MATERIAL SAFETY DATA SHEET

1. Identification of the substance or mixture and of the supplier

GHS product identifier: DIOCTYL PHTHALATE / DOP

Recommended use of the chemical and restrictions on use:

- Recommended use: Additives such as PVC, plastics, rubber, ink, adhesive, and lubricant.
- Restrictions on use: Only Use for the recommended purpose, and do not use for a toys, infant product, artificial clay, medical infusion solution bag/blood bag purpose.

Supplier identifier:

- Manufacturers information
  - Manufacturers name: Hanwha Chemical Corporation
  - Address: 722-1, Hwangseong-dong, Nam-gu, Ulsan, Korea
  - Respondent: Ulsan 3 plant plasticizer production team
    - Tel: +82-52-279-1022

- Supplier information
  - Supplier name: Hanwha Chemical Corporation
  - Address:18F, Hanwha Building, 1, Janggyo-dong, Jung-gu, Seoul, Korea
  - Respondent: PVC MU
    - Tel: +82-2-729-2779

- Emergency phone number: +82-52-279-1022, +82-2-729-2779

2. Hazards identification

GHS classification of the substance/mixture:

- Serious eye damage/eye irritation: Category 2B
- Mutagenicity: Category 2
- Reproductive toxicity: Category 1B
- Specific target organ toxicity (Repeated exposure): Category 2

GHS label elements, including precautionary statements:

- Pictogram and symbol:

- Signal word: danger
- Hazard statements:

H320: Causes eye irritation.
H341: Suspected of causing genetic defects.
H360: May damage fertility or the unborn child.
H373: May cause damage to organs through prolonged or repeated exposure.

- Precautionary statements:
  - Precaution:
    - P201: Obtain special instructions before use.
    - P202: Do not handle until all safety precautions have been read and understood.
    - P260: Do not breathe dust/fume/gas/mist/vapours/spray.
    - P264: Wash thoroughly after handling.
    - P281: Use personal protective equipment as required.
  - Treatment:
    - P314: Get Medical advice/attention if you feel unwell.
    - P305+P351+P338: IF IN EYES Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do. continue rinsing.
    - P337+P313: If eye irritation persists, Get medical advice/attention.
    - P308+P313: IF exposed or concerned, get medical advice/attention.
  - Storage:
    - P405: Store locked up.
  - Disposal:
    - P501: Dispose the contents/container in accordance with local/regional/national/ International regulations.

NFPA

- health: **1** fire: **1** reactive: **0**

3. Composition/information on ingredients

Chemical Name	Common Name Synonyms	CAS number	Content (%)
Di-2-Ethylhexylphthalate	Bis(2-ethylhexyl) phthalate DOP, DEHP	117-81-7	≥99.7
2-ETHYLHEXANOL (2-ETHYL-1-HEXANOL)	2-ETHYL-1-HEXANOL	104-76-7	≤0.3

4. First aid measures

Eye contact:

- In case of contact with substance, immediately flush skin and eyes with running water for at least 20 minutes.
- Remove contact lenses if present and easy to do.
- If irritation, pain, turgidity, tear and dazzling develop and persist, get medical attention.

Skin contact:

- Remove contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin and eyes with running water for at least 20 minutes.

- For minor skin contact, avoid spreading material on unaffected skin.

Inhalation:

- Get medical attention if irritation and symptoms develop.

Ingestion:

- Do NOT induce vomiting.
- If vomiting occurs, keep head lower than hips to prevent aspiration.
- If swallowed, immediately call a POISON CENTER or doctor/physician.

Acute and delayed symptoms/effects

- Inhalation: Respiratory may be affected.
- Skin contact: May cause slightly irritation.
- Eye contact: May cause slightly irritation.

Indication of immediate medical attention and notes for physician:

- Call 911 or emergency medical service. Get immediate medical advice/attention, if you needed.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

5. Firefighting measures

Suitable (and unsuitable) extinguishing media:

- Suitable extinguishing media: Dry chemical, extinguishing agent, CO_2, water, regular foam
- unsuitable extinguishing media: Do not use straight streams.
- In case of major fire and large quantities:
  - Use regular extinguishing agent, fine water spray.
  - Move containers from fire area if you can do it without risk.

Tank/trailer/train truck fire:

- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.

Specific hazards arising from the chemical:

- Thermal decomposition products: Carbon oxides
- Fires and an explosion
  - It could be a slight fire hazard.

Special protective equipment and precautions for fire-fighters

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:

- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Certainly ventilate closed spaces.
- In the opposite direction to the wind and the low areas to avoid please.

