

FLUID FOR THE BIOTAC[®] AND BIOTAC[®] SP TACTILE SENSORS

September 23, 2020

Mixing Procedure (82% PG 1M NaBr)

The BioTac fluid is a composition of:

- 82% Propylene Glycol
- 18% Water
- 1M Sodium Bromide (NaBr)

Mix an 82% Propylene Glycol / 18% Distilled Water solution by volume

- Add desired volume of Propylene Glycol to a Graduated Cylinder
- Multiply the volume by 18/82 (=0.2195) and measure this volume of water in another graduated cylinder
- Mix the two liquids in a beaker

Add 1.0 M NaBr (molecular weight: 102.894 g/mol)

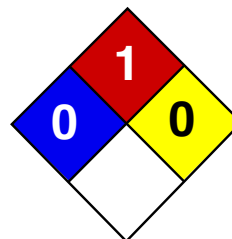
- Calculate the total fluid volume of Propylene Glycol and Distilled Water Solution
- Calculate required NaBr crystal weight:
 - $\text{NaBr weight} = (1 \text{ mol/L}) * (\text{liters of fluid}) * (102.894 \text{ g/mol})$
- Measure out the appropriate amount of NaBr crystal as calculated
- Gradually mix NaBr crystal into fluid until crystals are completely dissolved

Material Safety Data Sheet Notes

For safety considerations please consult the MSDS sheets of the two fluids used to prepare the BioTac fluid (attached). These chemicals have a health rating of 2 based on the Hazardous Materials Identification System, indicating that temporary or minor injury may occur if mishandled. Of particular notability:

- Medical attention may be required in the event of skin contact, eye contact, ingestion, or inhalation, CONSULT BOTH MSDS IN THE CASE OF AN ACCIDENT
- As advised in both MSDS sheets, use of proper protective equipment such as gloves, lab coats and splash goggles are advised for safety.

This summary is not a comprehensive list of safety data. Read and understand both attached MSDS before preparing or handling BioTac fluid.



Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet Propylene glycol MSDS

Section 1: Chemical Product and Company Identification

Product Name: Propylene glycol

Catalog Codes: SLP1162, SLP2974

CAS#: 57-55-6

RTECS: TY2000000

TSCA: TSCA 8(b) inventory: Propylene glycol

CI#: Not applicable.

Synonym: 1,2,-propanediol, 1,2-dihydroxypropane

Chemical Name: Propylene Glycol

Chemical Formula: CH₃CHOHCH₂OH

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Propylene glycol	57-55-6	100

Toxicological Data on Ingredients: Propylene glycol: ORAL (LD50): Acute: 20000 mg/kg [Rat]. 22000 mg/kg [Mouse]. DERMAL (LD50): Acute: 20800 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of inhalation.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 371°C (699.8°F)

Flash Points: CLOSED CUP: 99°C (210.2°F). OPEN CUP: 107°C (224.6°F) (Cleveland).

Flammable Limits: LOWER: 2.6% UPPER: 12.5%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis, moisture.

Storage:

Hygroscopic. Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 23°C (73.4°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 10 (mg/m³) from AIHA Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Oily liquid.)

Odor: Practically Odorless.

Taste: Practically Tasteless.

Molecular Weight: 76.1g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 188°C (370.4°F)

Melting Point: -59°C (-74.2°F)

Critical Temperature: Not available.

Specific Gravity: 1.036 (Water = 1)

Vapor Pressure:

0 kPa (@ 20°C) 0.08 mmHg at 20 C 0.129 mmHg at 25 C

Vapor Density: 2.62 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -0.9

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, acetone.

Solubility: Soluble in cold water, hot water, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat, exposure to moist air or water

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Hygroscopic; keep container tightly closed. Incompatible with chloroformates, strong acids (nitric acid, hydrofluoric acid), caustics, aliphatic amines, isocyanates, strong oxidizers, acid anhydrides, silver nitrate, reducing agents.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact.

Toxicity to Animals:

Acute oral toxicity (LD50): 18500 mg/kg [Rabbit]. Acute dermal toxicity (LD50): 20800 mg/kg [Rabbit].

Chronic Effects on Humans: May cause damage to the following organs: central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant, permeator), of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May affect genetic material (mutagenic). May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: May cause mild skin irritation. It may be absorbed through the skin and cause systemic effects similar to those of ingestion. Eyes: May cause mild eye irritation with some immediate, transitory stinging, lacrimation, blepharospasm, and mild transient conjunctival hyperemia. There is no residual discomfort or injury once it is washed away. Inhalation: May cause respiratory tract irritation. Ingestion: It may cause gastrointestinal tract irritation. It may affect behavior/central nervous system(CNS depression, general anesthetic, convulsions, seizures, somnolence, stupor, muscle contraction or spasticity, coma), brain (changes in surface EEG), metabolism, blood (intravascular hemolysis, white blood cells - decreased neutrophil function), respiration (respiratory stimulation, chronic pulmonary edema, cyanosis), cardiovascular system(hypotension, bradycardia, arrhythmias, cardiac arrest), endocrine system (hypoglycemia), urinary system (kidneys), and liver. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may cause allergic contact dermatitis. Ingestion: Prolonged or repeated ingestion may cause hyperglycemia and may affect behavior/CNS (symptoms similar to that of acute ingestion). Inhalation: Prolonged or repeated inhalation may affect behavior/CNS (with symptoms similar to ingestion), and spleen

