



Initiators for thermoplastics



Nouryon

Nouryon creates everyday essentials

Nouryon is your partner in essential solutions for a sustainable future

We are a global, specialty chemicals leader. Markets and consumers worldwide rely on our essential solutions to manufacture everyday products, such as personal care, cleaning goods, paints and coatings, agriculture and food, pharmaceuticals, and building products. Furthermore, the dedication of approximately 8,200 employees with a shared commitment to our customers, business growth, safety, sustainability and innovation has resulted in a consistently strong financial performance. We operate in over 80 countries around the world with a portfolio of industry-leading brands.

Within our Polymer Specialties business, we produce everyday essentials for the global polymer, recycling and polymer processing industries. We are among the world's leading producers of organic peroxides, metal alkyls and organometallic specialties, which are essential ingredients for the thermo-plastic, composite and rubber industries. We are widely known for our world-class products, including Laurox®, Trigonox®, Perkadox® and brands.



A global partner

Our manufacturing sites and distribution centers are found all around the globe. Our global distribution network allows us to deliver our products to you anywhere in the world. That's how we ensure security of supply and easy access to quality products wherever you are.

All our sites are ISO 9001 and ISO 14001 certified to ensure the highest product quality and strict compliance with environmental regulations. We continually invest in manufacturing techniques, high quality standards, safety, innovation, active technical support and a reliable supply chain.



Contributing to a sustainable future



Our Commitment:

We partner with our customers, suppliers and employees to deliver innovative solutions, drive progress and create a safe and sustainable today and tomorrow for everyone.



WE EMPOWER AND ENGAGE

We empower our employees and engage with our suppliers and communities to deliver a positive impact

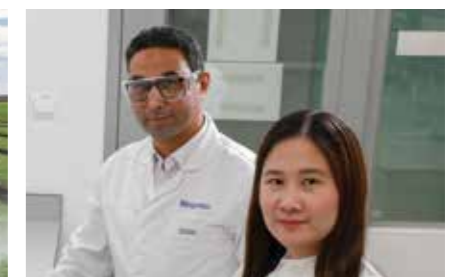
Key sustainable development goals:



WE INNOVATE AND GROW

We enable growth by meeting customer demand for innovative and sustainable solutions

Key sustainable development goals:



WE OPERATE RESPONSIBLY

We enhance operational excellence and efficiency to continuously improve our safety and environmental performance suppliers, and society to drive sustainable progress

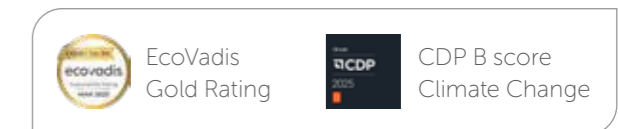
Key sustainable development goals:



Our memberships and partnerships



Our ratings



Our ambitions and targets

Safety ambition:
Zero injuries and harm

- By the end of 2030, we have targeted reducing our absolute Scope 1 & 2 GHG emissions by **40%**, vs. a 2019 base year
- By the end of 2030, we have targeted reducing our total waste intensity by **10%**, and water consumption intensity by **10%**, vs. a 2019 base year¹

By 2050, we aspire to be a **net zero** organization

2030 2050

Empowering the polymer cycle

Building on a sustainability driven strategy. We deliver essential ingredients that enhance and support the polymer cycle.



Recycling of polyolefins

We are unique at being the only producer of a full product portfolio for recyclers that allows tuning of the MFI of polypropylene in both directions: UP and DOWN.



With our technology recyclers have the opportunity of producing a large range of recycled polypropylene products for the most diverse applications, expanding their market reach to high-end applications for which virgin PP was usually preferred.

We continuously develop new products and innovate to meet the needs of the recycling market.

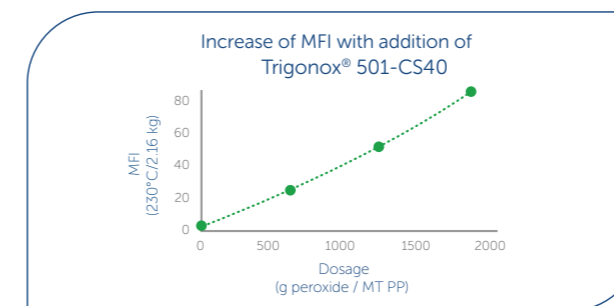
MFI UP ↑	
Product	physical form
Trigonox® 501	liquid
Trigonox® 301	liquid, granules
Trigonox® 101	liquid, granules
Perkadox® 14	flakes, powder, granules
MFI DOWN ↓	
Perkadox® PM	granules

Our latest innovations for upcycling of polypropylene

Go UP with the MFI of polypropylene
Trigonox® 501-CS40 for consistent quality

Recycled Polypropylene (PP) is produced from feedstock with different Melt Flow Indexes resulting in fluctuating quality of recycled PP, causing instability during processing at converters.

Our last generation vis-breaking peroxide Trigonox® 501-CS40 is used in the reactive extrusion of recycled PP to achieve a higher MFI and a narrower Molecular Weight Distribution. This results in constant and reproducible recycled PP quality.

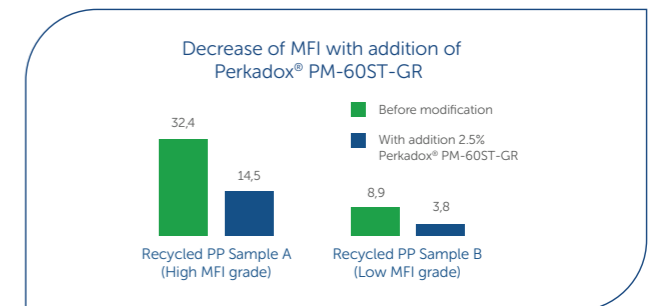


Trigonox® 501-CS40 is superior to traditional vis-breaking peroxides (i.e., Trigonox® 101, Perkadox® 14); in fact, it shows a 60% reduction in the Volatiles Organic Compounds produced during extrusion and can be stored at room temperature.

Go DOWN with the MFI of polypropylene
Perkadox® PM-60ST-GR for high melt strength

Most of the properties of recycled plastics are inferior to virgin plastics due to exposure to UV and sunlight during the article's use and lifetime.

We have patented a new technology in which Perkadox® PM-60ST-GR is used in the reactive extrusion of recycled PP to decrease the MFI to levels similar to virgin polymer. This is known as upcycling of plastics.



With the use of Perkadox® PM-60ST-GR the melt strength, elasticity and mechanical properties of recycled PP are greatly improved, allowing higher recycled content and use of recycled PP in new applications (i.e., foaming, thermoforming).

Innovation

As an innovative company we have a range of new, high-value products and technologies that serve your current and future needs. These innovations provide you with all kinds of benefits ranging from lower production costs to higher production output, and increased safety of your operations.

CiD technology for PVC

We have developed a new technology to improve the production efficiency and product quality of PVC. Continuous Initiator Dosing (CiD) using Nouryon's Trigonox® 187 product line can increase the output of any PVC production plant by 10-40%. In addition, product quality and safety of PVC production is improved together with energy savings and reduced CO₂ emissions.

