SAFETY DATA SHEET

Date Printed: January 20, 2020
Version: 4
Regulation: According to Regulation 2012 OSHA Hazard Communication Standard; 29 CFR Part 1910.1200

1. Identification

1.1 Product identifier

1.1.1 Product of name: DOP

1.1.2 Other means of identification: Bis (2-Ethylhexyl) phthalate

1.2 Recommended use of the chemical and restrictions on use

1.2.1 Recommended use: Additives such as PVC, and rubber, plastic, ink, glue, paint, lubricant

1.2.2. Restrictions on use: Do not use for purposes other than those recommended, children's toys, child care products, artificial clay and medical infusion bags/blood bags

1.3 Details of the supplier of the safety data sheet

1.3.1 Manufacturer

Company name: Hanwha Solutions Co, Ltd.
Address: Ulsan plant, Hanwha Solutions Co, Ltd., 22, Yongyeon-ro 230beon-gil, Nam-gu, Ulsan, Korea
Prepared by: Plasticizer Production Team
Contact Telephone: +82-52-279-1024

1.3.2 Supplier & Distributor

Company name: Hanwha Solutions Co, Ltd.
Address: Hanwha Bldg., Janggyo-dong, Jung-gu, Seoul, Korea
Prepared by: PLS Sales Team
Contact Telephone: +82-2-729-2990

1.4 Emergency phone number

Emergency phone: +82-2-729-2990 (Sales) / +82-52-279-1024(Plant)

2. Hazard(s) identification

2.1 Classification of the substance or mixture

According to Regulation 2012 OSHA Hazard Communication Standard; 29 CFR Part 1910.1200

Physical / Chemical Hazards: Not classified

Health Hazards:

Carcinogenicity: Category 2

Reproductive toxicity: Category 1B

Environmental Hazards:

Hazardous to the aquatic environment (chronic): Category 3

2.2 Label elements, including precautionary statements

- **Pictogram and symbol**:

- **Signal word**: Danger
- **Hazard statements**:

H351 Suspected of causing cancer.
H360 May damage fertility or the unborn child.
H412 Harmful to aquatic life with long lasting effects.

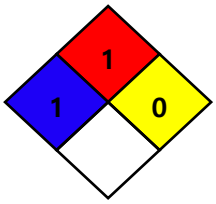
- **Precautionary statements:**
  P201 Obtain special instructions before use.
  P202 Do not handle until all safety precautions have been read and understood.
  P273 Avoid release to the environment.
  P281 Use personal protective equipment as required.

- **Treatment statements:**
  P308+P313 If exposed or concerned: Get medical advice/ attention.

- **Storage statements:**
  P405 Store locked up.

- **Disposal statements:**
  P501 Dispose the contents/container in accordance with local/regional/national/international regulations.

2.3 Other hazard information not included in hazard classification (NFPA)



- **Health:** 1
- **Flammability:** 1
- **Reactivity:** 0

3. Composition/information on ingredients

Component	Common name and synonyms	CAS No.	Conc. / %
Bis(2-Ethylhexyl) phthalate	Diethylhexyl phthalate	117-81-7	100

4. First-aid measures

4.1 Description of first aid measures

Eye contact
- Call emergency medical service.
- In case of contact with substance, immediately flush eyes with running water for at least 20 minutes.

Skin contact
- Call emergency medical service.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin with running water for at least 20 minutes.
- For minor skin contact, avoid spreading material on unaffected skin.

Inhalation
- If exposed or concerned: Get medical advice/ attention.
- Move victim to fresh air.
- Keep victim warm and quiet.

Ingestion
- If exposed or concerned: Get medical advice/ attention.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.

4.2 Most important symptoms and effects, both acute and delayed

- Inhalation: May not cause acute toxicity of inhalation.

- Skin contact: May not cause severe skin corrosion.
- Eye contact: May not cause severe eye damage.

