

## Product Safety Assessment

### Diethyl Sulfate

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#### Names

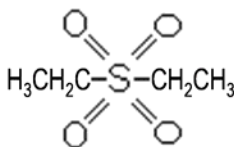
- CAS No. 64-67-05
- Diethyl sulfate
- Diethyl monosulphate
- Diethyl sulphate
- Sulfuric acid, diethyl ester
- Ethyl sulphate

#### Product Overview

- Diethyl sulfate (DES) is an important chemical intermediate to make products for coatings, pharmaceuticals, personal care products, detergents and textiles.<sup>1</sup> See Product Uses.
- As sold by The Dow Chemical Company, DES is a colorless liquid with a mild odor. It can cause severe eye burns and skin irritation. Prolonged exposure to skin can cause burns or blisters and lead to absorption of harmful quantities. It is harmful if inhaled or swallowed. DES has caused tumors in animals.<sup>2</sup> DES is categorized as a probable carcinogen in humans (Group 2A)<sup>3</sup> and a category 2 mutagen<sup>4</sup> based on animal results. See Health Information.
- DES is an industrial intermediate, used to make other products, and is not sold for consumer use. Proper workplace procedures and protective equipment can reduce the risk of exposure. Under fire conditions, the smoke may contain DES in addition to combustion products of varying composition which may be toxic and / or irritating.<sup>5</sup> See Exposure Potential and Physical Hazard Information.
- DES is readily biodegradable and its bioconcentration potential is low.<sup>6</sup> Acute exposures to DES can be slightly toxic to aquatic organisms. See Environmental Information.

#### Manufacture of Product <sup>7,8</sup>

- **Capacity** – DES has been produced commercially in the United States for at least 80 years. Dow Chemical is the only domestic supplier of DES, with a stocking location in the greater Houston area. DES is considered a High Production Volume chemical, produced or imported in quantities of greater than 1 million pounds per year. There are no published data on the total global production volume of DES.
- **Process** – DES can be produced by two different reactions: 1) by absorbing ethylene in concentrated sulfuric acid, or 2) by fuming sulfuric acid in ethyl ether or ethyl alcohol. Dow uses the second method. The chemical structure of the DES molecule is shown below.



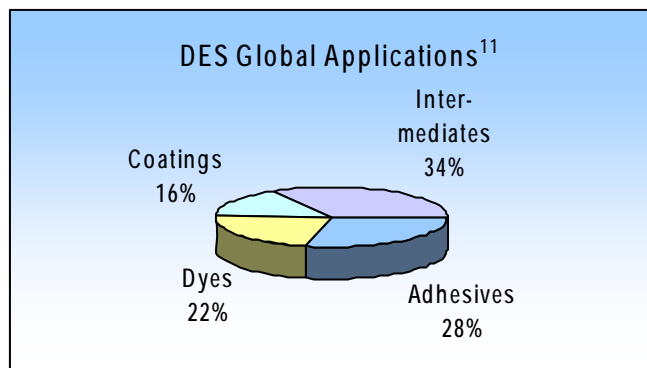
## Product Description<sup>9</sup>

As produced by Dow, DES is a colorless, viscous liquid with a faint ether odor. It is very slightly soluble in water and mixes with alcohol, ether and most polar solvents.

## Product Uses<sup>10,11</sup>

DES is used as a chemical intermediate to make other products for:

- Coatings
- Pharmaceuticals
- Personal care
- Detergents
- Textiles



## Exposure Potential<sup>12,13,14,15</sup>

DES is used in the production of many products, but is not sold directly for consumer use. Based on the uses for DES, the public could be exposed through:

