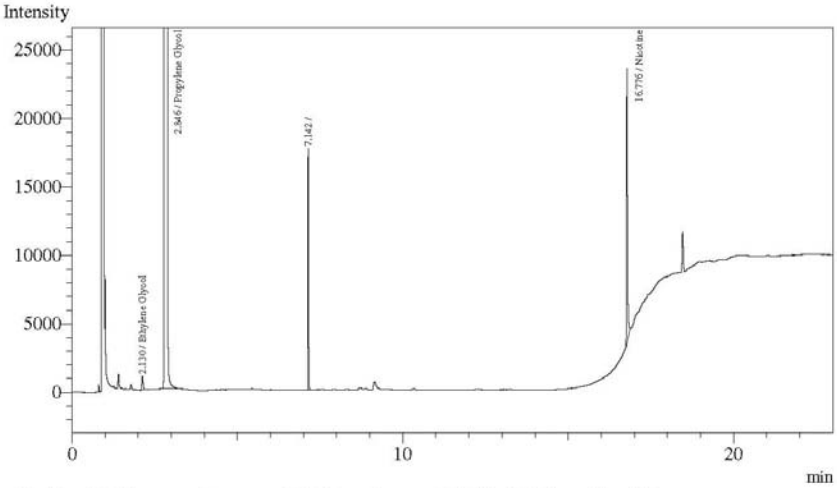
Figure 4: GC-FID Chromatogram of Captured Vapor from Regal Cartridge

Analysis Date & Time : 9/17/2009 12:00:56 PM
User Name : Admin
Vial# : 7
Sample Name : nic in vapor
Sample ID : nic in vapor
Sample Type : Unknown
Injection Volume : 1.00
ISTD Amount :

Data Name : C:\GCsolution\Data\split_splitless\glyc-10.gcd
Method Name : C:\GCsolution\Data\split_splitless\ZB624(2)_USP propylene glycol255.gcm



Peak#	Ret.Time	Area	Height	Conc.	Unit	Mark	ID#	Cmpd Name
1	2.130	2650	975	0.102	%		1	Ethylene Glycol
2	2.846	2548556	853886	97.718	%		2	Propylene Glycol
3	7.142	16900	16673	0.648				
4	16.776	39975	19882	1.533	%		4	Nicotine
Total		2608081	891416					

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Table II: Composition Profile for Liquid and Vapor inLife Regal Product

#	Name	Relative % in Smoke Juice	Relative % in Vapors	CAS No.	Comments*
1	Propylene Glycol (PPG)	98.7	97.7	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	Ethylene Glycol (EG)		0.1	107-21-1	The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have not classified ethylene glycol and propylene glycol for carcinogenicity.
3	Diethylene Glycol (DEG)		n.d.**	111-46-6	U.S. National Toxicology Program acute toxicity studies for Diethylene glycol Acute toxicity summary rating for this chemical using NTP data: Not Acutely Toxic to Slightly Toxic
4	Nicotine	1.3	1.5	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
5	Unknown		0.6		

*cf. "Gamucci" report, http://www.atsdr.cdc.gov/toxprofiles//phs96.html, http://www.pesticideinfo.org/List_NTPStudies.jsp?Rec_Id=PC38176
** < 0.01% (wt/wt)

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: $C_3H_8O_2$

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/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	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.
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SIGMA-ALDRICH

Material Safety Data Sheet

Version 3.0
Revision Date 02/25/2009
Print Date 07/15/2009

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 : $C_{10}H_{14}N_2$
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/m3	1994-09-01	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Skin contact does contribute to exposure.				
		TWA	0.5 mg/m3	1989-03-01	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
	Skin contact does contribute to exposure.				
		TWA	0.5 mg/m3	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/cm3
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 (NOx)

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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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 Co., 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.

SIGMA-ALDRICH

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006
Version 3.1 Revision Date 11.12.2008
Print Date 23.09.2009
GENERIC EU MSDS - NO COUNTRY SPECIFIC DATA - NO OEL DATA

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

Product name : Ethylene glycol

Product Number : 293237
Brand : Sigma-Aldrich

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. HAZARDS IDENTIFICATION

Risk advice to man and the environment
Harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : $C_2H_6O_2$
Molecular Weight : 62,07 g/mol

CAS-No.	EC-No.	Index-No.	Classification	Concentration
Ethylene glycol				
107-21-1	203-473-3	603-027-00-1	Xn, R22	-

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

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

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

In case of eye contact
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

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.

Environmental precautions
Do not let product enter drains.

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

hygroscopic

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

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
The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it. 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
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid
Colour	colourless

Safety data

pH	no data available
Melting point	-13 °C
Boiling point	195 - 198 °C at 1.013 hPa

Flash point	111 °C - closed cup
Ignition temperature	400 °C
Lower explosion limit	3,2 %(V)
Upper explosion limit	15,3 %(V)
Vapour pressure	0,11 hPa at 20 °C 0,13 hPa at 20 °C
Density	1,1130 g/cm3
Water solubility	completely miscible soluble
Partition coefficient: n-octanol/water	log Pow: -1,36

10. STABILITY AND REACTIVITY

Storage stability
Stable under recommended storage conditions.

Materials to avoid
Strong acids, Strong oxidizing agents, Strong bases, Aldehydes, Aluminum

Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides

11. TOXICOLOGICAL INFORMATION

Acute toxicity

LD50 Oral - rat - 4.700 mg/kg

LD50 Dermal - rabbit - 10.626 mg/kg

Irritation and corrosion

Eyes - rabbit - Mild eye irritation - 24 h

Sensitisation

no data available

Chronic exposure

This product is or contains a component that is probably not carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

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.

Laboratory experiments have shown teratogenic effects.

Overexposure may cause reproductive disorder(s) based on tests with laboratory animals.

Signs and Symptoms of Exposure

When ingested early symptoms mimic alcohol inebriation and are followed by nausea, vomiting, abdominal pain, weakness, muscle tenderness, respiratory failure, convulsions, cardiovascular collapse, pulmonary edema, hypocalcemic tetany, and severe metabolic acidosis. Without treatment, death may occur in 8 to 24 hours. Victims who survive the initial toxicity period usually develop renal failure along with brain and liver damage., Exposure to and/or consumption of alcohol may increase toxic effects.

Potential Health Effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.
Ingestion	Harmful if swallowed.
Target Organs	Liver, Cardiovascular system., Eyes, Kidney, Central nervous system,

Additional Information
RTECS: KW2975000

12. ECOLOGICAL INFORMATION

Elimination information (persistence and degradability)

no data available

Bioaccumulation	Remarks: Does not bioaccumulate. other fish - 61 d Bioconcentration factor (BCF): 0,60

Ecotoxicity effects

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 18.500 mg/l - 96 h
	LC50 - Leuciscus idus (Golden orfe) - > 10.000 mg/l - 48 h
	NOEC - Pimephales promelas (fathead minnow) - 32.000 mg/l - 7 d
	NOEC - Pimephales promelas (fathead minnow) - 39.140 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates.	EC50 - Daphnia magna (Water flea) - 74.000 mg/l - 24 h
	NOEC - Daphnia - 24.000 mg/l - 48 h
	LC50 - Daphnia magna (Water flea) - 41.000 mg/l - 48 h

Further information on ecology

no data available

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

ADR/RID
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

Labelling according to EC Directives

EC Label

Hazard symbols

Xn	Harmful

R-phrase(s)

R22	Harmful if swallowed.

16. OTHER INFORMATION

Further information

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