4.3 Indication of immediate medical attention and notes for physician

- Exposures require specialized first aid with contact and medical follow-up.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

5. Fire-fighting measures

5.1 Extinguishing media

- **Suitable extinguishing media:** Carbon dioxide, alcohol foam, dry sand, dry chemical powder
- **Unsuitable extinguishing media**: Straight streams

5.2 Specific hazards arising from the chemical

- Thermal decomposition products: Carbon oxides, others
- May decompose at high temperatures into forming toxic gases.
- Containers may explode when heated.
- Some of these materials may burn, but none ignite readily.
- Non-combustible, substance itself does not burn but may decompose upon heating, then produce corrosive and/or toxic fumes.

5.3 Special protective equipment and precautions for fire-fighters

- Wear self-contained breathing apparatus (SCBA) and adaptive chemical protective clothing.
- The fire suppression is not fully protectable from the hazard.
- Rescuers should put on appropriate protective gear.
- Evacuate area and fight fire from a safe distance.
- Substance may be transported in a molten form.
- Some may be transported hot.
- Dike fire-control water for later disposal; do not scatter the material.
- Move containers from fire area if you can do it without risk.
- Fire involving Tanks; Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Fire involving Tanks; Cool containers with flooding quantities of water until well after fire is out.
- Fire involving Tanks; Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Fire involving Tanks; Always stay away from tanks engulfed in fire.
- Fire involving Tanks; For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- Clean up spills immediately, observing precautions in Protective Equipment section.
- Isolate hazard area.
- Keep unnecessary and unprotected personnel from entering.
- Eliminate all ignition sources.
- Stop leak if you can do it without risk.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Cover with plastic sheet to prevent spreading.
- Prevent dust cloud.
- Please note that there are materials and conditions to avoid.

6.2 Environmental precautions

- Avoid release to the environment.
- Prevent entry into water ways: sewers, basements or confined areas.

6.3 Methods and materials for containment and cleaning up

- Collect spillage.
- Absorb spills with inert material (e.g., dry sand or earth), then place in a chemical waste container.
- Absorb the liquid and scrub the area with detergent and water.
- With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.
- Powder Spill; Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry.
- Small Spill; Take up with sand or other non-combustible absorbent material and place into containers for later disposal.
- Large Spill; Dike far ahead of liquid spill for later disposal.

7. Handling and storage

7.1 Precautions for safe handling

- Do not handle until all safety precautions have been read and understood.
- Follow all MSDS/label precautions even after container is emptied because they may retain product residues.
- Loosen closure cautiously before opening.
- Avoid breathing vapors from heated material.
- Do not enter storage area unless adequately ventilated.
- Be careful to high temperature.

7.2 Conditions for safe storage, including any incompatibilities

- Store in a closed container.
- Empty drums should be completely drained, properly bunged, and promptly returned to a drum reconditioner, or properly disposed of.

8. Exposure controls/personal protection

8.1 Occupational Exposure limits

- **ACGIH regulation**: TWA=5mg/m^3
- **Biological exposure index**: Not available
- **OSHA regulation**: TWA=5mg/m^3, STEL= 10 mg/m^3
- **NIOSH regulation**: TWA=5mg/m^3, STEL= 10 mg/m^3
- **EU regulation**:
  - Austria: TWA=5mg/m^3 [TMW] (inhalable fraction, listed under Di-sec-octyl phthalate), STEL= 50 mg/m^3[KZW] (inhalable fraction, 1 X 30 min, listed under Di-sec-octylphthalate)
  - Bulgaria: TWA=5mg/m^3
  - Croatia: TWA= 5mg/m^3 [GVI], STEL=50 mg/m^3 [KGVI]
- **Other**:
  - Australia: TWA=5mg/m^3, STEL=10mg/m^3
  - Canada: TWA=5mg/m^3
  - Columbia: TWA=5mg/m^3

8.2 Exposure controls

Appropriate engineering controls

- Good general ventilation (typically 10 air changes per hour) should be used.
- Ventilation rates should be matched to conditions.
- If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits.
- If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Respiratory protection

- Follow the OSHA respirator regulations found in 29 CFR 1910.134. Use a NIOSH/MSHA approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Eye protection

- Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Hand protection

- Wear appropriate protective gloves(Nitrile rubber) by considering physical and chemical properties of chemicals.
- Contact health and safety professional or manufacturer for specific information.
- Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices.
- Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product.
- Gloves must be inspected prior to use

Body protection

- Impervious clothing, the type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance	
Description:	Liquid
Color:	Colorless
Odor :	Odorless
Odor threshold :	Not available
pH :	6~7
Taste:	Not available
Taste threshold:	Not available
Melting point/freezing point :	-55 ℃(-67˚F)
Initial boiling point and boiling range :	384℃ (1013 hPa)
Flash point :	216℃(Cleveland open cup)
Evaporation rate :	Not available
Flammability (solid, gas) :	Not applicable
Upper/lower explosive limits :	- / 0.3%(245℃)
Vapor pressure :	0.023mmHg (25℃)
Vapor density :	13.45 (air=1)
Relative density	0.981(68 °F / 20 °C)
Solubility :	0g/l (20°C)
Partition coefficient: n-octanol/water :	5.03
Auto-ignition temperature :	390 ℃
Decomposition temperature	> 393 °C
Viscosity(Dynamic) :	56.6 mPa.s (77 °F / 25 °C), 81.4 cP (20℃)
Molecular weight :	390.57 g/mol

"NOTE: The physical data presented above are typical values and should not be construed as a specification"

10. Stability and reactivity

10.1 Reactivity/Chemical stability/Possibility of hazardous reactions:

- Stable under normal temperatures and pressures.
- No dangerous polymerization under conditions of normal use.

10.2 Conditions to avoid:

- Keep away from heat/flames/sparks and other sources of ignition.
- Avoid contact with incompatible materials.

10.3 Incompatible materials: Oxidizing agents, acid, base

10.4 Hazardous decomposition products: Carbon oxides, others

11. Toxicological information

Information on toxicological effects	
(a) Acute toxicity	
Oral	Not classified
	- Rat, LD_{50}>20,000mg/kg b.w.
Dermal	Not classified
	- Rat, LD_{50}=19,800mg/kg (Food and Drug Administration's cuff test)
Inhalation	Not classified
	- Rat, LC_{50}=10,600 mg/m^3· 4h
(b) Skin Corrosion/ Irritation	Not classified
	- In Skin irritation / corrosion test with rabbits, DEHP was slightly irritating to the rabbit skin. But it was fully reversed within 8days. (erythema score: 1-1.33, edema score: 0-0.33) (OECD TG 404)
(c) Serious Eye Damage/ Irritation	Not classified
	- In Acute Eye Irritation/Corrosion test with rabbits, DEHP was considered as non-irritant for the eye. (OECD TG 405)
(d) Respiratory sensitization	Not classified
	- In respiratory sensitization test with mice, DEHP is not considered as a respiratory sensitizer.
(e) Skin Sensitization	Not classified
	- DEHP was unequivocally not sensitizing in the guinea pig maximization test (OECD TG 406)
(f) Carcinogenicity	Category 2
	- ACGIH: Group A3(Confirmed Animal Carcinogen with Unknown Relevance to Humans) - IARC: Category 2B (Possible Human Carcinogen) - Korea: Category 2 (Limited evidence of human or animal carcinogenicity) - U.S EPA IRIS: B2 (Probable human carcinogen) - NTP: R (Anticipated Carcinogen)
(g) Mutagenicity	Not classified