Environmental precautions and protective procedures:

- Atmosphere: Ventilate appropriately.
- Land: Make an embankment for further processing.
- Underwater: Prevent entry into waterways, sewers, basements.

The methods of purification and removal:

- Small spill:
  - Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
  - Use clean non-sparking tools to collect absorbed material.
- Large spill:
  - Dike far ahead of liquid spill for later disposal.
  - Prevent entry into waterways, sewers, basements or confined areas.

7. Handling and storage

Precautions for safe handling:

- Store in a closed container.
- Avoid heat, sparks, flames and other sources of ignition.
- Store in a well ventilated place.
- Avoid inhalation of particulate matter and gas.
- Wash thoroughly after handling.
- Use certified fit and safety, protective equipment.
- Wear face protective equipment.
- Use general dilution ventilation and/or local exhaust ventilation to control airborne exposures.

Conditions for safe storage:

- Avoid contact with heat, sparks, flames.
- Store in a closed container.
- Store away from waterworks and sewage.

8. Exposure controls/personal protection

Occupational Exposure limits:

- Korean Occupation of Safety and Health Regulation : TWA-5mg/m^3
- ACGIH: 8-hour TWA- 5 mg/m^3; STEL 10 mg/m^3
- OSHA: PEL TWA- 5 mg/m^3; STEL 10 mg/m^3
- NIOSH: TWA-5 mg/m^3, STEL-10 mg/m^3
- Biological exposure index : Not available
- EU Regulation:
  - Austria: 8-hour TWA- 5mg/m^3
  - Denmark: 8-hour TWA- 3mg/m^3
  - Sweden(HGV): 8-hour TWA- 3mg/m^3, STEL-5mg/m^3 (15min)
  - United kingdom(OES): 8-hour TWA- 5mg/m^3, STEL-10mg/m^3
  - Germany: 8-hour TWA- 10mg/m^3, STEL-100mg/m^3 (30min)
  - Netherlands(MAC): 8-hour TWA- 5mg/m^3
  - Czech Republic: 8-hour TWA- 5mg/m^3, STEL-10mg/m^3
  - France(VME): 8-hour TWA- 5mg/m^3
  - Belgium: 8-hour TWA- 5mg/m^3, STEL-10mg/m^3
- Other: Not available

Appropriate engineering controls:

- Provide local exhaust ventilation system to keep the airborne concentrations of vapours below their respective threshold limit value.
- Check legal suitability of exposure level.

Personal protective equipment:

- Respiratory protection:
  -Respiratory protection: Wear NIOSH or European Standard EN 149 approved full or half face piece (with goggles) respireatory protective equipment when necessary.

  At concentrations above the NIOSH REL:
  (APF =10,000): Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
  (APF =10,000): Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.
  Escape:
  (APF =50)Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
- Eye/Face protection:
  -An eye wash unit and safety shower station should be available nearby work place.
  -Wear facepiece with goggles to protect from scattering toxic substance.
- Hand protection: Wear chemical-resistant gloves to avoid direct contact with chemical substance to prevent exposure of skin.
- Body protection: Wear appropriate protective chemical-resistant clothing.

9. Physical and chemical properties

Appearance: Liquid (colorless)

Odor: odorless

Odor threshold: Not available

Tatse: Not available

Taste threshold: Not available

pH: Not available

Melting point/freezing point: -42°C

Initial boiling point and boiling range: 233°C

Flash point: >218°C

Evaporation rate: Not available

Flammability: No flammable liquid

Upper/lower flammability or explosive limits: Upper flammability range: 0.15%, lower flammability range: 0.18 %

Vapor pressure: 1.88 hPa (20°C)

Vapor density: 16.0 (air=1)

Relative density: 0.98 (20℃)

Solubility (ies): 0.003-1.3 mg/l (20°C)

Specific gravity: 0.98 (20℃)

Partition coefficient: n-octanol/water: logKow= 8 (20°C)

Auto ignition temperature: 350℃

Decomposition temperature: Not available

Viscosity: 26 mPas (40℃)

Molecular weight: 390.57 g/mol

10. Stability and reactivity

Chemical stability: Stable under normal temperatures and pressures

Possibility of hazardous reactions: It will not a occur polymerization reaction.

Conditions to avoid (e.g., static discharge, shock or vibration):

- Avoid heat, sparks, flames and other sources of ignition.
- Avoid contact with prohibited mixture materials.

- Avoid release to the environment.

Incompatible materials: Oxidizing agents, Acids, Alkalis

- Hazardous decomposition products: Other degradation products

11. Toxicological information

Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact):

- Inhalation: Respiratory may be affected.
- Skin and eye contact: May cause slightly irritation.
- Eye contact: May cause slightly irritation.

