

ASEPTIC PACKAGING

Hydrogen peroxide and peracetic acid
for the food and beverage industry

OXTERIL[®]
PERACLEAN[®]





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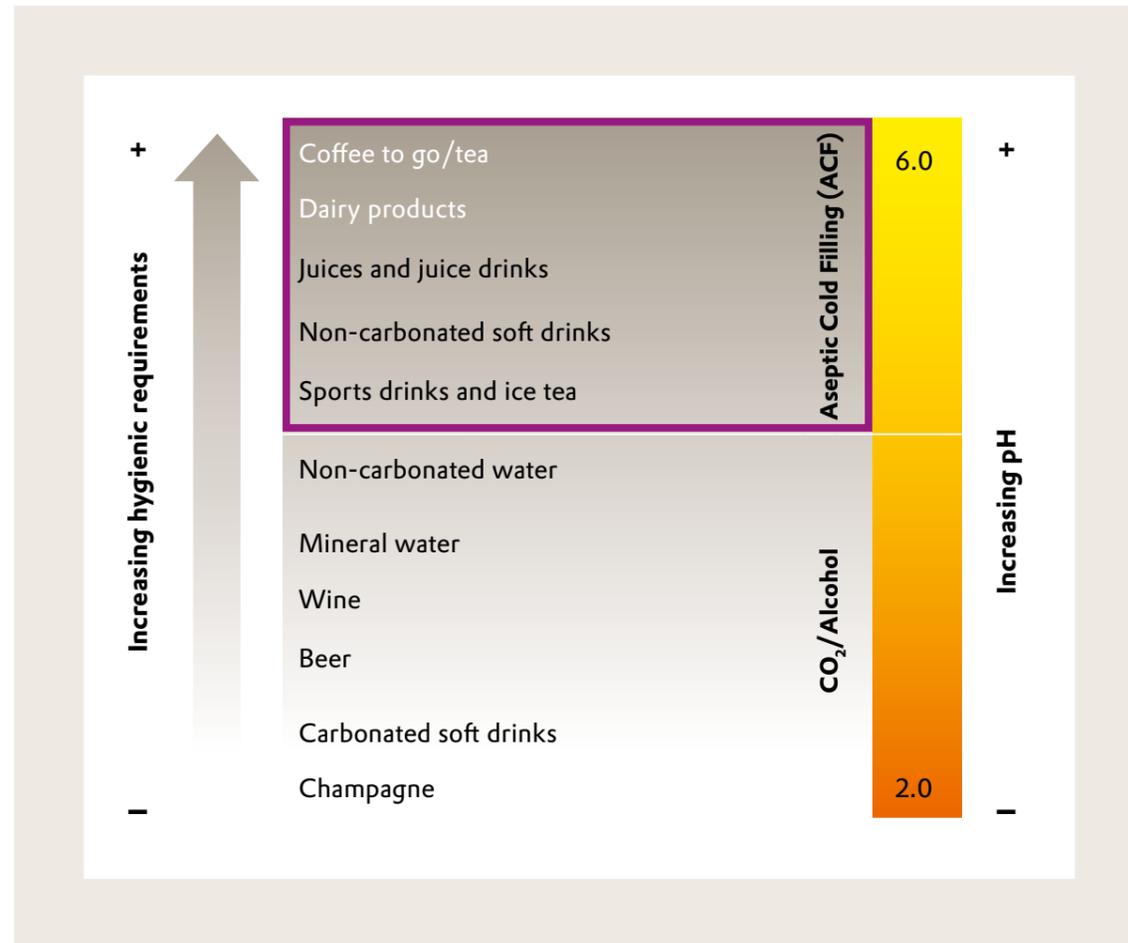
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Evonik is one of the world’s largest producers of hydrogen peroxide. Our worldwide capacity is more than 950,000 tonnes per year. We are the innovative leader in high quality products and services, offering more than a century of worldwide experience to serve the megatrends of the modern society and to deliver an exceptional value for our customers. To ensure optimal supply of hydrogen peroxide to the world market, we operate production facilities at thirteen locations around the world.