New peroxide formulations for PVC

New innovative peroxide suspensions and emulsions have been developed to serve the current and future needs of the PVC industry. These new peroxide formulations improve sustainability and safety during the production of PVC. Food contact-approved peroxide formulations have been developed by Nouryon to serve the European PVC industry, whereas new methanol-free peroxide formulations have been developed to serve the US PVC industry.

These newly developed peroxide formulations are also intrinsically safer than solvent-based formulations and provide safer transport, safer storage and safer use. Trigonox® 187-W40 is an example of the innovative new peroxide emulsions product line, which is directly suited for use in combination with Nouryon's CiD Technology.

Innovative new IBC solution: less waste, less handling and storage

We now offer highly concentrated Type F organic peroxides in unique composite Intermediate Bulk Containers (IBC's). These provide our customers with improved safety, easier storage as well as handling advantages.



Innovative alternative to azo initiators

We have developed an attractive alternative for azo initiators. Trigonox® 421, one of our recent innovations in organic peroxides, is a new initiator for acrylics polymerization and the production of polymer polyols. This new peroxide is a better handling and eco-premium alternative to azo initiators as it is free of toxic decomposition products. Furthermore, it is an easy dosing liquid providing handling advantages during production. Trigonox® 421 product is used as a drop-in alternative for 2,2'-Azodi(isobutyronitrile) (AIBN).

Polymer modification: CR-PP

We have developed and patented Trigonox® 501-CS40 peroxide that is used for controlled rheology polypropylene (CR-PP). This new peroxide brings remarkable advantages for polypropylene producers. The Trigonox 501 product line is food-contact approved, and provides low volatiles, good organoleptics and a cost benefit to the production of CR-PP grades.

Circular polymers and recycling

Managing polymer waste is becoming one of the top priorities for the polymer industry. Nouryon has traditionally been supplying products that are used in the recycling of polymer waste streams. Our products can be used to adjust the melt index of recycle material. Organic peroxides can also act as compatibilizer in a mixed polymer recycle supply. As an industry leader in sustainability, we strive to jointly develop solutions that further increase the efficiency of recycling processes (see page 5).

Trigonox®

Polymerization initiators

Laurox®, Perkadox®, Trigonox® brands

Our range of organic peroxides for the manufacture of polyvinyl chloride (PVC), low density polyethylene (LDPE), acrylics, styrenics, controlled-rheology polypropylene (CR-PP), and other thermoplastics is the world's largest. We cover classes such as peroxy(di)carbonates, diacyl peroxides, peroxyketals, peroxyesters, dialkyl peroxides and hydroperoxides. In addition we supply azo (N-N) and carbon-carbon (C-C) initiators. You name it, we produce it.



Our products find use in a huge range of industrial and consumer goods. These include window frames, piping systems, food containers, automotive parts, cosmetic bottles, children's toys, carry bags or as insulation in electrical cables. Look around you and chances are you'll see Nouryon's influence.

Organic peroxides are also important materials in pharmaceutical and fine chemical synthesis or as active pharmaceutical ingredient (API). In fact, some of the world's best selling API's are synthesized using our products.

Much of our success is due to our philosophy of creating close partnerships with our customers. What do you want to achieve? From optimizing applications, improving efficiencies, resolving difficulties or even developing new organic peroxides, we're happy to meet with you to discuss your requirements.

We are able to supply a wide range of initiators to meet all requirements with respect to area of application, polymerization temperature, rate of radical formation and storage facilities.

Listed are the highest concentrations of formulations

Please visit us at nouryon.com for complete product listings. Formulations in solvents or water or concentrations other than those indicated, as well as unique custom blends of various peroxides can be made available. However, safety characteristics and the appropriate environmental and transportation regulations have to be taken into account. Whatever your particular requirements, we can develop the product to match.



Scan QR code to watch our short video on how we help make polymers



Your safety is our priority

Nouryon is recognized as the global leader in organic peroxide safety. Our proven success in safely handling organic peroxides is due to our long-term commitment to developing and maintaining high safety standards. We at Nouryon always place safety as our top priority.

Sharing our experience in safety is one of the most important resources we offer. Through our safety programs we provide expert advice on the handling of our products including:

- classroom review of safety and handling of organic peroxides
- consultation on storage and dosing facility design
- demonstrations on the safe use, handling and control of organic peroxides

Our Safety Research Laboratory in Deventer, The Netherlands is heavily involved in R&D, ensuring the development of safe products and processes. Studies are carried out, in order to provide a high level of safety in manufacturing, handling and transport of dangerous goods.

In general organic peroxides are thermally unstable compounds, decomposing at relatively low temperatures. However, knowledge of proper handling techniques, carefully designed facilities and thorough training of personnel can overcome the hazards. Personnel who understand and pay proper attention will be able to handle organic peroxides confidently and safely.

Storage temperatures SADT: Self-Accelerating Decomposition Temperature

The SADT is the lowest temperature at which self-accelerating decomposition may occur with a substance in the packaging as used in transport. Transportation temperatures are derived from the SADT according to the recommendations by the United Nations Committee of Experts on the Transport of Dangerous Goods.

T_s max.

The T_s max. given in the product list on pages 12-21 is the recommended maximum storage temperature at which the product is stable and quality loss will be minimal.

T_s min.

A minimum storage temperature (T_s min.) is given if phase separation, crystallization or solidification of the product is known to occur below the temperature indicated. We recommend that you store the product above the T_s min. indicated for quality and in some cases safety reasons.

T_{em}: Emergency temperature

The T_{em} is derived from the SADT and is the temperature at which emergency procedures must be implemented.

T_c Control temperature

The T_c is also derived from the SADT and is the maximum temperature at which the product can be safely transported. A T_c is not required if the SADT exceeds 50°C.

Both the T_{em} and T_c are related to safety and do not apply to product quality. To maintain product quality the recommended storage temperatures (T_s min. and max.) have to be observed.

UN Numbers

All products accepted for transport are assigned to generic entry numbers according to classification principles as described in the recommendations by the United Nations Committee of Experts on the Transport of Dangerous Goods. An explanation of all relevant UN numbers is given in Table 1.

Survey of thermal stability

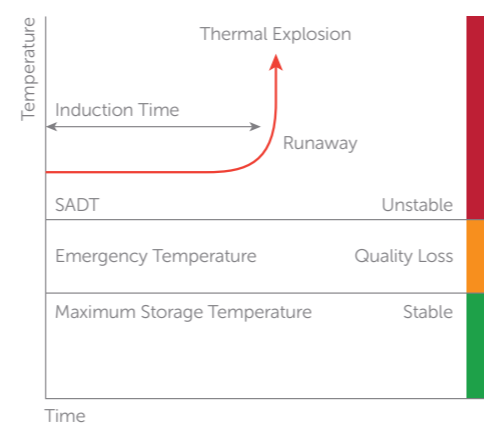


Table 1. Classification of organic peroxides

UN NO.	CLASSIFICATION	NOURYON HAZARD RATING	MAXIMUM CONTAINER SIZE
3103	type C; liquid	High	50 kg (110 lb)
3104	type C; solid		
3113	type C; liquid, temperature controlled		
3114	type C; solid, temperature controlled		
3105	type D; liquid	Medium	50 kg (110 lb)
3106	type D; solid		
3115	type D; liquid, temperature controlled		
3116	type D; solid, temperature controlled	Low	400 kg (880 lb)
3107	type E; liquid		
3117	type E; liquid, temperature controlled	Low	400 kg (880 lb)
3108	type E; solid		
3109	type F; liquid	Very low	IBC's / Tanks
3110	type F; solid		
3119	type F; liquid, temperature controlled		
3120	type F; solid, temperature controlled		
None	Non-dangerous good	No	Unrestricted
SELF-REACTIVE SUBSTANCES			
3234	type C; solid, temperature controlled	High	50 kg (110 lb)
3226	type D; solid	Medium	50 kg (110 lb)
3236	type D; solid, temperature controlled		



Scan QR code to watch our short video on how our safety services can support you.

