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

Product Name : Pentane 80/20
Product Uses : Industrial solvent, blowing agent.
Manufacturer/Supplier : TOP Solvent Company Limited
                      555/1 Energy Complex Building A, 11th Floor
                      Viphavadi Rangsit Road Chatuchak, Bangkok 10900
                      Thailand
Telephone : +66 2 299 0003 or +66 2 797 2993
Fax : +66 2 797 2983
Emergency Telephone Number : +66 2 299 0003 [working hours] or
                             +66 38 683090 ext.103 [out of working hours]
Other Information : TOPSol is a trademark owned by TOP Solvent Company
                    Limited

2. HAZARDS IDENTIFICATION

GHS Classification : FLAMMABLE LIQUIDS, Category 1
                    SPECIFIC TARGET ORGAN SYSTEMIC TOXICITY (SINGLE
                    EXPOSURE), Category 3 Narcotic effects
                    ASPIRATION HAZARD, Category 1
                    AQUATIC TOXICITY (CHRONIC), Category 2

GHS label elements
Symbol(s) :
Signal words : Danger

GHS Hazard Statements
Physical Hazards : H224 Extremely flammable liquid and vapour.
Health Hazards : H304 May be fatal if swallowed and enters airways.
                 H336 May cause drowsiness or dizziness.
Environmental Hazards : H411 Toxic to aquatic life with long lasting effects.
Pentane 80/20
Version 2.1
Effective Date 1-June-2012

Material Safety Data Sheet

GHS Precautionary statements

Prevention: P210  Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233  Keep container tightly closed.
P240  Ground/bond container and receiving equipment.
P241  Use explosion-proof electrical/ventilating/lighting equipment.
P242  Use only non-sparking tools.
P243  Take precautionary measures against static discharge.
P280  Wear protective gloves/protective clothing/eye protection/face protection.
P261  Avoid breathing dust/fume/gas/mist/vapors/spray.
P271  Use only outdoors or in a well-ventilated area.
P273  Avoid release to the environment.

Response: P303+P361+P353  IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower.
P370+P378  In case of fire: Use appropriate media for extinction.
P304+P340  IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
P312: Call a POISON CENTER or doctor/physician if you feel unwell.
P301+P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P331  Do NOT induce vomiting.

Storage: P403+P235  Store in a well-ventilated place. Keep cool.
P405  Store locked up.

Disposal: P501: Dispose of contents and container to appropriate waste site or reclaimer in accordance with local and national regulations

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Identity: Mixture of n-Pentane and Iso-Pentane

Classification of components according to GHS
4. FIRST AID MEASURES

General Information : Keep victim calm. Obtain medical treatment immediately.
Inhalation : Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.
Skin Contact : Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye Contact : Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion : If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3° C), shortness of breath, chest congestion or continued coughing or wheezing. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. Give nothing by mouth. Do not induce vomiting.

Notes to physician
Most important symptoms /effects, acute & delayed : Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest
congestion, shortness of breath, and/or fever. Respiratory irritation signs and symptoms may include a temporary burning sensation of the nose and throat, coughing, and/or difficulty breathing. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, lightheadedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death.

Immediate medical attention, special treatment

Causes central nervous system depression. Dermatitis may result from prolonged or repeated exposure. Potential for chemical pneumonitis. Consider: gastric lavage with protected airway, administration of activated charcoal. Call a doctor or poison control center for guidance. Potential for cardiac sensitisation, particularly in abuse situations. Hypoxia or negative inotropes may enhance these effects. Consider: oxygen therapy.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Specific Hazards: Carbon monoxide may be evolved if incomplete combustion occurs. Will float and can be reignited on surface water. The vapour is heavier than air, spreads along the ground and distant ignition is possible.

Extinguishing Media: Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only. Do not discharge extinguishing waters into the aquatic environment.

Unsuitable Extinguishing Media: Do not use water in a jet.

Protective Equipment for Firefighters: Wear full protective clothing and self-contained breathing apparatus.

Other Advice: Keep adjacent containers cool by spraying with water.

6. ACCIDENTAL RELEASE MEASURES

Observe all relevant local and international regulations.
Personal Precautions, Protective Equipment and Emergency Procedures: Avoid contact with spilled or released material. Immediately remove all contaminated clothing. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. For guidance on disposal of spilled material see Chapter 13 of this Material Safety Data Sheet.

Environmental Precautions: Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment (of product and fire fighting water) to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapour or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment.

Methods and material for containment and clean up: For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely.

Additional Advice: Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Vapour may form an explosive mixture with air.

7. HANDLING AND STORAGE

General Precautions: Avoid breathing vapours or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. On guidance on selection of personal protective equipment
see Chapter 8 of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.