	- *In vitro*: - Bacterial Reverse Mutation Assay with/ without metabolic activation (*S. typhimurium*, TA 1535, TA 1537, TA 98, TA 100): Negative (OECD TG 471) - Mammalian cell micronucleus test with/ without metabolic activation (*Chinese hamster lung fibroblasts (V79)*): Negative (GLP) - Mammalian Chromosome Aberration Test with/ without metabolic activation (*Chinese hamster Ovary (CHO)*): Negative (OECD TG 473) *In vivo*: - Unscheduled DNA Synthesis (UDS) Test with Mammalian Liver Cells with rat: Negative (OECD TG 486) - Mammalian Bone Marrow Chromosome Aberration Test with rat: Negative (OECD TG 475)
(h) Reproductive toxicity	Category 1B
	- In Two-Generation Reproduction Toxicity Study with Rats, based on impaired fertility and litter parameters noted at 7,500 ppm and above, and decreased various sperm end-points noted at 7500 and 10,000 ppm and based on decreased absolute and/or relative testis weights noted at 7,500 and 10,000 ppm, macroscopic pathological findings (small or aplastic testes) noted at 300, 1,000, 7,500 and 10,000 ppm, and microscopic pathological findings (testis seminiferous tubular atrophy) noted at 300, 7,500 and 10,000 ppm. DEHP is a reproductive toxicant at 7500 and 10,000 ppm with the presence of toxicity in the liver, kidneys, and adrenals. Other than the hepatocellular toxicity at 1,000 ppm, there was no general toxicity observed at dose levels below 1,000 ppm. There was no reproductive toxicity observed at doses lower than 7500 ppm except for a possible increase of small testes and prostates which may represent an increased incidence of developmental abnormalities in the male reproductive organs at 300 and/or 1000 ppm. ($NOAEL_{Reproductive\ toxicity}$=70mg/kg-F0, 48mg/kg-F1, 46mg/kg-F1), ($NOAEL_{Developmental\ toxicity}$=8mg/kg-F0, 4.9mg/kg-F1, 4.8mg/kg-F2) (OECD TG 416) - In Combined Chronic Toxicity / Carcinogenicity Studies with mice for 104wk (100, 500, 1500, 6000 ppm), Liver: peroxisome proliferation and ↑ weight (males) from 500 ppm; ↑ weight, adenomas and carcinomas (both sexes) from 1,500 ppm; kidney: ↓ weight (especially males) and chronic progressive nephropathy (both sexes) from 1,500 ppm; testes: ↓ weight, ↑ incidence and severity of bilateral hypospermia from 1,500 ppm; epididymis: ↑ immature or abnormal sperm forms and hypospermia from 1,500 ppm; ↓ survival (males); changes in liver, kidneys, and testes were at least partially reversible following recovery period (NOAEL=100ppm) (OECD TG 453, GLP)
(i) Specific target organ toxicity (single exposure)	Not classified
	- In acute oral toxicity with rats, the primary effects were hepatic lesions, in the form of centrilobular necrosis or inflammation, in rats that received 1500 or 5000 mg/kg. DEHP also produced a three- to fourfold increase in the number of hepatocytes with mitotic figures at all doses. Liver weight was increased. (LD_{50}>5,000mg/kg) (OECD TG 425)
(j) Specific target organ toxicity (repeat exposure)	Not classified
	- In Repeated Dose Inhalation Toxicity: 28/14-Day test with rats during 6 hours per day, 5 days per week for 4 weeks (1.0, 0.05 and 0.01 mg/L). In the highest dose group, a significant increase in relative lung weights was seen in male rats. This was accompanied by foam cell proliferation and thickening of the alveolar septi. (NOAEL=50mg/m^3) (OECD TG 412, GLP)
(k) Aspiration Hazard	Not available

12. Ecological information

12.1 Toxicity	

Acute toxicity	Category 1
	Fish: 96h, LC_{50}(*Pimephales promelas*)>0.17mg/L (OECD TG 203, GLP) Invertebrate: Not available Algae: 72h, EC_{50}(*Pseudokirchnerella subcapitata*)>0.003mg/L (OECD TG 201)
Chronic toxicity	Category 1
	Fish: 90d, NOEC(*Oryzias latipes*)=5mg/L Invertebrate: 21d, NOEC(*Daphnia magna*)=0.158mg/L (OECD TG 211) Algae: Not available
12.2 Persistence and degradability	- Persistence: It is expected to be high persistency due to Log Kow is more than 4. (Log Kow = 7.861(25°C, pH7)) Degradability: DEHP's phototransformation half-life in air was 1 day.
12.3 Bioaccumulative potential	- Bioaccumulation: Bioaccumulation is expected to be high according to the BCF > 500 (BCF = 1,380) (EPA OTS 796.2750) - Biodegradation: As well-biodegraded, it is expected to have low accumulation potential in living organisms (100% biodegradation was observed after 21 days)
12.4 Mobility in soil	- Potency of mobility to soil. (Koc = 482,000)
12.5 Hazardous to the ozone layer	- Not classified
12.6 Other adverse effects	- Not available

13. Disposal considerations

Disposal method

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

Disposal precaution

Consider the required attentions in accordance with waste treatment management regulation.