ASEPTIC PACKAGING – DEFINITELY SAFE

Aseptic packaging is used to protect food and beverages all along the supply chain. It guarantees a high quality of the packed food stuff combined with a long shelf life. As consumer demand grows for preservative-free 'natural' beverages and for products with additional benefits, nowadays a vast variety of food and beverage products are aseptically packaged in cartons, pouches, cups or bottles. Aseptic packaging utilizes hydrogen

peroxide or peracetic acid for the sterilization of the packaging material and machines and enables the introduction of gently bottled beverages without additional thermal stress or added preservatives. The focus is on slightly acidic to neutral pH food and beverage products with rising hygienic requirements, such as dairy products and juices.



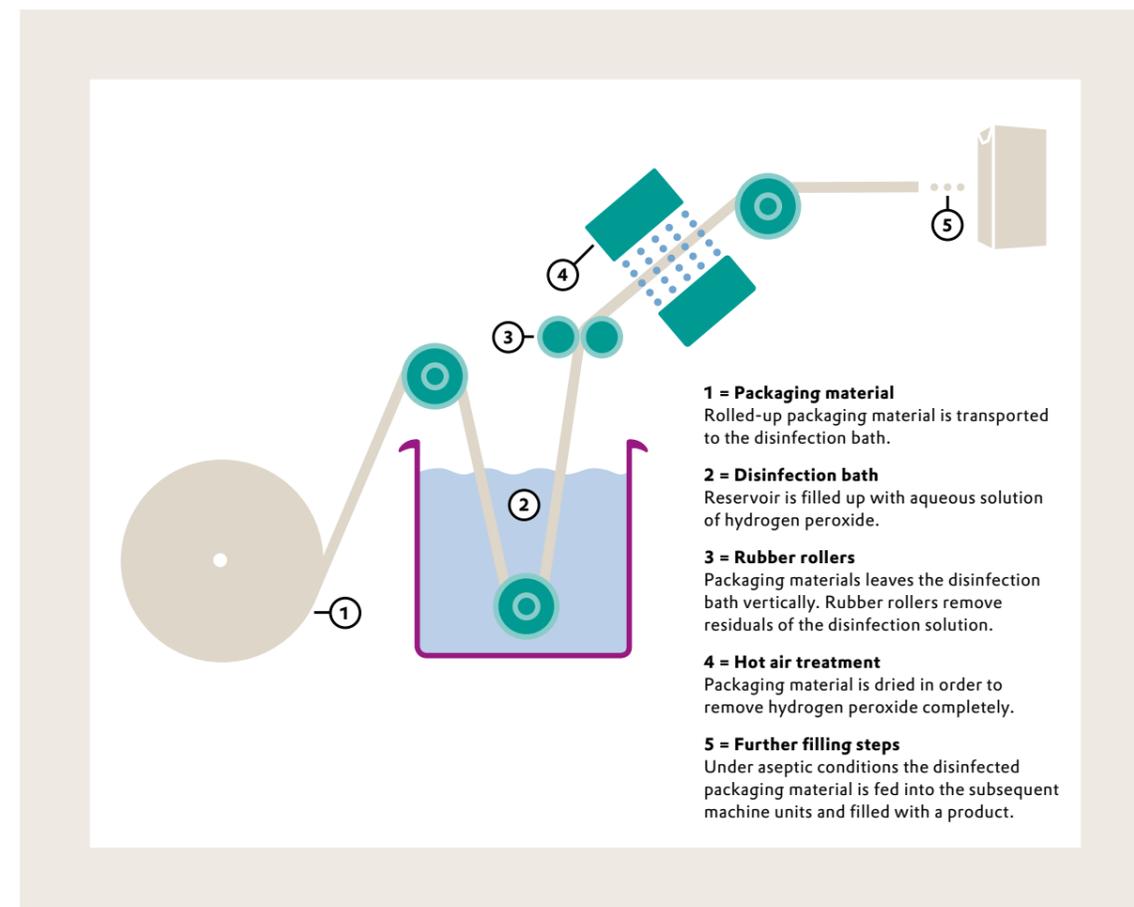
Evonik is a trusted and long-standing partner to the aseptic packaging industry, supplying OXTERIL® and PERACLEAN® products with superior quality and outstanding technical service. Our continuous product innovation in close cooperation with our customers and leading aseptic machine manufacturers allows us to provide technology tailored cutting-edge products. Our products are approved and recommended by the major packaging machine manufacturers, such as Bosch, Elopak, GEA, KHS, Krones, SIG, TetraPak and many more.