Symptoms related to the physical, chemical and toxicological characteristics:

- Explosives, Water reactive substances, Oxidizing, Self-reactive substances, Organic peroxides: Not applicable (no relevance to molecular structure)
- Refer to "5) Acute and delayed symptoms/effects" of "4.First aid measures"

Symptoms related to the physical, chemical and toxicological characteristics:

- Acute toxicity:
  - oral: Not classified LD_{50}= 20000 ㎎/㎏ bw (Rat)
  - dermal: Not classified LD_{50}= 24500 ㎎/㎏ bw (Rabbit)
  - Inhalation: Not classified LC_{50} > 10.62 mg/L/4hr (Rat)
- Skin Corrosion/ Irritation: Not classified
  - Rabbit, index=0.84/8, not irritating (patch test). In humans repeated dermal application of undiluted DEHP over a period of 7 day did not produce skin irritation or sensitization.
- Serious Eye Damage/ Irritation: Category 2B
  - Rabbit, not irritating/All observations for chemosis, corneal opacity and lesions of the iris were negative. In humans Potential symptoms of overexposure are irritation of eyes and mucous membranes.
- Respiratory sensitizer: Not available
- Skin Sensitization: Not classified
  -Patch with 500ug/l of the testsubstance, occlusive, No dermal reactions were observed in any of the test and control animals during induction and following challenge treatments. This substance is not sensitizing under the study conditions.
- Carcinogenecity: Not classified
  -IARC: 3
  -NTP: R
  -OSHA: not listed
  -ACGIH: A3
  -Regulation 1272/2008: not listed
  -US EPA: 2B
  -An increase in the incidence of hepatocellular adenomas and mononuclear cell leukemia was also observed in the males of this group.
- Mutagenicity: Category 2
  - *In vitro*: Gene mutation in Saccharomyces cerevisiae (Saccharomyces cerevisiae PV-1, PV-2, PV-3, PV-4a,b), DNA damage and repair assay (Rat hepatocytes): Negative Cytogenetic assay (Chinese hamster liver cells), Gene mutation assay

(Saccharomyces cerevisiae D6), Cell transformation assay (Syrian hamster Embryo (SHE) cells): Positive
-*In vivo*: UDS, DNA repair assay, alkaline elution assay (Rat, F344 Males), Recombination assay (Bacillus subtilis): Negative
Cytogenetic assay (Syrian hamster females), Somatic mutation assay (Drosophila melanogaster): Positive
The results have been negative in the majority of the *in vitro* and in *vivo* studies on DEHP, MEHP and 2-EH for detection of gene mutation, DNA damage, and chromosomal effects. The more conclusive positive results were obtained on cell transformation, induction of aneuploidy, and cell proliferation. These test systems are, however, also sensitive to several non-genotoxic substances such as tumour promoters and/or peroxisome proliferators. Taken together all the results, both negative and positive, DEHP and its major metabolites are considered to be non-mutagenic substances.

- Reproductive toxicity: Category 1B
  - In a study performed according to OECD Guideline 414 and GLP principles, DEHP was tested for its prenatal toxicity in Wistar rats (BASF, 1995; Hellwig et al., 1997).
  Reduced uterus weight was assessed as to be associated with the high embryolethality (see below). Severe developmental effects were observed: statistically significantly increased implantation loss. There also was a statistically significant lower number of live foetuses/dam, decreased foetal body weights, a drastically increased incidence of of external, soft tissue, and skeletal malformed foetuses/litter (in total approximately 70% of the foetuses/litter), predominantly of the tail, brain, urinary tract, gonads, vertebral column, and sternum.
- Specific target organ toxicity (single exposure): Not classified
  - Shaffer et al.(1945) has presented a case report on two adult male subjects who had swallowed DEHP as single doses of 5 g and 10 g, respectively. No symptoms resulted from the 5 g dose while the ingestion of 10 g caused mild gastric disturbances and "moderate catharsis".
- Specific target organ toxicity (repeat exposure): Category 2
  - Rat(OECD TG 408(GLP)), 13weeks, oral, there were slight but significant decreases in red blood cell counts and serum haemoglobin, albumin, and potassium levels. Microscopic examination revealed minimal to mild hepatocellular hypertrophy in the liver from all rats of both sexes, minimal focal necrosis. In the thyroid, mild histological changes consisting of reduced follicle size and colloid density were detected in eight animals. The NOAEL for the testicular effects (based on Sertoli cell vacuolation in male rats) was considered to be 50 ppm DEHP in the diet (3.7 mg/kg bw/day). A NOAEL for the effects on the kidney, can be considered to be 500 ppm (37.6 mg/kg bw in males).
- Aspiration Hazard: Not available