Packaging

We continuously develop new and innovative packaging making logistics more efficient and improving safety standards even beyond existing transport regulations. From bottles to tank trucks we offer a variety of packaging options for both liquid and solid organic peroxides.

Liquid organic peroxides

Liquid peroxides from Nouryon are available in packages shown in Table 2. Package sizes expressed in gallons are only available in North America.

We also understand the need to innovate our packaging. For instance our Nourytainer®. Developed by Nouryon it is recognized as the world's benchmark in liquid organic peroxide packaging. Nouryon also was the first organic peroxide producer to introduce intermediate bulk containers (IBC's). And we're continually looking for new ways to optimize safe transport, handling and storage of organic peroxides.

Most recently we've led the way with our new composite IBC's for dilute type F organic peroxides. Due to their weight and dimensions, these IBC's offer benefits in safety and handling during transport and storage while giving all the advantages of our stainless steel containers. The specially designed lid, used as a emergency vent, is an Nouryon invention. In addition, they are readily available and have a lower environmental impact.

The Nouryon development of a cooled trailer with IBC's connected to a manifold eliminates the in-house handling and transport of IBC's. Organic peroxide formulations can be directly pumped into storage tanks by a leak-free, dry-break connection. All unloading facilities are present on the trailer.

Our continuous investment in refrigerated trucks, bulk tankers and dedicated reefers (refrigerated containers) specifically designed to safely transport our products is another demonstration of our commitment to security of supply.

Solid initiators

Standard packages for our solid initiators are shown in Table 3.

Most solid initiators are packaged in polyethylene bags inside non-returnable corrugated boxes. The number of bags per box varies, depending on the weight of initiator per bag.

For the availability of our products in IBC's, bulk or non-standard packages, please consult your Nouryon account manager.



Scan QR code to watch our short video on safe supply of organic peroxides in composite IBCs



Table 2. Standard packages for liquid peroxides

PACKAGE	VOLUME	NET WEIGHT	COMMENTS
Bottle	1 gallon	7-8 lb	packaged as 4 polyethylene bottles per non-returnable carton
HDPE can	20-30 liter (5.3-8 gallon)	15-25 kg (6.8-11.3 lb)	single component, polyethylene container (Nourytainer®)
Drum	15 gallon	100 lb	returnable polyethylene drum
	55 gallon	300-410 lb	polyethylene or steel drum
	200 liter	150 kg	steel drum
IBC	220 liter	165-190 kg	returnable polyethylene drum
	1000 liter	800-1000 kg	recollectable composite container (for emulsions and suspensions)
	1000 liter	700-1000 kg	recollectable, conductive composite container
Tank truck	1250 liter	850-1100 kg	reusable stainless steel container
	330 gallon	2000 lb	reusable stainless steel container
	20 m ³ 7000 gallon	varies with product	for transport of bulk shipments of dilute type F organic peroxides

Table 3. Standard packages for solid initiators

PACKAGE	NET WEIGHT	COMMENTS
Carton	varies with product	polyethylene bags inside non-returnable cardboard box
Crate	varies with inner package	polyethylene bags inside returnable plastic crate
Drum	20-25 kg (45-55 lb)	fiber drum

Different solutions in diluted peroxide formulations (see tables on page 14-29)

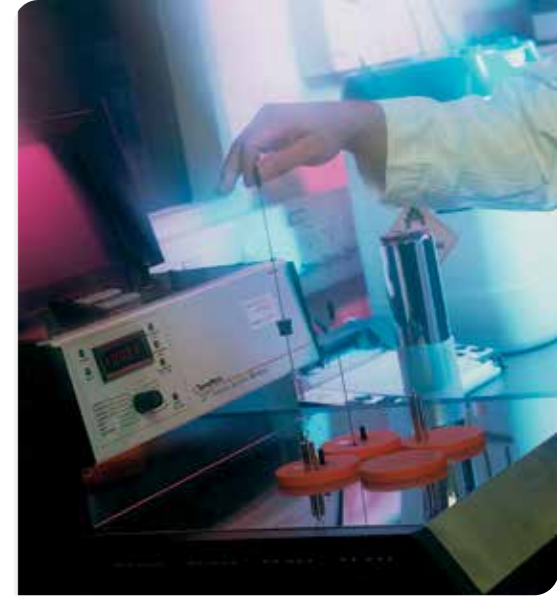
In diluted peroxide formulations the letter 'C' refers to Isododecane which is used exclusively in Europe, Middle East, India and Africa.

In the America's 'odorless mineral spirits' is used and products are indicated with "CH" to distinguish the different solvent.