TAKING A CLOSER LOOK – ASEPTIC PACKAGING TECHNOLOGIES

The core step in aseptic packaging is to disinfect the packaging material in order to prevent any biological contamination of the foodstuff during the packaging process. Currently, the standard aseptic process is able to reduce the germ count by log5 and there are even attempts to reach log6 in the future. Looking more into the details of this technology, there are mainly four different approaches.

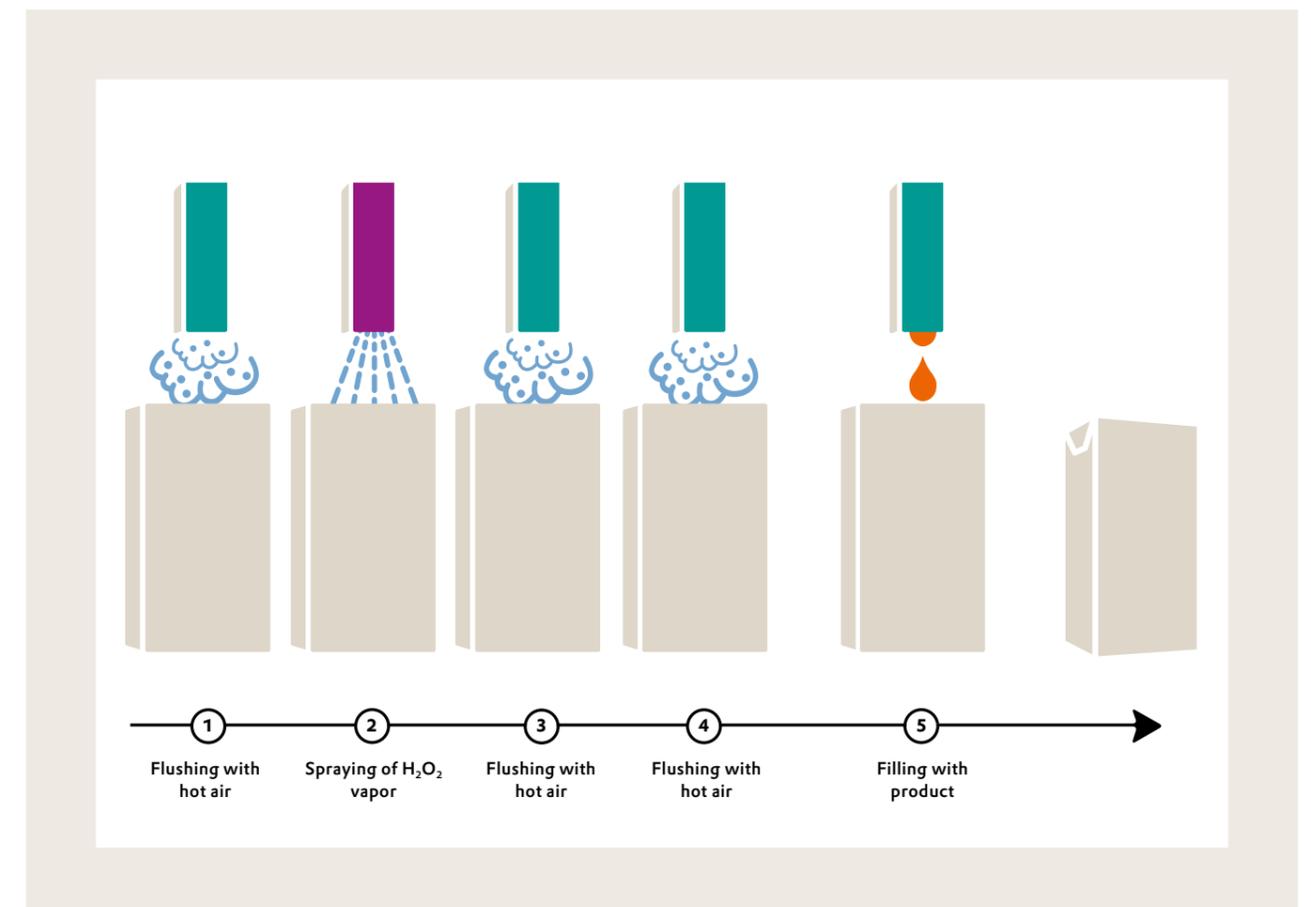
Immersion bath technology

The still flat but printed packaging material (in this case always multilayer paperboard carton) is pulled through a heated bath of 35% H₂O₂. As there are only a few seconds of contact, the H₂O₂ has to be heated up to a temperature of 70 - 85 °C to achieve an appropriate germ reduction. Remaining hydrogen peroxide is removed by pressurized air, then the carton is formed, the food filled in and the packaging unit sealed. It is a common effect that due to the bath temperature water is evaporated and thus the concentration of the remaining H₂O₂ goes up above 40%. This trend turns around the moment there are enough impurities in the bath (e.g. coming with the paperboard) and the resulting decomposition is faster than the evaporation. In some machines there is an active dilution feature installed which feeds deionized water into the bath to keep the concentration below an upper limit. Current machines produce about 8,000 - 15,000 units per hour. The average consumption of H₂O₂ 35% is about 0.2 ml per packaging unit.



Spraying technology

