LUCIDOL

ORGANIC PEROXIDES

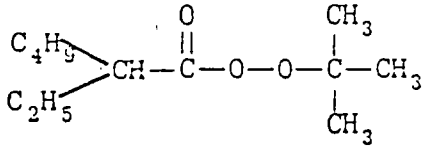
C - 70

t-BUTYL PEROCTOATE

Product Bulletin 6.701

t-Butyl Peroctoate is an efficient medium temperature initiator exhibiting catalytic activity in the same range as that of benzoyl peroxide. Because this new perester is a liquid, it dissolves much more easily in monomers and resins and can be metered or pumped like any liquid catalyst.

Chemical Structure



Empirical Formula $C_{12}H_{24}O_3$

Molecular Weight 216.3

SPECIFICATIONS

t-Butyl Peroxy (2-ethyl hexanoate) . .	97.0% minimum
Active Oxygen	7.18% minimum

PROPERTIES

Form	Liquid
Color	Colorless
Odor	Faint
Freezing Point	Below -30°C
Specific Gravity @ 25°C/25°C	0.8950 minimum
Refractive Index @ 25°C	1.4260 minimum
Viscosity in Centipoises	
@ 20°C (68°F) . . .	3.8
@ 30°C (86°F) . . .	2.8
@ 40°C (104°F) . . .	2.1
Flash Point	Above 88°C (190°F)
Solubility	Miscible with esters, ketones, alcohols, hydrocarbons; practically insoluble in water

The following table shows that t-Butyl Peroctoate has approximately the same half-life as benzoyl peroxide. This means that t-Butyl Peroctoate will also perform over the wide temperature range which has made benzoyl peroxide useful in so many applications.

THERMAL DECOMPOSITION DATA

Half-life ($t_{\frac{1}{2}}$) in dilute benzene solutions:

Temperature °C	Temperature °F	t-Butyl Peroctoate	Benzoyl Peroxide	t-Butyl Perbenzoate
70	158	13.3 hr.	14.9 hr.	6 weeks
85	185	2.2 hr.	2.2 hr.	5 days
100	212	25 min.	25 min.	18 hr.
115	239	5.5 min.	5.5 min.	3.2 hr.
130	266	1.3 min.	1.3 min.	35 min.

primarily:

1. Efficiency - In most commercial resins, t-Butyl Peroctoate provides nearly the same gel and cure characteristics as does twice the amount of benzoyl peroxide. In other words, the perester is almost two times as efficient. This is particularly true at temperatures over 225°F.

2. Convenience - Since this is a liquid catalyst, it can easily be poured, metered, pumped or dispensed. Moreover, t-Butyl Peroctoate dissolves in monomers and resins much more readily than benzoyl peroxide granules or even paste. It is entirely free of plasticizers.

3. Safety - Although t-Butyl Peroctoate is flammable, it does not burn with the ferocity of dry benzoyl peroxide. Moreover, it is not shock-sensitive. The product's overall safety characteristics can be considered similar to those of t-butyl perbenzoate.

APPLICATIONS

t-Butyl Peroctoate may be substituted for benzoyl peroxide in all applications where the latter has proved useful. Two of the largest applications are:

1. Monomer Polymerization - This includes all types of vinyl monomers, e.g., vinyl acetate, vinyl chloride, styrene, ethylene, etc. Experiments have shown that t-Butyl Peroctoate is as efficient as benzoyl peroxide in polymerizing styrene. The amounts of catalyst needed will vary from 0.01% to 2% in a temperature range of about 180°-300°F. The absence of aromatic groups lessens the chance of color development in the finished polymer.

2. Polyester Curing - t-Butyl Peroctoate is especially advantageous in this application. The amounts required will generally be in the area of 0.5% to 1% by weight on the resin. Possible operating temperatures are wide, and can range from about 200°-300°F.

The following Standard SPI Exotherm data illustrate the efficiency of t-Butyl Peroctoate. Using a basic polyester resin at three different molding temperatures, 0.5% by weight of t-Butyl Peroctoate is compared to 1% benzoyl peroxide.

	0.5% t-Butyl Peroctoate			1.0% Benzoyl Peroxide		
Bath Temp. °F	212	240	302	212	240	302
Gel Time, min.	3.5	2.0	1.1	3.0	1.8	1.0
Cure Time, min.	4.8	3.1	1.9	4.2	2.7	1.7
Peak Exotherm	429	438	449	424	438	442

Unlike benzoyl peroxide, t-Butyl Peroctoate is not accelerated at room temperature by dimethylaniline or cobalt promoters. It is, however, possible to obtain reduced gel and cure times at elevated temperatures through the use of promoters. Dimethylaniline is more effective than cobalt naphthenate.

in a basic polyester resin, employing 1% by weight of t-Butyl Peroctoate and a bath temperature of 180°F:

	Gel Time min.	Cure Time min.	Peak Exotherm
Catalyst alone	5.2	7.0	403
Catalyst plus 0.1% dimethylaniline	2.7	4.4	401
Catalyst plus 0.3% cobalt naphthenate	4.3	5.7	398

PACKING

t-Butyl Peroctoate is packed and labeled in accordance with Agent T. C. George's Tariff as Peroxide Organic Solution Liquid N.O.S. under Dept. of Transportation (DOT) Regulations.