Precautions for safe Handling:
- Avoid contact with skin, eyes, and clothing. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/sec until fill pipe submerged to twice its diameter, then <= 7 m/sec). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Handle and open container with care in a well ventilated area. Ventilate workplace in such a way that the Occupational Exposure Limit (OEL) is not exceeded. Do not empty into drains.

Conditions for safe Storage:
- Must be stored in a diked (bunded) well-ventilated area, away from sunlight, ignition sources and other sources of heat. Bulk storage tanks should be diked (bunded). Keep away from aerosols, flammables, oxidizing agents, corrosives and from other flammable products which are not harmful or toxic to man or to the environment. Storage Temperature: Ambient.

Product Transfer:
- Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/sec until fill pipe submerged to twice its diameter, then <= 7 m/sec). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations. Keep containers closed when not in use. Do not use compressed air for filling, discharging or handling.

Recommended Materials:
- For containers, or container linings use mild steel, stainless steel. For container paints, use epoxy paint, zinc silicate paint.

Unsuitable Materials:
- Avoid prolonged contact with natural, butyl or nitrile
Containers, even those that have been emptied, can contain explosive vapours. Do not cut, drill, grind, weld or perform similar operations on or near containers.

Other Advice: Ensure that all local regulations regarding handling and storage facilities are followed.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

**Occupational Exposure Limits**

<table>
<thead>
<tr>
<th>Material</th>
<th>Source</th>
<th>Type</th>
<th>ppm</th>
<th>mg/m3</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pentane, Iso</td>
<td>ACGIH</td>
<td>TWA</td>
<td>600 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEL</td>
<td>300 mg/m3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentane, -n</td>
<td>ACGIH</td>
<td>TWA</td>
<td>600 ppm</td>
<td>1800</td>
<td>2250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEL</td>
<td>750</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Information: Adequate ventilation to control airborne concentrations below the exposure guidelines/limits.

**Biological Exposure Index (BEI) - See reference for full details**

<table>
<thead>
<tr>
<th>Material</th>
<th>Determinant</th>
<th>Sampling time</th>
<th>BEI</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pentane, Iso</td>
<td></td>
<td></td>
<td></td>
<td>No biological limit</td>
</tr>
<tr>
<td>Pentane, -n</td>
<td></td>
<td></td>
<td></td>
<td>allocated.</td>
</tr>
</tbody>
</table>

Appropriate Engineering Controls: The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits. Local exhaust ventilation is recommended. Firewater monitors and deluge systems are recommended.
Eye washes and showers for emergency use.

**Individual protection Measures**

Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.

**Respiratory Protection**

If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Where air filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for organic gases and vapours [boiling point <65°C (149°F)] meeting EN371. Where air-filtering respirators are unsuitable (e.g., airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus.

**Hand Protection**

Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739, AS/NZS:2161) made from the following materials may provide suitable chemical protection: Longer term protection: Nitrile rubber gloves Incidental contact/Splash protection: PVC or neoprene rubber gloves Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended. Application of a non-perfumed moisturizer is recommended.

**Eye Protection**

Chemical splash goggles (chemical monogoggles).

**Body protection**

Chemical resistant gloves/gauntlets, boots, and apron. Where risk of splashing or in spillage clean up, use chemical resistant one-piece overall with integral hood.

**Thermal hazards**

Not applicable

**Monitoring Methods**

Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate. Examples of sources of recommended air monitoring methods are given.
Environmental Exposure Controls: Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Colourless Liquid.
Odour: Paraffinic.
Odour threshold: Data not available.
pH: Not applicable.
Boiling point: Typical 25-36 °C / 77-97 °F
Melting / freezing point: Typical -130 °C / -202 °F
Flash point: Typical -50°C / -58 °F (Abel)
Explosion / Flammability limits in air: 1.3 - 7.8 % (V)
Auto-ignition temperature: 285 °C / 545 °F (ASTM E-659)
Vapour pressure: Typical 68 kPa at 20 °C / 68 °F
                      Typical 169 kPa at 50 °C / 122 °F
Density: Typical 630 kg/m3 at 15 °C / 59 °F (ASTM D-1298)
Water solubility: Negligible
Solubility in other solvents: Data not available
n-octanol/water partition coefficient (log Pow): 3.4
Decomposition temperature : Note: Stable under normal conditions of use.
Dynamic viscosity : Data not available.
Kinematic viscosity : 0.32 mm²/s at 25 °C / 77 °F
Vapour density (air=1) : 2.5 at 20 °C / 68 °F
Electrical conductivity : Typical 0.93 pS/m at 20°C.
Evaporation rate (nBuAc=1) : 12 (ASTM D 3539, nBuAc=1)
Volatile organic carbon : 84% (EC/1999/13)
Molecular weight : 72 g/mol