12. Ecological information

Aquatic Ecotoxicity:

-Acute toxicity: Not classified(Indicates mortality were observed at the highest test concentration to calculate an acute toxicity value.)
-Chronic toxicity: Not classified(No reproductive is toxicity)

- Fish: 96hr-LC_{50}(*Cyprinodon varegatus*) >0.16 mg/l (EAP-660/3-75-009, GLP)
- Crustacea: 48hr-EC_{50}(*Daphnia magna*) >0.16mg/l (EEC, C.2, GLP)
- Algae: 96hr-ErC_{50}(*Pseudokirchneriella subcapitata*) =>0.1mg/l (EEC, C.2, GLP)
- Fish: 70d-NOEC(*Oncorhynchus mykiss*) =0.0073 mg/l(No reproductive is toxicity)
- Crustacea: 21d- NOEC(*Daphnia magna*) =0.158 mg/l (No reproductive is toxicity)

Persistence degradability:

- Persistence: High persistency (Log Kow is estimated over more than 4 (log Kow=8) (estimated))
- Degradability: The estimated range of atmospheric photosynthesis half-life is 2000 years. This substance is not readily degraded.

Bioaccumulative potential:

- Bioaccumulation: Bioaccumulation is expected according to high the BCF>500(BCF=582) (experimental), log Kow=8 (experimental).
- Biodegradation: Readily biodegradable(biodegraded over more than 95% after 5 days)

Mobility in soil: High potency of mobility to soil (Koc values = 119600 L/kg)

13. Disposal considerations

1) Disposal method:

- Incinerate waste
  - Incinerate at high temperature.
  - Stabilizer waste.

2) Disposal precaution:

  - All the generated waste shall be disposed in accordance with the specific standard and method prescribed in the Act so that the environmental pollution may be minimized in the course of collecting, carrying, keep and disposing the waste.
  - The waste shall not flutter or flow out, and a bad smell shall not be diffused.
  - The pollutants shall be disposed below the allowable exhaust standard.
  - Without just reason, the waste shall not be discarded in a place other than the designated places.
  - The waste shall be disposed in the waste disposal facility.

14. Transport information

UN Number: Not applicable

UN Proper shipping name: Not applicable

Transport Hazard class: Not applicable

Packing group: Not applicable

Marine pollutant: Not applicable

Special precautions

- In case of fire: Not applicable
- In case of leakage: Not applicable

15. Regulatory information

Korea:

-Occupational Safety and Health Regulation: occupational exposure assessment
-Toxic Chemical Control Act: Toxic Chemicals (2006-1-556)
-Dangerous Material Safety Management Regulation: class4 4th petroleum 6000 ℓ
-Wastes Control Act: Not applicable

EU classification:

- Classification: Repr. Cat. 2; R60-61
- Risk phrases: R60, R61
- Safety phrases: S53, S45
- EU REACH SVHC Free Certified(Authorization list Updated by ECHA on October, 2010), Restriction

U.S.A management information:

- **OSHA**(29CFR1910.119): Not regulated
- **CERCLA103** 규정(40CFR302.4): 45.3599kg 100lb
- **EPCRA 302**(40CFR355.3): Not regulated
- **EPCRA 304**(40CFR355.4): Not regulated
- **EPCRA 313:** Not regulated

Substance of Roterdame Protocol: Not applicable

Substance of Stockholme Protocol: Not applicable

Substance of Montreal Protocol: Not applicable

16. Other information

Information source and references:

-ECB:ESIS (European chemical Substances Information System): http://ecb.jrc.it/esis
-International Uniform Chemical Information Database (IUCLID): http://ecb.jrc.it/esis
-IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT (Multivolume work)., p. S7 216 (1987)
-REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008
-Korea Occupational Health & Safety Agency: http://www.kosha.net
-U.S. National library of Medicine (NLM) Hazardous Substances Data Bank (HSDB): (http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB.htm)
-European Union Risk Assessment Report/ BIS(2-ETHYLHEXYL) PHTHALATE (DEHP), 2008
-ACGIH, TLV and BEIs # 0108, 2008
-Society for Occupational Health Recommendation of Occupational Exposure, 1993
-Waste Control Act enforcement regulation attached [1]
-National chemicals information systems (http://ncis.nier.go.kr)
-Korea dangerous material inventory management system (http://hazmat.nema.go.kr)

Issuing date: 1 December 2006

Revision number and date:

- revision number: 3rd
- date of the latest revision: 19 Jul 2011

The information contained herein is to the best of our knowledge and belief accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee for result obtained, and assume no responsibility for damages incurred by use of this product. It is the responsibility of the user to comply with all federal, state and local laws and regulations.