

Global Product Strategy (GPS) Safety Summary

Tert-Butyl Hydroperoxide (*T-Hydro Solution*)

This GPS Safety Summary is a high-level summary intended to provide the general public with an overview of product safety information on this chemical substance. It is not intended to provide emergency response, medical or treatment information, nor to provide an overview of all safety and health information. This summary is not intended to replace the Safety Data Sheet. For detailed guidance on the use or regulatory status of this substance, please consult the Safety Data Sheet, the Product Safety Bulletin and the Product Stewardship Bulletin (PSB).

Chemical Identity

Brand name: *T-Hydro Solution*

Composition: 70% Tert-Butyl Hydroperoxide (TBHP) in 30% water

Chemical name (IUPAC): Hydroperoxide, 1,1-Dimethylethyl (TBHP)

CAS number: 75-91-2 (TBHP)

EC number: 200-915-7 (TBHP)

Molecular formula: C₄H₁₀O₂ (TBHP)

Uses and Applications

T-Hydro Solution provides a source of active oxygen selected for diverse oxidation technologies. Many industries, including polymers and specialty chemicals, use *T-Hydro Solution* as an initiator and/or oxidant. Epoxidation of propylene to propylene oxide accounts for the largest commercial use of Tert-Butyl Hydroperoxide (TBHP).

Producers of initiators use *T-Hydro Solution* to synthesize many peresters, dialkyl peroxide and perketal derivatives. The product itself serves as a free radical initiator for polymerizations, copolymerizations, graft polymerizations and curing of polymers.

T-Hydro Solution offers advantages such as versatility, selectivity and reactivity control with catalyst choice, mild reaction conditions and bulk availability.

T-Hydro Solution is also used in preparing specialty chemicals required by fine chemical and performance industries such as pharmaceuticals and agrochemicals. TBHP can selectively oxidize hydrocarbons, olefins and alcohols.

Physical / Chemical Properties

T-Hydro Solution is a clear, colorless liquid of low molecular weight with a pungent odor. It is a highly reactive, flammable, liquid hydroperoxide of low volatility. The flash point for *T-Hydro Solution* is 38°C (100°F). The boiling and freezing points of *T-Hydro Solution* are 96°C (205°F) and -3°C (27°F), respectively.

T-Hydro Solution is always produced, distributed, and used as a 70% solution of TBHP in water to maintain stability. The material is stable at temperatures below 38°C (100°F). However, due its nature as a hydroperoxide, at increased temperatures *T-Hydro Solution* can start to burn violently with a concurrent generation of oxygen.

Contamination with acids, bases and especially polyvalent metal ions such as those from iron can accelerate the decomposition rate. Spontaneous combustion may occur if mixed with readily oxidizable organic or flammable material.

T-Hydro Solution has been classified as hazardous under the Globally Harmonized System on classification and labeling (GHS) for its flammability properties.

Health Effects

The primary routes of exposure to *T-Hydro Solution* are by inhalation and dermal contact.

T-Hydro Solution may be harmful if swallowed, toxic in contact with the skin, and it can be fatal via the inhalation route of exposure. It is corrosive to skin and eyes and causes respiratory irritation. *T-Hydro Solution* has mutagenic potential. *T-Hydro Solution* has been classified as hazardous under GHS for these health effects.

The table below gives an overview of the health effects assessment results for *T-Hydro Solution*.

Effect Assessment	Result
Acute Toxicity Oral / inhalation / dermal	Harmful if swallowed and toxic in contact with the skin. Can be fatal via the inhalation route of exposure.
Irritation / corrosion Skin / eye/ respiratory tract	Corrosive to skin and eyes, will cause severe skin burns and eye damage. Highly irritating to respiratory tissue.
Sensitisation	Causes allergic skin reactions.
Toxicity after repeated exposure Oral / inhalation / dermal	Based on available data, nasal tissues have shown to be especially sensitive to irritation and/or corrosion from repeated exposure. Tissue damage anticipated at local sites of contact following repeated inhalation exposure.
Genotoxicity / Mutagenicity	Has mutagenic potential. However, due to its rapid breakdown to non-genotoxic products, this concern is primarily directed at the site of first contact with the material, and not expected to affect internal organs or reproductive tissues.
Carcinogenicity	Based on available data, no indications of carcinogenicity observed.
Toxicity for reproduction	Based on available data, no developmental toxicity or reprotoxicity is anticipated.

Environmental Effects

T-Hydro Solution is toxic to aquatic life and its principal metabolite, tertiary-butyl alcohol, is not readily biodegradable. It has been classified as hazardous under GHS for its aquatic toxicity.

The table below gives an overview of the environmental assessment results for *T-Hydro Solution*

Effect Assessment	Result
Aquatic Toxicity	Toxic to aquatic life with long-lasting effects.