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): >5000 mg/l 24 hours [Goldfish]. >10000 mg/l 48 hours [guppy]. >10000 mg/l 48 hours [water flea].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information**Federal and State Regulations:**

Pennsylvania RTK: Propylene glycol Minnesota: Propylene glycol TSCA 8(b) inventory: Propylene glycol

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):

R21/22- Harmful in contact with skin and if swallowed. S24/25- Avoid contact with skin and eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

Section 16: Other Information**References:**

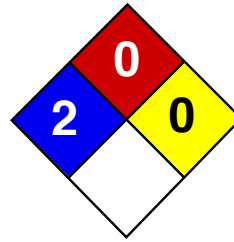
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Supplier MSDS -LOLI -RTECS -HSDB

Other Special Considerations: Not available.

Created: 10/10/2005 08:24 PM

Last Updated: 11/01/2010 12:00 PM

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Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Sodium bromide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium bromide	Contact Information:
Catalog Codes: SLS3820, SLS1600	Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396
CAS#: 7647-15-6	US Sales: 1-800-901-7247 International Sales: 1-281-441-4400
RTECS: VZ3150000	Order Online: ScienceLab.com
TSCA: TSCA 8(b) inventory: Sodium bromide	CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300
CI#: Not available.	International CHEMTREC, call: 1-703-527-3887
Synonym: Bromide salt of sodium	For non-emergency assistance, call: 1-281-441-4400
Chemical Name: Sodium Bromide	
Chemical Formula: NaBr	

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium bromide	7647-15-6	100

Toxicological Data on Ingredients: Sodium bromide: ORAL (LD50): Acute: 3500 mg/kg [Rat]. 7000 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:

Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Do not ingest. Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 25°C (77°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 102.91 g/mole

Color: Not available.

pH (1% soln/water): 6.5-8.0

Boiling Point: 1390°C (2534°F)

Melting Point: 755°C (1391°F)

Critical Temperature: Not available.

Specific Gravity: 3.21 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol.

Solubility:

Easily soluble in cold water, hot water. Soluble in methanol. 1 g dissolves in 1.1 ml of water. 1 g dissolves in about 16 ml of alcohol. 1 g dissolves in 6 ml of methanol

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, moisture

Incompatibility with various substances: Reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Absorbs moisture from the air but is not deliquescent. Hygroscopic. Also incompatible with alkaloidal and heavy metal salts, and Bromine Trifluoride.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 3500 mg/kg [Rat].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects (male and female effects on fertility and effects on newborns and fetotoxicity) based on animal data Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: May cause mild skin irritation. Eyes: Causes eye irritation. Inhalation: May cause respiratory tract irritation. Ingestion: May cause gastrointestinal tract irritation with nausea and vomiting, abdominal pain, constipation. Bromide poisoning following acute ingestion is more rare and may affect the central nervous system (CNS depression - somnolence, confusion, ataxia, coma and other symptoms similar to chronic ingestion), cardiovascular system (hypotension, tachycardia), kidneys (acute renal failure, urinary incontinence), and respiration (acute respiratory distress syndrome). It may also cause eye disturbances such as mydriasis and nystagmus, disturbances of apparent color of objects, blurring or indistinctness of vision, apparent movement or wiggling and change in apparent size of objects, large pupils, subnormal reaction to light, diplopia, and photophobia. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may cause skin rashes. Eyes: Prolonged or repeated eye contact may cause blepharitis, and conjunctivitis. Prolonged or repeated ingestion may cause skin rashes (bromoderma, acne, pyoderma gangrenosum, erythema multiforme), affect the liver, endocrine system (thyroid), metabolism(anorexia), blood, vision (visual disturbances, permanently decreased vision and may produce a toxic syndrome, "Bromism" which may be characterized by behavior/central nervous symptoms such CNS depression, irritability, headache, confusion, slurred speech, memory loss, lethargy, ataxia, tremor, agitation, delusion, disoriented, paranoia, aggressiveness, hallucinations, mania, fatigue, seizure, neuropathy, muscle weakness, coma. Also, in individuals with chronic bromism, the tongue may have a coated or furred appearance.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Sodium bromide

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):

R36- Irritating to eyes. S2- Keep out of the reach of children. S24/25- Avoid contact with skin and eyes. S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:26 PM

Last Updated: 11/01/2010 12:00 PM

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