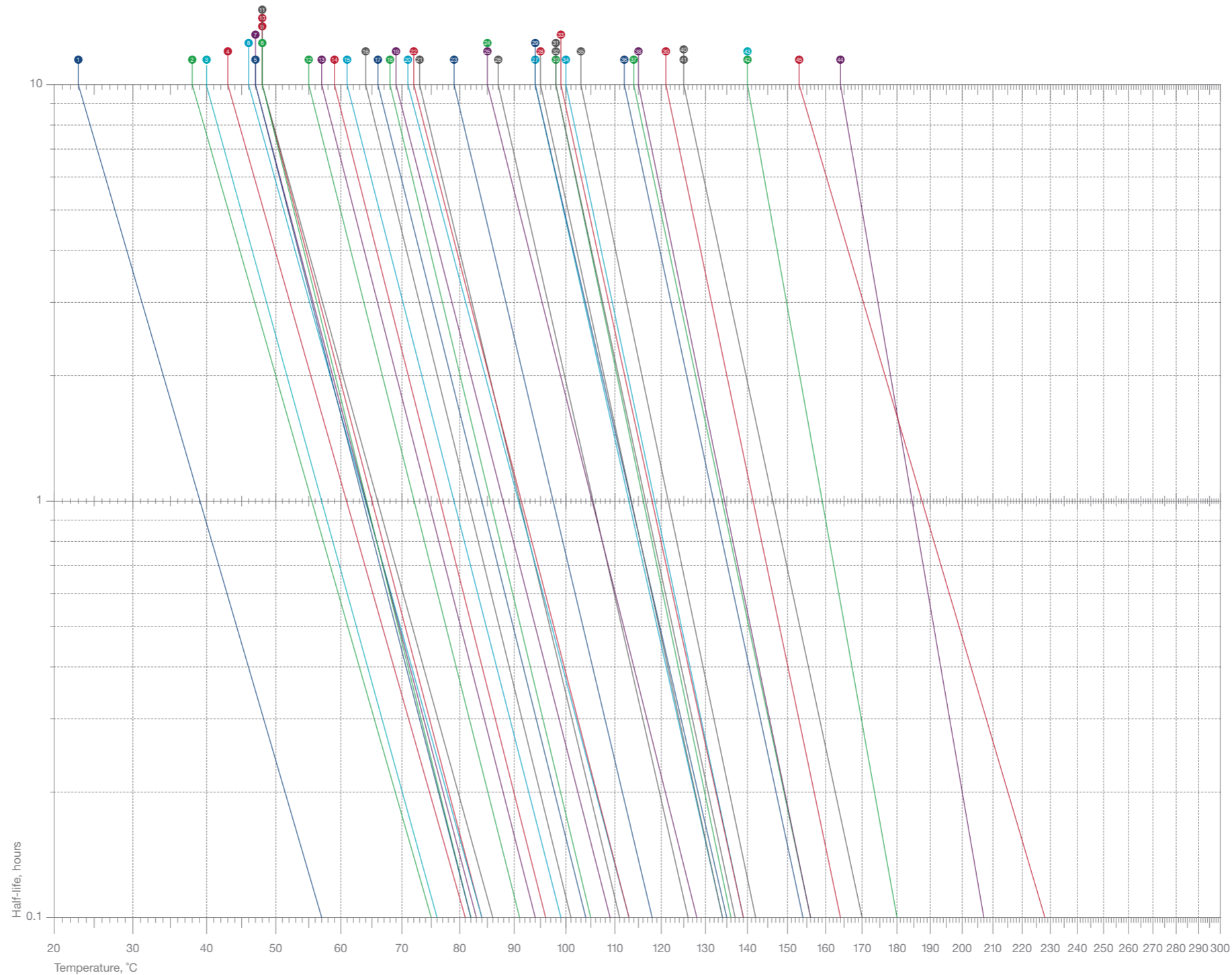
In Asia our odorless mineral spirits' based products are indicated by "CL".



Half-life chart



PRODUCT NAME	CHEMICAL NAME
1 TRIGONOX 187	Diisobutyl peroxide
2 TRIGONOX 99	Cumyl peroxyneodecanoate
3 TRIGONOX 423	1,1,3,3-Tetramethylbutyl peroxyneodecanoate
4 TRIGONOX 123	tert-Amyl peroxyneodecanoate
5 TRIGONOX SBP	Di-sec-butyl peroxydicarbonate
6 PERKADOX 16	Di(4-tert-butylcyclohexyl) peroxydicarbonate
7 TRIGONOX EHP	Di(2-ethylhexyl) peroxydicarbonate
8 TRIGONOX 23	tert-Butyl peroxyneodecanoate
9 PERKADOX 24	Dicetyl peroxydicarbonate
10 PERKADOX 26	Dimyristyl peroxydicarbonate
11 TRIGONOX 425	1,1,3,3-Tetramethylbutyl peroxyvalate
12 TRIGONOX 125	tert-Amyl peroxyvalate
13 TRIGONOX 25	tert-Butyl peroxyvalate
14 TRIGONOX 36	Di(3,5,5-trimethylhexanoyl) peroxide
15 LAUROX	Dilauroyl peroxide
16 PERKADOX AIBN	2,2'-Azodi(isobutyronitrile)
17 PERKADOX AMBN	2,2'-Azodi(2-methylbutyronitrile)
18 TRIGONOX 141	2,5-Dimethyl-2,5-di(2-ethylhexanoylperoxy)hexane
19 TRIGONOX 421	1,1,3,3-Tetramethylbutyl peroxy-2-ethylhexanoate
20 TRIGONOX 121	tert-Amyl peroxy-2-ethylhexanoate
21 PERKADOX L	Dibenzoyl peroxide
22 TRIGONOX 21	tert-Butyl peroxy-2-ethylhexanoate
23 PERKADOX 41	tert-Butyl peroxyisobutyrate
24 PERKADOX ACCN	1,1'-Azodi(hexahydrobenzotrile)
25 TRIGONOX 29	1,1-Di(tert-butylperoxy)-3,3,5-trimethylcyclohexane
26 TRIGONOX 122	1,1-Di(tert-amylperoxy)cyclohexane
27 TRIGONOX 22	1,1-Di(tert-butylperoxy)cyclohexane
28 TRIGONOX 131	tert-Amylperoxy 2-ethylhexyl carbonate
29 TRIGONOX 42	tert-Butyl peroxy-3,5,5-trimethylhexanoate
30 TRIGONOX D	2,2-Di(tert-butylperoxy)butane
31 TRIGONOX BPIC	tert-Butylperoxy isopropyl carbonate
32 TRIGONOX 117	tert-Butylperoxy 2-ethylhexyl carbonate
33 TRIGONOX 127	tert-Amyl peroxybenzoate
34 TRIGONOX F	tert-Butyl peroxyacetate
35 TRIGONOX C	tert-Butyl peroxybenzoate
36 PERKADOX BC	Dicumyl peroxide
37 PERKADOX 14	Di(tert-butylperoxyisopropyl)benzene(s)
38 TRIGONOX 101	2,5-Dimethyl-2,5-di(tert-butylperoxy)hexane
39 TRIGONOX B	Di-tert-butyl peroxide
40 TRIGONOX 301	3,6,9-Triethyl-3,6,9-trimethyl-1,4,7-triperoxonane
41 TRIGONOX 501	1,2,4,5,7,8-Hexoxonane, 3,6,9-trimethyl-3,6,9-tris(Et and Pr)
42 TRIGONOX TMBH	1,1,3,3-Tetramethylbutyl hydroperoxide
43 TRIGONOX K	Cumyl hydroperoxide
44 TRIGONOX A	tert-Butyl hydroperoxide
45 TRIGONOX TAHF	tert-Amyl hydroperoxide



Kinetic Data

With the exception of hydroperoxides, the half-life is determined by differential scanning calorimetry-thermal activity monitoring (DSC-TAM) of a dilute solution of the initiator in monochlorobenzene. Kinetic data of the decomposition of hydroperoxides in monochlorobenzene are determined titrimetrically.

The tables in this catalog list the temperatures at which the half-lives are 0.1 hour, 1.0 hour and 10 hours.

The half-life can be calculated from the Arrhenius equation

$$k_d = A \cdot e^{-E_a/RT} \text{ and } t_{1/2} = \ln 2 / k_d$$

The Arrhenius frequency factor (A) and activation energy (E_a) are given in the tables on pages 14-29.

The residual concentration of the initiator can be calculated by means of the equation

$$[I] = [I_0] \cdot e^{-k_d t}$$

The initiators in the tables on pages 12-21 are arranged in descending order of activity, based on the 1.0 hour half-life temperature.