In this case the fully printed and preformed packaging units are sprayed with vaporized hydrogen peroxide. Besides the traditional multilayer paperboard carton those machines can also be designed to process cups, cans or small plastic bottles. The temperature of the vapor is about 150 - 200 °C to compensate the even shorter contact time compared to the immersion bath. Remaining disinfectant is removed by spraying hot steam afterwards. The foodstuff is then filled in and the unit is sealed. Available machines slightly vary in how to heat and dose the hydrogen peroxide. Current machines produce about 10,000 - 24,000 packaging units per hour, the average consumption of H₂O₂ 35% is about 0.2 ml per packaging unit. Some of the PET bottle machines use a spraying step as well by dosing peracetic acid into a stream of hot steam. Consumption here is about 0.3 ml peracetic acid 5% per unit.



Dry disinfection

The so-called dry disinfection is a further developed spraying technology, first applied for PET bottles. Hydrogen peroxide is sprayed into a bottle in a way that no condensation occurs at the inner walls of the packaging unit. Thus, removal of remaining disinfectant is much easier. Current PET bottle machines are much bigger than the paperboard machines described above. They usually start with the plain plastic granulates as raw material and include a blower module to produce the bottles on site. Their capacity goes up to 50,000 units per hour, consuming about 0.6 ml H₂O₂ 35% per unit.

Rinser cold disinfection

PET bottle packaging machines could also have a rinser instead of a dry disinfection module. This technology rinses the bottles (upside down) with an aqueous disinfectant solution, mostly based on peracetic acid as active chemical. A second washing step with clear water must follow to remove remaining disinfectant. The rinser approach does not need high temperatures and is also named cold aseptic. Average consumption of peracetic acid is about 0.2 - 0.5 ml per unit.