- **Workplace exposure** – Exposure can occur either in a DES manufacturing facility or in the various industrial and manufacturing facilities that use DES, primarily by inhalation or skin contact. DES is manufactured using closed systems, limiting the exposure potential to when the system is opened for sampling or equipment maintenance. Chemical goggles, gloves, an approved positive-pressure self-contained breathing apparatus (SCBA) and protective equipment should be worn to avoid contact with lungs, eyes, skin and clothing. Each manufacturing, industrial and service facility should have appropriate work process and safety equipment policies in place to limit DES exposure. Good industrial hygiene practices minimize the risk of exposure. See the Safety Data Sheet (SDS) for acceptable glove materials, which include: butyl rubber, ethyl vinyl alcohol laminate (EVAL) and neoprene.
- **Consumer exposure to products containing DES** – Consumers could be exposed through releases of DES during production or industrial use of DES. Based on its use and the rapid hydrolysis of any residual DES from production, no significant exposure to consumers is anticipated. See Health Information or the Safety Data Sheet (SDS).
- **Environmental releases** – In the event of a spill, the focus should be on containing the spill to prevent contamination of soil, surface or ground water. If a DES release reaches soil and water nearby, it is slightly toxic to fish on an acute basis. Large spills to natural waterways are likely to kill aquatic organisms. Human and animal contact with vapors and contaminated soil should be avoided. See Environmental, Health and Physical Hazard Information.
- **Large release** – Industrial spills or releases are infrequent. Production and manufacturing facilities are generally designed to contain spills within the site. If a large spill does occur, isolate the area and take measures to prevent the material from reaching the soil and water nearby. Keep unnecessary and unprotected personnel from entering the area. The material should be captured, collected and re-processed, or disposed of according to federal, state/provincial or local regulations. Follow emergency procedures carefully. Under fire conditions, the smoke may contain the original material in addition to combustion products of varying composition which may be toxic and / or irritating. Combustion products may include and are not limited to: acid fumes, sulfur oxides, carbon monoxide and carbon dioxide. Emergency personnel should wear proper protective equipment including a SCBA and chemical-resistant fire-fighting clothing. Isolate the fire area and deny unnecessary entry (keep people away). Avoid contact with the material and smoke during fire-fighting operations. See Environmental, Health and Physical Hazard information.

## Health Information<sup>16</sup>

If handled improperly, DES may cause severe irritation of, or burns to, the eye with corneal injury. This may result in permanent impairment of vision, even blindness. Brief skin contact may cause severe irritation. Prolonged contact may cause skin burns or blisters. Prolonged or widespread skin contact may result in absorption of harmful amounts.

If improperly handled, DES vapors can easily reach concentrations that may cause irritation of the nose and throat, nausea, vomiting, even death. Swallowing small amounts will not likely cause injury; however,

swallowing larger amounts may cause injury. If large amounts are swallowed, do not induce vomiting. Call a physician and/or transport to emergency facility immediately.

DES has caused tumors when painted on the skin of test animals. IARC has classified diethyl sulfate as a Group 2A material, probably carcinogenic to humans based on the limited evidence in humans and sufficient evidence in animals. The International Uniform Chemical Information Database (IUCLID) data set for DES also states that it may cause genetic damage and be a category 2 mutagen.<sup>17</sup>

For general handling of DES, avoid contact with eyes, skin and clothing. Avoid breathing vapor. Do not swallow. Wash thoroughly after handling and keep in closed containers. Use only with adequate ventilation.

For more information on the health hazards of DES and recommended protective equipment, view the SDS.

### **Environmental Information**<sup>18,19</sup>

DES is expected to be readily biodegradable and has a low potential for bioconcentration. When released into water, DES biodegrades into ethanol (inherently biodegradable) and sulfuric acid. Because DES rapidly hydrolyzes, it is unlikely that consumers will be exposed to significant quantities of DES.

Acute exposures to DES can be slightly toxic to aquatic organisms and uncontained, large spills may kill aquatic organisms. DES should not be dumped into sewers, on the ground or into any body of water. All disposal methods must be in compliance with all federal, state/provincial and local laws and regulations. Regulations may vary in different locations.

### **Physical Hazard Information**<sup>20</sup>

Spills of DES liquid can cause a slip hazard. DES should be stored in a cool, dry place in 304 or 316 stainless steel, or baked-phenolic-lined steel containers.

Elevated temperatures can cause DES to decompose. Generation of gas during decomposition can cause pressure in closed systems. Avoid contact with moisture, alcohols, nitric acid, peroxides, strong bases and strong oxidizers. DES becomes corrosive when wet. Avoid contact with metals such as aluminum.

In fire situations, keep people away and deny unnecessary entry. Use water spray to cool fire-exposed containers. Firefighters should wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire-fighting clothing, including fire-fighting helmet, coat, trousers, boots and gloves. Avoid contact with this material during fire-fighting operations. If contact is likely, change to full chemical-resistant fire-fighting clothing in addition to SCBA.