- k_d = rate constant for the initiator dissociation in s⁻¹
- A = Arrhenius frequency factor in s⁻¹
- E_a = Activation energy for the initiator dissociation in J/mole
- R = 8.3142 J/mole.K
- T = temperature in K
- t_{1/2} = half-life in s

- [I₀] = original initiator concentration
- [I] = initiator concentration at time t
- t = time measured from the start of decomposition in s

Our polymerization Initiators

* see explanation on page 11

PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	GENERAL DATA				STORAGE DATA		KINETIC DATA T (°C) FOR T1/2					SAFETY DATA				STANDARD PACKAGE TYPE See also page 11	
		Molecular weight	Assay (%)	Active oxygen (%)	Physical form	T ₂ max. (°C)	T ₂ min. (°C)	0.1 h	1.0 h	10 h	A (1/s)	E _a (kJ/mole)	SADT (°C)	T _{em} (°C)	T _c (°C)	UN No.		
	Di(2-ethylhexyl) peroxydicarbonate [16111-62-9]	346.5		4.62				83	64	47	1.83E+15	122.45						
TRIGONOX EHP-C75*	$\text{CH}_3-(\text{CH}_2)_3-\underset{\text{C}_2\text{H}_5}{\text{CH}}-\text{CH}_2-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{CH}_2-\underset{\text{C}_2\text{H}_5}{\text{CH}}-(\text{CH}_2)_3-\text{CH}_3$	75		3.46	in hydrocarbon solvent	-15	-25						5	-5	-15	3115	HDPE can	
TRIGONOX EHP-W60		60		2.77	emulsion in water and methanol	-15	-25							5	-5	-15	3119	HDPE can
TRIGONOX EHP-W40S		40		1.85	frozen flakes	-20	-25							0	-10	-20	3119	IBC
TRIGONOX EHPS		98		4.53	liquid	-15								5	-5	-15	3120	carton
TRIGONOX EHPS-C75*		75		3.46	in hydrocarbon solvent	-20								0	-10	-20	3113	HDPE can
	tert-Butyl peroxyneodecanoate [26748-41-4]	244.4		6.55				84	64	46	1.52E+14	115.47						
TRIGONOX 23	$\begin{array}{c} \text{R}_1 \quad \text{O} \quad \text{CH}_3 \\ \parallel \quad \parallel \\ \text{R}-\text{C}-\text{C}-\text{O}-\text{O}-\text{C}-\text{CH}_3 \\ \parallel \quad \parallel \\ \text{R}_2 \quad \text{CH}_3 \end{array}$	95		6.22	liquid	-10	-30						15	5	-5	3115	HDPE can	
TRIGONOX 23-C50*		50		3.27	in hydrocarbon solvent	-10	-20							15	5	-5	3119	IBC
TRIGONOX 23-W50		50		3.27	emulsion in water and methanol	-10	-25							20	10	0	3119	HDPE can
						-10	-25							15	5	-5	3119	IBC
	Dicetyl peroxydicarbonate [26322-14-5]	570.9		2.80				84	65	48	3.02E+15	124.30						
PERKADOX 24-FL	$\text{CH}_3-(\text{CH}_2)_{15}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-(\text{CH}_2)_{15}-\text{CH}_3$	94.5		2.65	flakes	20							40	35	30	3120	carton	
PERKADOX 24L		91		2.55	powder	20							40	35	30	3120	carton	
PERKADOX 24-W35		35		0.98	suspension in water	15	0						40	35	30	3119	HDPE can	
	Dimyristyl peroxydicarbonate [53220-22-7]	514.8		3.11				84	65	48	2.82E+15	124.10						
PERKADOX 26	$\text{CH}_3-(\text{CH}_2)_{13}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-(\text{CH}_2)_{13}-\text{CH}_3$	96		2.98	flakes	15							35	25	20	3116	carton	
	1,1,3,3-Tetramethylbutyl peroxyvalate [22288-41-1]	230.3		6.95				86	66	48	2.47E+14	117.50						
TRIGONOX 425-C75*	$\begin{array}{c} \text{CH}_3 \quad \text{O} \quad \text{CH}_3 \quad \text{CH}_3 \\ \parallel \quad \parallel \quad \parallel \quad \parallel \\ \text{CH}_3-\text{C}-\text{C}-\text{O}-\text{O}-\text{C}-\text{CH}_2-\text{C}-\text{CH}_3 \\ \parallel \quad \parallel \quad \parallel \quad \parallel \\ \text{CH}_3 \quad \text{CH}_3 \quad \text{CH}_3 \end{array}$	75		5.21	in hydrocarbon solvent	-15	-25						20	10	0	3115	HDPE can	
	tert-Amyl peroxyvalate [29240-17-3]	188.3		8.50				91	72	55	4.12E+15	127.76						
TRIGONOX 125-C75*	$\begin{array}{c} \text{CH}_3 \quad \text{O} \quad \text{CH}_3 \\ \parallel \quad \parallel \\ \text{CH}_3-\text{C}-\text{C}-\text{O}-\text{O}-\text{C}-\text{C}_2\text{H}_5 \\ \parallel \quad \parallel \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$	75		6.37	in hydrocarbon solvent	-10	-30						25	15	10	3113	HDPE can	


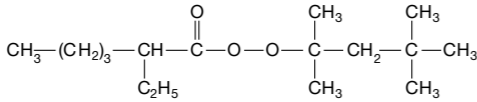
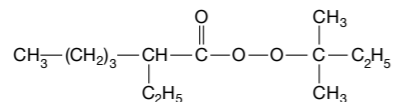
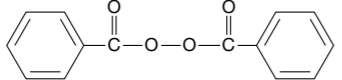
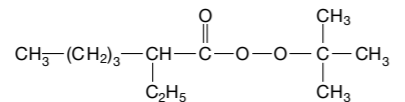
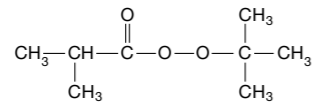
Our polymerization Initiators