EVONIK'S PORTFOLIO FOR ASEPTIC PACKAGING

The described aseptic packaging technologies allow diverse and tailor-made packaging options for today's market trends (e.g. fancy shaped packaging, "to-go" packaging, high sophisticated opening devices). In order to accompany these market trends and to meet the requirements of the industry, Evonik is constantly developing its products. We offer PERACLEAN® peracetic acid products and OXTERIL® hydrogen peroxide products, specially designed for the use in state-of-the-art aseptic packaging technologies.

Analogue to hydrogen peroxide, peracetic acid belongs to the group of oxidative disinfectants acting on microbes by oxidizing their proteins and cells. Typical products are PERACLEAN® 5 and PERACLEAN® 15 with an peracetic acid content of 5% and 15%, but several other grades and concentrations are available as well. OXTERIL® is a 35% aqueous solution of highly purified high quality hydrogen peroxide based on a non-stannate containing stabilizer system that forms little to no residue on the packaging machines. OXTERIL® 350 BATH and OXTERIL® 350 SPRAY are tailor made for the individual immersion bath or spray process with regards to product stability, residues and packaging line effectiveness.

OXTERIL® 350 COMBI is designed especially for customers who run both immersion bath and spraying machines and feed the H₂O₂ out of one storage unit. OXTERIL® 350 SPRAY S is a high performance product characterized by extremely low evaporation residues, increased machine running times and reduced cleaning efforts. Therefore, this grade is especially suitable for dry disinfection processes. In order to meet the stringent requirements of the latest generation of high throughput packaging machines the stabilizer content in OXTERIL® 350 Spray S has been reduced to a minimum. Consequently, the use of the product in production has to be controlled thoroughly and any contact with stainless steel or other sources of possible contamination has to be kept at a minimum.

To guarantee a smooth and safe production at the customer site, it is key to choose the suitable product for each machine and process. If, for instance, a non-spray grade is used on spraying machines, the nozzles which apply the hydrogen peroxide onto the packaging surface can be blocked. This may lead to non-sterile conditions. Additionally, the high residues will build up in the evaporation unit resulting in higher energy consumption and superheating of the liquid.