10. STABILITY AND REACTIVITY

Chemical stability : Stable under normal conditions of use.
Conditions to Avoid : Avoid heat, sparks, open flames and other ignition sources. Prevent vapour accumulation.
Incompatible materials : Strong oxidising agents.
Hazardous Decomposition Products : Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases, including carbon monoxide, carbon dioxide and other organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.
Possibility of hazardous Reactions : Data not available.
Sensitivity to Static Discharge : Yes

11. TOXICOLOGICAL INFORMATION

Information on Toxicological effects

Basis for Assessment : Information given is based on product testing, and/or similar products, and/or components.
Likely routes of exposure : Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.
Acute Toxicity
Acute Oral Toxicity : Low toxicity : LD50 >5000 mg/kg , Rat
Acute Dermal Toxicity : Low toxicity : LD50 >5000 mg/kg
Acute Inhalation : Expected to be of low toxicity: LC50 >20 mg/l / 4 hours, Rat
Toxicity

High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.

Skin corrosion/irritation

Causes mild skin irritation. Prolonged/repeated contact may cause defatting of the skin which can lead to dermatitis.

Serious eye damage/irritation

Expected to be slightly irritating.

Respiratory Irritation

Inhalation of vapours or mists may cause irritation to the respiratory system.

Respiratory or skin Sensitization

Not a skin sensitiser.

Aspiration hazard

Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.

Germ cell mutagenicity

Not mutagenic.

Carcinogenicity

Not expected to be carcinogenic. Tumours produced in animals are not considered relevant to humans.

Reproductive and Developmental Toxicity

Not a development toxicant. Not expected to impair fertility.

Specific target organ toxicity – repeated exposure

Expected to have low toxicity on repeated exposure.

Repeted exposure may cause skin dryness or cracking.

Additional Information

Exposure to very high concentrations of similar materials has been associated with irregular heart rhythms and cardiac arrest.

12. ECOLOGICAL INFORMATION

Basis for Assessment

Incomplete ecotoxicological data are available for this product. The information given below is based partly on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity

Fish

Expected to be harmful: LL/EL/IL50 >10 - <= 100 mg/l.

Aquatic Invertebrates

Expected to be harmful: LL/EL/IL50 >10 - <= 100 mg/l.

Algae

Expected to be harmful: LL/EL/IL50 >10 - <= 100 mg/l.

Microorganisms

Practically non toxic : LL/EL/IL50 >100 mg/l.

Chronic Toxicity

:
Fish: NOEC/NOEL expected to be >1.0 - <=10 mg/l.
Aquatic Invertebrates: NOEC/NOEL expected to be >1.0 - <=10 mg/l.
Mobility: Floats on water. If product enters to soil, one or more constituents will be mobile and may contaminate ground water.
Persistence/degradability: Readily biodegradable.
Bioaccumulative potential: Not expected to bioaccumulate significantly.

13. DISPOSAL CONSIDERATIONS

Material Disposal: Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations.
Do not dispose into the environment, in drains or in water courses. Waste product should not be allowed to contaminate soil or water.

Container Disposal: Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard. Do not, puncture, cut, or weld uncleaned drums. Send to drum recoverer or metal reclamer.

Local Legislation: Disposal should be in accordance with applicable regional, national, and local laws and regulations.

14. TRANSPORT INFORMATION

Land (as per ADR classification): Regulated
Class: 3
Packing group: I
Hazard identification no.: 33
UN No.: 1265
Danger label (primary risk): 3
Proper shipping name: Pentanes
Environmentally Hazardous: No

IMDG
Identification number: UN 1265
Proper shipping name: Pentanes
Material Safety Data Sheet

Class / Division : 3
Packing group : I
Marine pollutant : No

IATA (Country variations may apply)
UN No. : 1265
Proper shipping name : Pentanes
Class / Division : 3
Packing group : I

Sea (Annex II of MARPOL 73/78 and the IBC code)
Pollution Category : Y
Ship Type : 3
Product Name : Pentane (all isomers)
Special Precaution : Refer to Chapter 7, Handling & Storage, for special precautions which a user needs to be aware of or needs to comply with in connection with transport.

Additional Information : This product may be transported under nitrogen blanketing. Nitrogen is an odourless and invisible gas. Exposure to nitrogen may cause asphyxiation or death. Personnel must observe strict safety precautions when involved with a confined space entry.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Chemical Inventory Status
ACIS : Listed. (All components)
DSL : Listed. (All components)
TSCA : Listed. (All components)
EINECS : Listed. (All components)
KECI (KR) : Listed. (All components)
PICCS (PH) : Listed. (All components)

16. OTHER INFORMATION
MSDS Version Number : 2.1

MSDS Effective Date : 1-June-2012

Uses and Restrictions : Raw material for use in the chemical industry.
Use only in industrial processes, Blowing agent.

MSDS Distribution : The information in this document should be made available to all who may handle the product.

Disclaimer : This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.