* see explanation on page 11

PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	GENERAL DATA				STORAGE DATA		KINETIC DATA T (°C) FOR T1/2					SAFETY DATA				STANDARD PACKAGE TYPE See also page 11	
		Molecular weight	Assay (%)	Active oxygen (%)	Physical form	T _s max. (°C)	T _s min. (°C)	0.1 h	1.0 h	10 h	A (1/s)	E _a (kJ/mole)	SADT (°C)	T _{em} (°C)	T _c (°C)	UN No.		
	tert-Butyl peroxyvalate [927-07-1]	174.2		9.18				94	75	57	7.09E+14	123.59						
TRIGONOX 25-C75*	$\begin{array}{c} \text{CH}_3 \quad \text{O} \\ \quad \\ \text{CH}_3-\text{C}-\text{C}-\text{O}-\text{O}-\text{C}-\text{CH}_3 \\ \quad \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$		75	6.89	in hydrocarbon solvent	-5	-20						20	10	0	3113	HDPE can	
TRIGONOX 25-C40*			40	3.67	in hydrocarbon solvent	-5	-20							25	15	10	3119	IBC
TRIGONOX 25-C25*			25	2.30	in hydrocarbon solvent	-5	-20							15	10	5	3119	Bulk
	Di(3,5,5-trimethylhexanoyl) peroxide [3851-87-4]	314.5		5.09				96	77	59	2.84E+15	128.34						
TRIGONOX 36-C75*	$\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \quad \text{O} \quad \text{O} \quad \text{CH}_3 \quad \text{CH}_3 \\ \quad \quad \quad \quad \quad \\ \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}-\text{CH}_2-\text{C}-\text{O}-\text{O}-\text{C}-\text{CH}_2-\text{CH}-\text{CH}_2-\text{C}-\text{CH}_3 \\ \quad \quad \quad \\ \text{CH}_3 \quad \text{CH}_3 \quad \text{CH}_3 \quad \text{CH}_3 \end{array}$		75	3.82	in hydrocarbon solvent	0	-10						20	10	0	3115	HDPE can	
TRIGONOX 36-C50*			50	2.54	in hydrocarbon solvent	0	-10							25	15	10	3119	IBC
TRIGONOX 36-C37.5*			37.5	1.91	in hydrocarbon solvent	0	-15							10	5	0	3119	Bulk
TRIGONOX 36-W50			50	2.54	emulsion in water and methanol	0	-22							25	15	10	3119	HDPE can / IBC
	Dilauroyl peroxide [105-74-8]	398.6		4.01				99	79	61	3.92E+14	123.37						
LAUROX	$\text{CH}_3-(\text{CH}_2)_{10}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-(\text{CH}_2)_{10}-\text{CH}_3$		99	3.97	flakes	30							50	45	40	3106	carton	
LAUROX S			99	3.97	powder	30							50	45	40	3106	carton	
LAUROX W-40			40	1.61	suspension in water	20	0							50	45	40	3109	HDPE can / IBC
	2,2'-Azodi(isobutyronitrile) [78-67-1]	164.2						101	82	64	2.89E+15	130.23						
PERKADOX AIBN	$\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \\ \quad \\ \text{CH}_3-\text{C}-\text{N}=\text{N}-\text{C}-\text{CH}_3 \\ \quad \\ \text{CN} \quad \text{CN} \end{array}$		99		solid	25							50	45	40	3234	carton / fiber drum	
	2,2'-Azodi(2-methylbutyronitrile) [13472-08-7]	192.3						104	84	66	1.38E+15	128.93						
PERKADOX AMBN	$\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \\ \quad \\ \text{CH}_3-\text{CH}_2-\text{C}-\text{N}=\text{N}-\text{C}-\text{CH}_2-\text{CH}_3 \\ \quad \\ \text{CN} \quad \text{CN} \end{array}$		98		solid	25							45	40	35	3236	carton	
PERKADOX AMBN-GR				98		granules	25							45	40	35	3236	carton / fiber drum
	2,5-Dimethyl-2,5-di(2-ethylhexanoylperoxy)hexane [13052-09-0]	430.6		7.43				105	86	68	2.19E+15	130.88						
TRIGONOX 141	$\text{CH}_3-(\text{CH}_2)_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-\text{CH}_2-\text{CH}_3$		92	6.84	liquid	15	-20						35	25	20	3113	HDPE can	

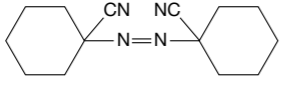
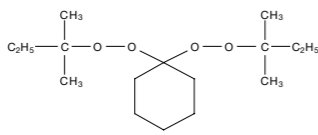
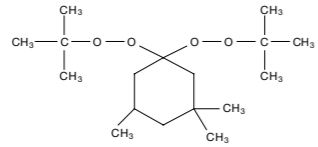
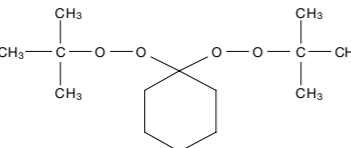
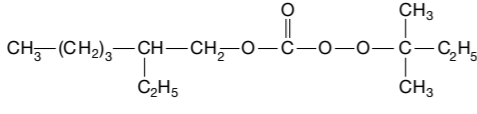
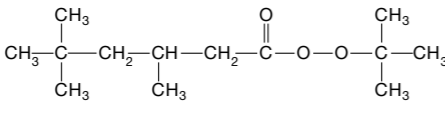
Our polymerization Initiators

* see explanation on page 11

PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	GENERAL DATA			Physical form	STORAGE DATA		KINETIC DATA T (°C) FOR T1/2					SAFETY DATA				STANDARD PACKAGE TYPE See also page 11	
		Molecular weight	Assay (%)	Active oxygen (%)		T ₂ max. (°C)	T ₂ min. (°C)	0.1 h	1.0 h	10 h	A (1/s)	E _a (kJ/mole)	SADT (°C)	T _{em} (°C)	T _c (°C)	UN No.		
PERKADOX PM-W75	Di(4-methylbenzoyl) peroxide [895-85-2]	270.3	75	5.91	powder	40		108	88	70	5.11+15	134.4					3106	carton
				4.38														
TRIGONOX 421	1,1,3,3-Tetramethylbutyl peroxy-2-ethylhexanoate [22288-43-3]	272.4	90	5.87	liquid	5	-20	109	88	69	1.62E+14	123.80	30	20	15	3115	HDPE can	
				5.29														
TRIGONOX 121	tert-Amyl peroxy-2-ethylhexanoate [686-31-7]	230.3	95	6.95	liquid	5	-20	111	91	73	1.77E+15	132.11	35	25	20	3115	HDPE can	
				6.60														
PERKADOX L-W75	Dibenzoyl peroxide [94-36-0]	242.2	75	6.61	wet powder	40		113	91	71	6.94E+13	122.35	80				3104	carton
PERKADOX L-W40		40	2.64		suspension in water	30	0							60				3109
																		
TRIGONOX 21S	tert-Butyl peroxy-2-ethylhexanoate [3006-82-4]	216.3	97	7.40	liquid	10	-30	113	91	72	1.54E+14	124.90	35	25	20	3113	HDPE can	
TRIGONOX 21-C50*		50	3.70		in hydrocarbon solvent	10	-30							40	35	30	3119	IBC
TRIGONOX 21-C30*		30	2.22		in hydrocarbon solvent	10	-10							25	20	15	3119	Bulk
																		
TRIGONOX 41-C50*	tert-Butyl peroxyisobutyrate [109-13-7]	160.2	50	9.99	in hydrocarbon solvent	10		118	98	79	2.07E+15	135.16	30	20	15	3115	HDPE can	
				4.99														

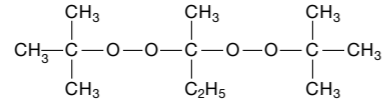
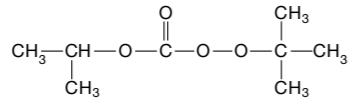
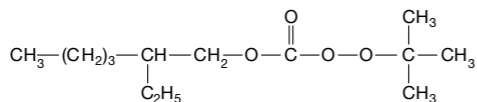
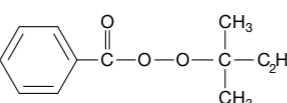
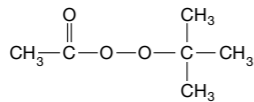
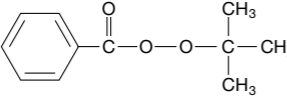
Our polymerization Initiators