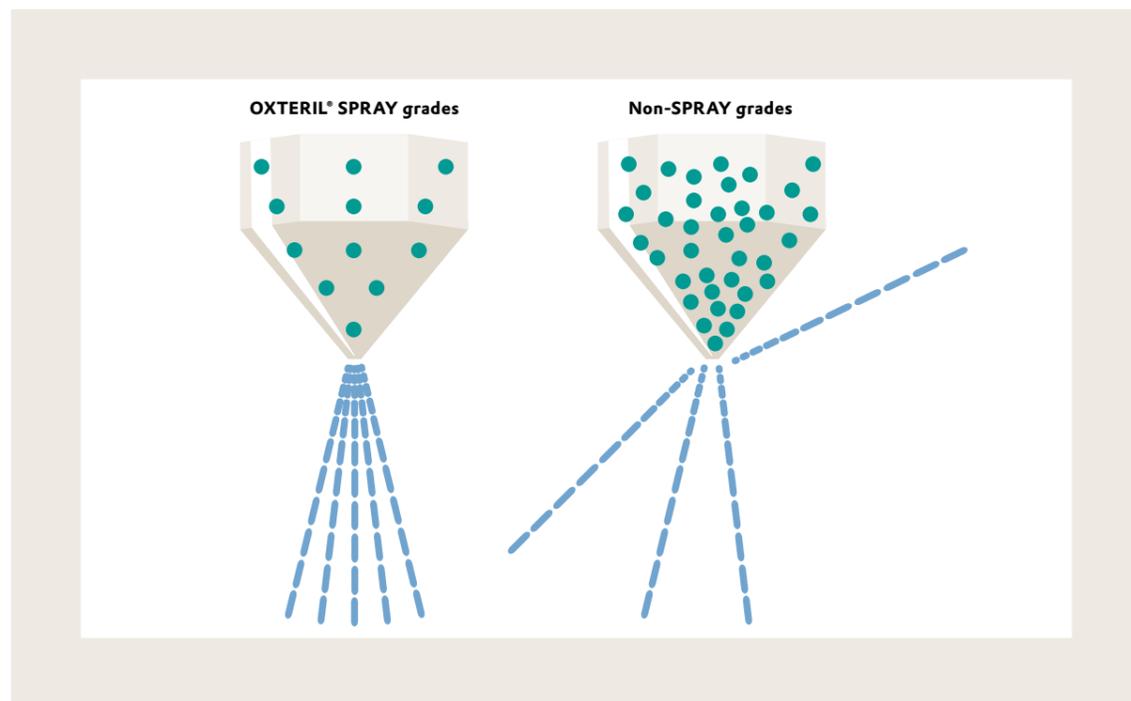


Table 1: Application guide

Product	Active substance	Application/process	Main packaging material
OXTERIL® 350 BATH	Hydrogen peroxide	Immersion	Carton
OXTERIL® 350 COMBI	Hydrogen peroxide	Spraying/dry disinfection and immersion	Carton, PET, PE
OXTERIL® 350 SPRAY	Hydrogen peroxide	Spraying/dry disinfection	Carton, PET, PE
OXTERIL® 350 SPRAY S	Hydrogen peroxide	Spraying/dry disinfection	Carton, PET, PE
PERACLEAN® 5	Peracetic acid	Rinser cold disinfection	PET, PE
PERACLEAN® 15	Peracetic acid	Rinser cold disinfection	PET, PE

Use biocides safely. Always read the labeling and the product information before use.

The table below shows an extract of specified and typical values of the four OXTERIL® grades and their compliance with the monograph of the Food Chemicals Codex (FCC).

Table 2: OXTERIL® product properties

Product	Unit	OXTERIL® 350 BATH	OXTERIL® 350 COMBI	OXTERIL® 350 SPRAY	OXTERIL® 350 SPRAY S	FCC Monograph
Specified						
H ₂ O ₂ -content	%	35 - 36	35 - 36	35 - 36	35 - 36	
Non-volatile residue	ppm	< 30	< 25	< 20	< 10	< 60
Typical						
Acidity (as H ₂ SO ₄)	%	< 0.025	< 0.025	< 0.025	< 0.025	< 0.03
Phosphate (as PO ₄)	ppm	< 10	< 10	< 10	< 5	< 50
Lead (Pb)	ppm	< 0.02	< 0.02	< 0.02	< 0.02	< 4
Iron (Fe)	ppm	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5
Tin (Sn)	ppm	< 0.1	< 0.1	< 0.1	< 0.1	< 10

BIOCIDAL PRODUCT REGISTRATION (BPR)

The aim of the BPR is to harmonize the European rules for biocidal products and their active substances. Through risk assessment, it intends to provide a high level of protection for people, animals and the environment and to ensure that products are sufficiently effective against the target species. The BPR stipulates a two-step process, in which the active substance evaluation is followed by a product authorization of individual biocidal products. Biocidal products from Evonik containing peracetic acid and/or hydrogen peroxide fulfil the obligations of the European Biocidal Products Regulation

(BPR) (EU) No. 528/2012 and are therefore actively supported in the product registration under the BPR. In the transitional period the existing biocidal products are marketed with existing national biocidal registrations. In accordance with BPR, aseptic packaging represents a biocidal application, which is classified in "Main Group 1: Disinfectants, Product type 4 – Food and feed area." Evonik applies for the Union Authorization under the BPR, including product type 4. **Please contact us if you have any questions or need support with your registration.**



LABELING AND TRANSPORTATION

Hydrogen peroxide solutions with concentration higher than 8% by weight as well as aqueous solutions of peracetic acid are dangerous substances, e.g. according to Global Harmonized System (GHS) and the European Regulation No. 1272/2008. They must be labeled and handled correspondingly.