Container	Net Weight	Quantity
Polyethylene Bottle	6 oz.*	1 or 25/case
Polyethylene Bottle	12 oz.	1 or 25/case
Polyethylene Bottle	7 lbs.	1, 2 or 4/case
5 Gal. Polyethylene Container with DOT approved overpack	35 lbs.	

SHIPPING

t-Butyl Peroctoate is shipped under Yellow label via motor freight. Shipments must be made under controlled temperature conditions of 65°F or less. Lucidol expects to be the shipper in most cases. For delivery via other than Lucidol truck, arrangements must be made to assure controlled temperature conditions enroute.

* (Non-refrigerated shipment. See Price Schedule 6.701)

HANDLING AND STORAGE

t-Butyl Peroctoate is an oxidizing material and should be handled with care. All persons who handle this material should be familiar with the following facts.

Flammability. Although t-Butyl Peroctoate has a flash point above 88°C (190°F), once ignited, it burns vigorously and is difficult to extinguish. Keep t-Butyl Peroxtoate away from all sources of heat such as radiators, steam pipes, direct rays of the sun, open flames and sparks.

Contamination. Take care to avoid contamination with combustible materials, strong oxidizing or reducing agents, etc. Never add accelerators such as cobalt naphthenate or dimethylaniline to t-Butyl Peroctoate as rapid decomposition may result. Do not transfer t-Butyl Peroctoate from original containers to glass bottles, since gas pressure build-up could shatter the bottle. This hazard would be particularly pronounced if the peroxide becomes contaminated during the transfer process, thereby accelerating decomposition. Such decompositions can occur with explosive force due to the confining nature of the container.

methods to minimize static electricity with other organic materials, e.g., grounding or bonding equipment, maintaining high humidity where possible, shortening free fall of materials, etc., are recommended.

Storage Area. t-Butyl Peroctoate should be stored well separated from the manufacturing area and away from other combustible materials. Do not store t-Butyl Peroctoate with any material which is innately hazardous or which might induce decomposition. Storage areas for t-Butyl Peroctoate should be selected in accordance with local laws and regulations, subject to the approval of the insurance carrier. Bring into the manufacturing area only such quantities as will be used immediately. For additional information regarding the storage of organic peroxides, please request Lucidol Reprint 30.40.

Storage Temperature. t-Butyl Peroctoate should be stored below 65°F to maintain activity (active oxygen). Between 65°F and 90°F the peroxide decomposes (slowly) with accompanying loss of active oxygen. NEVER ALLOW t-BUTYL PEROCTOATE TO STAND ABOVE 90°F. After about 30 hours at ambient temperatures of 95-105°F, a 5 gallon (35 lbs.) quantity decomposes with burning. Additional details on hazards and test methods dealing with peroxides requiring refrigeration are given in Lucidol Reprint 30.42, entitled "A Relative Hazard Classification of Commercial Organic Peroxides."

Spillage and Disposal. Keep a supply of non-combustible Vermiculite or Perlite on hand to immediately soak up spilled material. Sweep the Vermiculite saturated with t-Butyl Peroctoate into a non-sparking shovel, deposit in a shallow trench in a safe place and ignite with a torch from a safe distance (kerosene-soaked rag on 6 ft. steel rod). Drain thoroughly and flush empty containers with water before discarding.

Fire. For small fires use Class B extinguishers (dry chemical, foam or carbon dioxide). For large fires evacuate area and apply water from a safe distance to cool down surroundings. If fire occurs near t-Butyl Peroctoate, wet down the containers with a spray of water.

FIRST AID

Care should be exercised by all personnel handling t-Butyl Peroctoate as all the physiological effects have not been fully determined. The material should not be allowed to remain in contact with the skin and inhalation of vapors should be avoided. In case of contact with the skin, wash with plenty of soap and water; for eyes, flush with plenty of water and get medical attention. In case of ingestion, administer an emetic to induce vomiting and call a physician.

LUCIDOL REPRINTS

For more comprehensive information regarding safe handling and storage procedures for organic peroxides request the following safety publications:

1. Lucidol Reprint 30.40, "Organic Peroxides, Their Safe Handling and Use"
2. Lucidol Reprint 30.41, "Safe Handling and Storage of Organic Peroxides in the Laboratory"
3. Lucidol Reprint 30.42, "A Relative Hazard Classification of Commercial Organic Peroxides"