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PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	GENERAL DATA			Physical form	STORAGE DATA		KINETIC DATA T (°C) FOR T1/2					SAFETY DATA				STANDARD PACKAGE TYPE See also page 11		
		Molecular weight	Assay (%)	Active oxygen (%)		T ₂ max. (°C)	T ₂ min. (°C)	0.1 h	1.0 h	10 h	A (1/s)	E _a (kJ/mole)	SADT (°C)	T _{em} (°C)	T _c (°C)	UN No.			
PERKADOX ACCN	1,1'-Azodi(hexahydrobenzotrile) [2094-98-6]	244.3						123	103	85	1.10E+16	142.19							
			98		powder		35							80			3226	fiber drum	
TRIGONOX 122-C80*	1,1-Di(tert-amylperoxy)cyclohexane [15667-10-4]	288.4		11.09				126	106	87	3.29E+15	139.46							
			80	8.88	in hydrocarbon solvent		30							55			3103	HDPE can	
TRIGONOX 29-C90*	1,1-Di(tert-butylperoxy)-3,3,5-trimethylcyclohexane [6731-36-8]	302.5		10.58				128	105	85	7.59E+13	127.52							
TRIGONOX 29-E90				90	9.52	in hydrocarbon solvent		25							60			3103	HDPE can
			90	9.52	solution in mineral oil		25							60			3103	HDPE can	
TRIGONOX 22-C80*	1,1-Di(tert-butylperoxy)cyclohexane [3006-86-8]	260.4		12.29				134	113	94	3.47E+15	142.40							
TRIGONOX 22-E50				80	9.83	in hydrocarbon solvent		25							60			3103	HDPE can
			50	6.14	solution in mineral oil		25							70			3105	HDPE can	
TRIGONOX 131	tert-Amylperoxy 2-ethylhexyl carbonate [70833-40-8]	260.4		6.14				134	113	95	2.22E+16	148.41							
			94	5.77	liquid		20							55			3105	HDPE can	
TRIGONOX 42S	tert-Butyl peroxy-3,5,5-trimethylhexanoate [13122-18-4]	230.3		6.95				135	114	94	1.94E+15	140.78							
TRIGONOX 42-C60*				97	6.74	liquid		25	-20						55			3105	HDPE can
TRIGONOX 42-C30*				60	4.17	in hydrocarbon solvent		25	-25						55			3109	IBC
			30	2.08	in hydrocarbon solvent		25	-20						45	40	35		3119	Bulk
							25	-20											

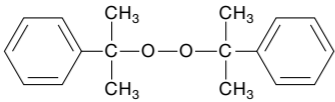
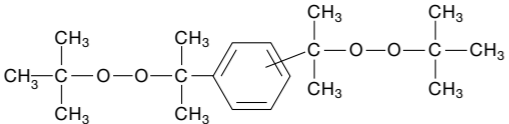
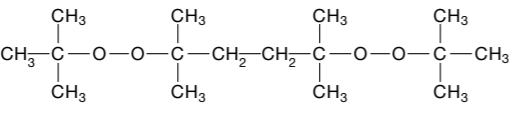
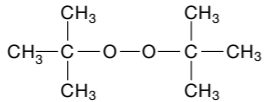
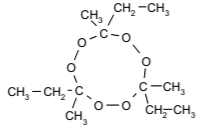

Our polymerization Initiators

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PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	GENERAL DATA			Physical form	STORAGE DATA		KINETIC DATA T (°C) FOR T1/2					SAFETY DATA				STANDARD PACKAGE TYPE See also page 11	
		Molecular weight	Assay (%)	Active oxygen (%)		T ₂ max. (°C)	T ₂ min. (°C)	0.1 h	1.0 h	10 h	A (1/s)	E _a (kJ/mole)	SADT (°C)	T _{em} (°C)	T _c (°C)	UN No.		
TRIGONOX D-C50*	2,2-Di(tert-butylperoxy)butane [2167-23-9]	234.3		13.66				136	116	98	9.30E+16	154.08						
			50	6.83	in hydrocarbon solvent	30							70				3103	HDPE can
TRIGONOX BPIC-C75*	tert-Butylperoxy isopropyl carbonate [2372-21-6]	176.2		9.08				137	117	98	2.49E+16	150.15						
			75	6.81	in hydrocarbon solvent	25	-20						70				3103	HDPE can
TRIGONOX 117	tert-Butylperoxy 2-ethylhexyl carbonate [34443-12-4]	246.3		6.49				137	117	98	4.07E+16	151.72						
			95	6.17	liquid	20							60				3105	HDPE can
TRIGONOX 127	tert-Amyl peroxybenzoate [4511-39-1]	208.3		7.68				139	118	99	8.38E+15	147.02						
			94	7.22	liquid	20							60				3103	HDPE can
TRIGONOX F-C50*	tert-Butyl peroxyacetate [107-71-1]	132.2		12.11				139	119	100	1.57E+16	149.36						
			50	6.05	in hydrocarbon solvent	10	-15						70				3103	HDPE can
TRIGONOX C	tert-Butyl peroxybenzoate [614-45-9]	194.2		8.24				142	122	103	2.23E+16	151.59						
			98	8.07	liquid	25	10						60				3103	HDPE can
TRIGONOX C-C75*			75	6.18	in hydrocarbon solvent	25	0						60				3105	HDPE can

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PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	GENERAL DATA				STORAGE DATA	KINETIC DATA T (°C) FOR T1/2					SAFETY DATA				STANDARD PACKAGE TYPE See also page 11	
		Molecular weight	Assay (%)	Active oxygen (%)	Physical form	T _i max. (°C)	T _i min. (°C)	0.1 h	1.0 h	10 h	A (1/s)	E _a (kJ/mole)	SADT (°C)	T _{em} (°C)	T _c (°C)		UN No.
PERKADOX BC-FF	Dicumyl peroxide [80-43-3]	270.4	99	5.92	crystals	30		154	132	112	9.24E+15	152.67	75			3110	carton
																	
PERKADOX 14S PERKADOX 14S-FL	Di(tert-butylperoxyisopropyl)benzene [25155-25-3]	338.5	96	9.08	solid	30		156	134	114	7.65E+15	152.69	80			3106	HDPE drum
			96	9.08	flakes	20							80			3106	carton
TRIGONOX 101 TRIGONOX 101-20PP TRIGONOX 101-7.5PP-BD TRIGONOX 101-E70	2,5-Dimethyl-2,5-di(tert-butylperoxy)hexane [78-63-7]	290.4	92	10.14	liquid	40	10	156	134	115	1.68E+16	155.49	80			3103	HDPE can / HDPE drum
			20	2.20	on polypropylene, beads	30							70			1325	carton
			7.5	0.83	on polypropylene, beads	30							70			none	carton
			70	7.71	solution in mineral oil	40	5						75			3109	HDPE can/IBC
TRIGONOX B TRIGONOX B-C90* TRIGONOX B-C30*	Di-tert-butyl peroxide [110-05-4]	146.2	99	10.83	liquid	40	-30	164	141	121	4.20E+15	153.46	80			3107	HDPE can / steel drum
			90	9.85	in hydrocarbon solvent	40	-25						75			3109	IBC
			30	3.28	in hydrocarbon solvent	40							65			3109	Bulk
TRIGONOX 301 TRIGONOX 301-20PP	3,6,9-Triethyl-3,6,9-trimethyl-1,4,7-triperoxonane [24748-23-0]	264.3	41	7.45	in hydrocarbon solvent	40	10	170	146	125	1.02E+15	150.23	110			3105	HDPE can
			8	1.45	on polypropylene, beads	40							90			3110	carton
TRIGONOX 501-CS40	1,2,4,5,7,8-Hexoxonane, 3,6,9-trimethyl-3,6,9-tris (Et and Pr) [1613243-54-1]	-	40	7.14	in hydrocarbon solvent	40	-25	170	146	125	1.09E+15	150.60	110			3105	HDPE can
																	