The exact classification of the particular product depends on the concentration of hydrogen peroxide and peracetic acid. The table below represents the classification of the aseptic products. **Please refer to our Material Safety Data Sheet for further details.**

Table 3: Classification of aqueous hydrogen peroxide solutions and peracetic acid according to the European Regulation No. 1272/2008

OXTERIL® 350 BATH food grade / OXTERIL® 350 SPRAY food grade OXTERIL® 350 COMBI food grade / OXTERIL® 350 SPRAY S food grade		
Hazard statements	H302 H315 H318 H332 H335	Harmful if swallowed. Causes skin irritation. Causes serious eye damage. Harmful if inhaled. May cause respiratory irritation.
Prevention statements	P261 P280 P301 + P312 P302 + P352 P304 + P340 P305 + P351 + P338	Avoid breathing dust/fume/gas/mist/vapours/spray. Wear protective gloves/protective clothing/eye protection/face protection. IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. IF ON SKIN: Wash with plenty of water/soap. IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
PERACLEAN® 5		
Hazard statements	H242 H290 H302 H312 H314 H332 H335 H410	Heating may cause a fire. May be corrosive to metals. Harmful if swallowed. Harmful in contact with skin. Causes severe skin burns and eye damage. Harmful if inhaled. May cause respiratory irritation. Very toxic to aquatic life with long lasting effects.
Prevention statements	EUH071 P210 P234 P273 P280 P302 + P352 P305 + P351 + P338 P308 + P311	Corrosive to the respiratory tract. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Keep only in original container. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection. IF ON SKIN: Wash with plenty of water/soap. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF exposed or concerned: Call a POISON CENTER/doctor.
PERACLEAN® 15		
Hazard statements	H242 H290 H302 H312 H314 H332 H335 H410	Heating may cause a fire. May be corrosive to metals. Harmful if swallowed. Harmful in contact with skin. Causes severe skin burns and eye damage. Harmful if inhaled. May cause respiratory irritation. Very toxic to aquatic life with long lasting effects.
Prevention statements	EUH071 P210 P273 P280 P303 + P361 + P353 P305 + P351 + P338 P308 + P311 P391	Corrosive to the respiratory tract. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF exposed or concerned: Call a POISON CENTER/doctor. Collect spillage.



ESHQ

Our environment, safety, health and quality values set out our commitments in these areas. Together with more detailed guidelines and procedures, they form a binding framework. The ESHQ values define protection of people and the environment as central elements of our activities. Evonik is committed to the global Responsible Care initiative, and we constantly strive to improve our performance in health, safety, environment and product stewardship. Our manufacturing facilities worldwide are certified according to the ISO 9001 as well as 14001 and 50001 series.

Packaging and storage

Depending on customer, grade, region and other requirements, the shipment of hydrogen peroxide and peracetic acid is made in small to large containers. For consumers of large quantities, the installation of a storage tank is recommended. It is our declared policy to pass on our many years of experience with hydrogen peroxide and peracetic acid to our customers. This includes the planning and construction of tank installations.

Our service can cover:

- Initial consultation
- Project planning and construction work
- Start-up
- Repair and modification work on
- Hydrogen peroxide installations
- Pre-delivery inspection

Common forms of packaging for hydrogen peroxide and peracetic acid are:

- Plastic canister: depending on product and concentration: 30 kg, 65 kg can (other sizes upon request)
- IBC (Intermediate Bulk Container): 1000 - 1200 kg
- Road tanker: up to 25 tonnes
- Overseas ISO container: 20 tonnes

In Germany, plastic packaging of hazardous products can be returned by the use of the RIGK-G-SYSTEM free of charge. The packaging is conveyed to a recovery system in accordance with the terms of the German Closed Substance Cycle Act (Kreislaufwirtschaftsgesetz [KrWG]).

For more information and contact data please visit www.rigk.de.

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