14. Transport information

14.1 UN No.: Not applicable

14.2 UN Proper shipping name: Not applicable

14.3 Transport Hazard classes: Not applicable

ADR: Not applicable

IMDG: Not applicable

ICAO/IATA: Not applicable

RID: Not applicable

14.4 Packing group: Not applicable

14.5 Environmental hazards: Not applicable

14.6 Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code): Not established

14.7 Special precautions for user

in case of fire: Not applicable

in case of leakage: Not applicable

15. Regulatory information

15.1 Safety, health and environmental regulation/legislation specific for the substance or mixture

USA Regulatory Information

TSCA (Toxic Substances Control Act): Section8(b) inventory: Present

Proposition 65: Regulated
OSHA Regulation: Not regulated
CERCLA Regulation: 100 lb RQ
SARA 302 Regulation: Not regulated
SARA 304 Regulation: Not regulated
SARA 313 Regulation: Regulated
SARA 311/312 Regulation: Chronic Health Hazard

Foreign Regulatory Information

Substance of Rotterdam Protocol: Not regulated
Substance of Stockholm Protocol: Not regulated
Substance of Montreal Protocol: Not regulated

Foreign Inventory Status

- Korea management information: Phase-in substance subject to registration (KE-02196)
- European List of Notified Chemical Substances (ELINCS)): Present (204-211-0)
- Japan management information: Existing and New Chemical Substances (ENCS): Present ((3)-1307)
- China management information: Inventory of Existing Chemical Substances (IECSC): Present (22159)
- Canada management information: Domestic Substances List (DSL): Present
- Australia management information: Inventory of Chemical Substances (AICS): Present
- New Zealand management information: Inventory of Chemicals (NZIoC): HSNO Approval: HSR002982
- Philippines management information: Inventory of Chemicals and Chemical Substances (PICCS): Present

16. Other information, including date of preparation or last revision

16.1 Indication of changes:
Preparation data: June 20, 2016
Version: 4
Revision date: January 20, 2020

16.2 Key literature reference and sources for data:
○ National chemicals information systems ; http://ncis.nier.go.kr
○ IARC Monographs on the Evaluation of Carcinogenic Risks to Humans; http://monographs.iarc.fr
○ ECHA; http://echa.europa.eu/registration-dossier/-/registered-dossier/15859
○ OECD SIDS; http://webnet.oecd.org/Hpv/UI/SIDS_Details.aspx?id=6E6AED5E-C43C-4930-A5FD-F3B4F5F558FF
○ NIOSH (The National Institute for Occupational Safety and Health)
○ ACGIH (American Conference of Governmental Industrial Hygienists)
○ TOMES-LOLI® ; http://www.rightanswerknowledge.com/loginRA.asp
○ National Emergency Management Agency-Korea dangerous material inventory management system; http://www.nema.go.kr/hazmat/main/main.jsp
○ Waste Control Act enforcement regulation attached [1]

16.3 Abbreviations
ACGIH: American Conference of Governmental Industrial hygienists
NIOSH: The National Institute for Occupational Safety and Health
OSHA: Occupational Safety & Health Administration
IARC: International Agency for Research on Cancer
ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
IMDG: International Maritime Dangerous Goods
ICAO/IATA: International Civil Aviation Organization/ International Air Transport Association
RID: Regulations Concerning the International Transport of Dangerous Goods by Rail

16.4 Other

- Product should be handled, stored, and used in accordance with the generally accepted industrial hygiene practices and in conformity with all the applicable legal regulations.
- The information provided herein is based on the knowledge possessed at this present time from the view point of safety requirements.
- It should, therefore, not be construed as guaranteeing specific properties.