Fate and behavior	Result
Biodegradation	Degrades rapidly to tertiary butyl alcohol (catalyzed by micro organisms), which is inherently biodegradable.
Bioaccumulation potential	Not bio-accumulative.
PBT / vPvB conclusion	Not considered to be either PBT or vPvB.

PBT = Persistent, Bio-accumulative and Toxic in the environment.

vPvB = very Persistent and very Bio-accumulative in the environment.

Exposure

Human health

Consumers generally will not come into contact with *T-Hydro Solution* as there are no supported uses for unreacted *T-Hydro Solution* in consumer products.

Personnel exposure to *T-Hydro Solution* in manufacturing facilities is considered very low because the process, storage and handling operations are enclosed. It is not used in a widespread or dispersive manner. Also, transfer (loading, transport, drumming) of *T-Hydro Solution* is conducted with dedicated equipment in dedicated containers and/or drums to prevent any release from the system. However, worker exposure can potentially occur during operations, such as product transfer, product sampling, or maintenance / repair activities on product containing systems. The risk of accidental exposure should be controlled by selecting and applying the appropriate Risk Management Measures.

Environment

The manufacture of *T-Hydro Solution* occurs in a closed and automated process with minimal release to the environment. Transfer (loading and transport) of *T-Hydro Solution* is conducted with dedicated equipment in dedicated containers and/or drums to prevent release from the system.

Risk Management Measures

For detailed guidance on the use of *T-Hydro Solution*, the Safety Data Sheet and the Product Safety Bulletin should be consulted.

T-Hydro Solution should only be handled by knowledgeable and trained personnel.

Flammability and stability

The vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Equipment should be grounded to prevent build-up of static electricity.

To maintain product stability and mitigate product flammability, additional risk management measures may be required such as:

- Provide for water dilution or add polyethylene saddles to capture free radicals in storage tanks;
- Continuous nitrogen purge on storage tanks to sweep out potential oxygen formation;
- Storage of drums in well ventilated storage areas.

It is recommended that the temperature of *T-Hydro Solution* in storage (both drums and bulk) be maintained in the range from 10°C to 38°C (50°F to 100°F). The material is stable at temperatures below 38°C (100°F), and the likelihood of formation of droplets of a water-rich phase will be minimal if stored within the recommended temperature range.

Human health

When using chemicals, make sure that there is adequate ventilation. Always use appropriate chemical-resistant gloves to protect your hands and skin, always wear eye protection such as chemical goggles, and always wear flame-retardant clothing. Do not eat, drink, or smoke where chemicals are handled, processed, or stored. Wash hands and skin following contact. If the substance gets into your eyes, rinse eyes thoroughly for at least 15 minutes with tap water and seek medical attention.

In the case of transfer or maintenance operations, always clear transfer lines prior to decoupling, and flush/drain to a closed system for recycle prior to opening equipment.

In cases where engineering controls cannot maintain airborne substance concentrations at exposure limits, or in cases with a risk of accidental exposure, additional risk management measures may be necessary for safe use, such as the use of a complete suit protecting against chemicals and supplied air, a self-contained breathing apparatus or respirator.

Environmental

Handle the substance within a closed system. In case of accidental release or spill, do not allow the product to enter sewers, surface or ground water. Clean up contamination/spills as soon as they occur.

Regulatory Information / Classification and Labeling

This substance has been registered under REACH by relevant companies of LyondellBasell in the European Union.

For a detailed overview of the regulatory status of this substance, please refer to the Product Stewardship Bulletin (PSB) available from the LyondellBasell corporate website.

Under the Globally Harmonized System on classification and labeling (GHS) substances are classified according to their physical, health and environmental hazards.

The hazards are communicated via specific labels on the product packaging and the Safety Data Sheet. GHS attempts to standardize hazard communication so that the intended audience (workers, consumers, transport workers, and emergency responders) can better understand the hazards of the chemicals in use.

For a detailed overview of the classification and labeling of this substance, please refer to the regional Safety Data Sheet, which can be found on the LyondellBasell corporate website.

Conclusion Statements

- *T-Hydro Solution* is used as an initiator and/or oxidant in Polymers and/or Specialty Chemicals industries. It has no supported uses in consumer products.
- *T-Hydro Solution* has been classified as hazardous. The main hazards are flammability, various health hazards (harmful if swallowed, toxic in contact with the skin, can be fatal if inhaled, corrosive to skin and eyes, highly irritating to respiratory tissue and mutagenic potential) and toxicity to aquatic life with long-lasting effects.
- Exposure to human health and environment is considered very low, as the *T-Hydro Solution* manufacturing process, storage and handling operations are enclosed.

Contact Information within Company

For further information on this product in general, please consult the LyondellBasell corporate website (www.lyb.com).

Date of issue

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Disclaimer

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T-Hydro Solution is a product of Lyondell Chemical Company and Lyondell Chemie Nederland B.V.