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** Contains 12.5% Di-tert-butyl peroxide (DTBP), total act. O 15.57%

PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	GENERAL DATA				STORAGE DATA		KINETIC DATA T (°C) FOR T1/2					SAFETY DATA				STANDARD PACKAGE TYPE See also page 11	
		Molecular weight	Assay (%)	Active oxygen (%)	Physical form	T ₂ max. (°C)	T ₂ min. (°C)	0.1 h	1.0 h	10 h	A (1/s)	E _a (kJ/mole)	SADT (°C)	T _{em} (°C)	T _c (°C)	UN No.		
TRIGONOX TMBH-L	1,1,3,3-Tetramethylbutyl hydroperoxide [5809-08-5] <chem>CC(C)(C)C(C)(C)OO</chem>	146.2	90	10.94 9.85	liquid	25	-5	180	159	140	1.90+18	181.99	60				3105	HDPE can
TRIGONOX K-90	Cumyl hydroperoxide [80-15-9] <chem>CC(C)(O)Oc1ccccc1</chem>	152.2	90	10.51 9.46	solution in aromatic solvent mixture	40	-30	195	166	140	1.15E+12	132.56	75				3109	HDPE can
TRIGONOX K-80			80	8.94	solution in aromatic solvent mixture	40	-30						70				3109	IBC
													75				3109	HDPE can
TRIGONOX A-80	tert-Butyl hydroperoxide [75-91-2] <chem>CC(C)(C)OO</chem>	90.1	80	17.75 14.20 **	solution in water and DTBP *	40	0	207	185	164	3.18E+17	186.01	90				3103	HDPE can
TRIGONOX A-W70			70	12.43	solution in water	35	0						80				3109	HDPE can / HDPE drum
						35	0						70				3109	steel IBC
						35	0						65				3109	plastic IBC
						35	0						55				3109	Bulk
TRIGONOX TAHP-W85	tert-Amyl hydroperoxide [3425-61-4] <chem>CC(C)C(C)OO</chem>	104.1	85	15.36 13.06	solution in water	30	-5	228	190	153			80				3109	HDPE drum



Trigonox® 501

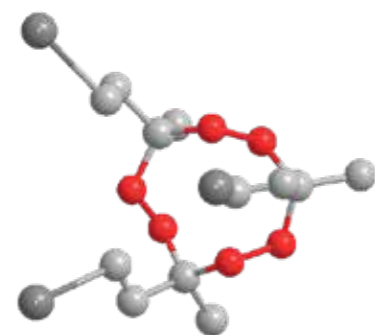
The next generation

We master science and technology to develop sustainable, innovative solutions that benefit our customers. For example, Trigonox® 501-CS40 peroxide, the most effective organic peroxide for Controlled Rheology Polypropylene (CR-PP) available in the market. This Nouryon invention offers several advantages over commonly used modifiers.



Why was this new product developed?

With the ever-larger size of PP production plants there is an increasing need for post reactor modification of PP, allowing for tailor made grades to be produced. Controlled Rheology Polypropylene is one of the best-known modified PP grades, and it finds use in many applications such as packaging, fibers and nonwovens. None of the current peroxides that are used for this application is ideal: they suffer from specific disadvantages such as high volatile generation, poor organoleptic properties, complex handling and safety issues, and high cost.



Trigonox® 501-CS40 is a drop-in replacement for Trigonox® 301

Trigonox® 501-CS40 peroxide is the next generation of organic peroxides for use in CR-PP. It addresses the industry-wide need to reduce Volatile Organic Compounds (VOC's) in CR-PP resin by generating significantly lower amount of VOC's than other commonly used peroxides.

Trigonox® 501-CS40 peroxide also shows excellent organoleptic properties and has been approved for food contact applications by both BfR and FDA. Quite uniquely, Trigonox® 501-CS40 product does not require any temperature conditioning for storage, which simplifies daily operations. And last but not least, Trigonox® 501-CS40 product is cost effective and helps to reduce production costs for CR-PP grades.

Trigonox® 421

For a sustainable night's rest

As a company of innovation we have a stream of new, high-value products and technologies, including our latest generation Trigonox® 421 organic peroxide for acrylic polymerization and polymer polyols production. Polymer polyols are used for foams used in e.g. upholstery and mattresses.

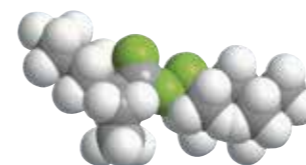
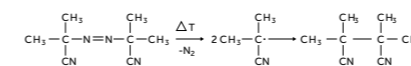


Trigonox® 421 peroxide is an eco-premium alternative to commonly use azo initiators.

- TMSN free
- No toxic decomposition products
- Drop-in replacement for AIBN and AMBN
- Easy to dose liquid

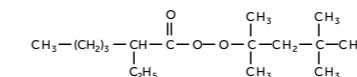
A new azo alternative

AIBN [2,2'-Azodi(isobutyronitrile)] is used in many polymerization processes. Upon decomposition the toxic tetramethylsuccinonitrile (TMSN) is formed. In answer to this problem Nouryon has developed Trigonox® 421, peroxide making TMSN history. On a yearly basis some 4,000 tons of TMSN are produced through the decomposition of AIBN:



Azo initiators and more specifically AIBN is used for its unique properties. Upon decomposition it generates 100% selective C-centered radicals. Compared to aggressive, O-centered radicals, that are generally formed by organic peroxides, these C-centered radicals allow for much better molecular weight control. This is mainly caused by the lower level of branching generated. This is specifically important for applications as high solid acrylic resins and polymer polyols.

Contrary to AIBN 1,1,3,3-tetramethylbutyl peroxy-2-ethylhexanoate (Trigonox® 421 product) does not generate toxic by-products:



Unlike most other peroxides, Trigonox® 421, upon decomposition, almost exclusively generates selective C-radicals. It is therefore, just like AIBN, specially suitable for those applications where control of branching and molecular weight is important. Meanwhile Trigonox® 421 product has replaced AIBN already in many commercial applications, proving the above concept in practice.

Another benefit of Trigonox® 421 peroxide is that it is liquid. It is, therefore, much easier to dose in industrial batch- and continuous processes.

In summary:

- Trigonox® 421 is a drop-in replacement for AIBN
- Trigonox® 421 generates no toxic decomposition products
- Trigonox® 421 is liquid, therefore easy to dose

Contact us

For product inquiry and ordering information, please contact your Nouryon account manager or regional sales office.

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Additional information

Product Data Sheets (PDS) and Safety Data Sheets (SDS) for our polymerization initiators are available at [nouryon.com](https://www.nouryon.com)

For information on our antifouling and secondary suspending agents please contact us. On request we also provide specific publications on the use and the safe handling and storage of our products.

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