DES containers may rupture from gas generation in a fire situation. During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and / or irritating. Combustion products may include and are not limited to: acid fumes, sulfur oxides, carbon monoxide and carbon dioxide.

Additional fire-fighting instructions and physical property information for DES are available on the Safety Data Sheet.

### **Regulatory Information**

Regulations may exist that govern the manufacture, sale, transportation, use and/or disposal of DES. These regulations may vary by city, state, country or geographic region. Information may be found by consulting the relevant Safety Data Sheet or Contact Us.

### **Additional Information**

- Safety Data Sheet
- IARC Summary and Evaluation Diethyl Sulfate
- DES Product Information Sheet

For more business information about DES or products produced using DES, visit the Dow Oxygenated Solvents web site.

## References

- <sup>1</sup> Dow Diethyl Sulfate Product Information Sheet, Form No. 327-00051-0405, April 2005, page 2.
- <sup>2</sup> Dow Diethyl Sulfate Safety Data Sheet, December 8, 2005, pages 1-2.
- <sup>3</sup> IARC Summary and Evaluation Diethyl Sulfate (<http://www.inchem.org/documents/iarc/vol54/04-diethyl-sulfate.html>), International Agency for Research on Cancer (IARC), Vol. 54, 1992, page 213.
- <sup>4</sup> IUCLID Dataset for Diethyl Sulfate, International Uniform Chemical Information Database, submitted by The Dow Chemical Company, December 17, 2003, pages 45-46.
- <sup>5</sup> Dow Diethyl Sulfate Safety Data Sheet, December 8, 2005, page 3.
- <sup>6</sup> Dow Diethyl Sulfate Safety Data Sheet, December 8, 2005, page 5.
- <sup>7</sup> IARC Summary and Evaluation Diethyl Sulfate (<http://www.inchem.org/documents/iarc/vol54/04-diethyl-sulfate.html>), International Agency for Research on Cancer (IARC), Vol. 54, 1992, page 278.
- <sup>8</sup> IUCLID Dataset for Diethyl Sulfate, International Uniform Chemical Information Database, submitted by The Dow Chemical Company, December 17, 2003, pages 6-7.
- <sup>9</sup> Dow Diethyl Sulfate Product Information Sheet, Form No. 327-00051-0405, April 2005, page 1.
- <sup>10</sup> Dow Diethyl Sulfate Product Information Sheet, Form No. 327-00051-0405, April 2005, page 2.
- <sup>11</sup> Dow business information 2005.
- <sup>12</sup> Dow Diethyl Sulfate Safety Data Sheet, December 8, 2005, page 3-5.
- <sup>13</sup> "Diethyl Sulfate CAS No. 64-67-5," Report on Carcinogens (<http://ntp.niehs.nih.gov/ntp/roc/eleventh/profiles/s078dime.pdf>), Eleventh Edition, National Toxicology Program, page 1.
- <sup>14</sup> "Diethyl Sulfate Hazard Summary," EPA Air Toxics Website ([www.epa.gov/ttn/atw/hlthef/diethyls.html](http://www.epa.gov/ttn/atw/hlthef/diethyls.html)), created April 1992; revised January 2000.
- <sup>15</sup> IUCLID Dataset for Diethyl Sulfate, International Uniform Chemical Information Database, submitted by The Dow Chemical Company, December 17, 2003, pages 6-7.
- <sup>16</sup> Dow Diethyl Sulfate Safety Data Sheet, December 8, 2005, pages 1, 2, 3 and 5.
- <sup>17</sup> IUCLID Dataset for Diethyl Sulfate, International Uniform Chemical Information Database, submitted by The Dow Chemical Company, December 17, 2003, pages 45-46.
- <sup>18</sup> Dow Diethyl Sulfate Safety Data Sheet, December 8, 2005, page 5.
- <sup>19</sup> "Robust Summaries & Test Plans: Sulfuric Acid, Diethyl Ester; Environmental Defense Comments," High Production Volume (HPV) Challenge Program, EPA website (<http://www.epa.gov/chemrtk/slfacdde/c15002ed.htm>), June 25, 2004.
- <sup>20</sup> Dow Diethyl Sulfate Safety Data Sheet, December 8, 2005, pages 2-4.

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