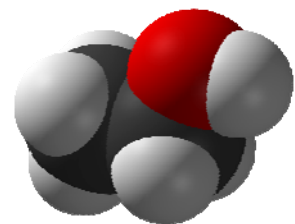
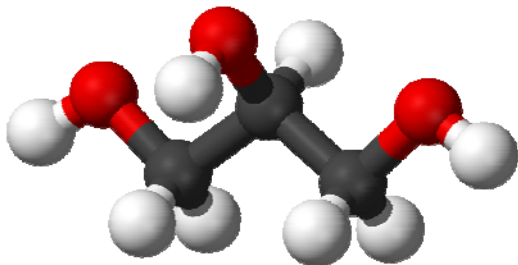
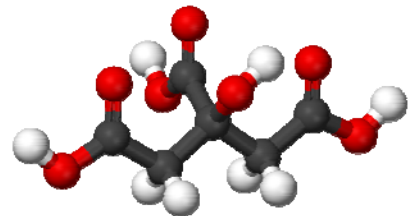
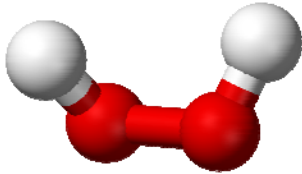


**FOOD
DECONTAMINATION
Information brochure**

FREEBAC D-150

Hydrogen peroxide solution 36%



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1. INTRODUCTION

After several years of intensive research and development, FREEBAC D-150 has successfully been introduced to the market. FREEBAC D-150 is a biological and environmental friendly product that reduces organic and bacteriological contamination. FREEBAC D-150 is primarily developed for the food processing industry and agriculture.

In 1995 a new category called "decontamination agents" was added to the Dutch Pure Food Act. In 2001 permission was granted to use FREEBAC D-150 as decontamination agent in the fish sector in Holland.

1.1 Composition and properties

FREEBAC D-150 is composed of 36% hydrogen peroxide (H_2O_2) and a carrier. The active ingredient is hydrogen peroxide, while the carrier prevents rapid dissolution of the hydrogen peroxide and creates a durable coating. Hydrogen peroxide dissociates into atomic oxygen and water. Atomic oxygen eliminates micro-organisms.

Leaving a coating on the treated product causes the long lasting and preserving effect of FREEBAC D-150. By stabilising the hydrogen peroxide, atomic oxygen will be released thereby preventing infection and re-infection. There are three types of FREEBAC D-150, all with different compositions to meet the desired strength and efficacy.

FREEBAC D-150:

- 💧 Eliminates bacteria and organic pollution
- 💧 Leaves a coating on the product
- 💧 Protects the product against infection and re-infection
- 💧 Is mild and long lasting
- 💧 Dissolves both gram positive as well as gram negative bacteria, viruses, moulds, algae and prevents slime and slime build-up
- 💧 Is not an antibiotic; no resistance can be built up

1.2 Basic features

FREEBAC D-150 has the features of a broad-spectrum disinfectant and distinguishes itself from conventional disinfectants (e.g. hydrogen peroxide, chlorine) by its mild and long lasting effects. Thanks to its unique features, it is permissible to put FREEBAC D-150 in direct contact with food, when the prescribed concentrations are followed.

1.3 Internal environmental policy

For many food producing and agricultural businesses it's difficult to manage bacteriological contamination. Legislations forces companies to meet stated quality requirements. FREEBAC D-150 can help you to meet those quality requirements safely.

2. APPLICATIONS

Applications of FREEBAC D-150 can be divided into two categories: preservation and disinfection.

2.1 Preservation

The main category is preservation: preventing the current bacteriological level from increasing. This application is ideal for the treatment of food, because it is not allowed to disinfect food after contamination. A rather low concentration of FREEBAC D-150 solution is used to prevent an increase in the present bacteriological contamination level.

2.2 Disinfection

The other category is disinfection. Disinfection reduces the bacteriological level significantly. Disinfection of production and storage rooms, equipment and machinery falls under this category. Once you have disinfected, you can always maintain a low concentration of FREEBAC D-150 to prevent bacteriological growth (preservation).

The main difference between these applications is the concentration of FREEBAC D-150. For preservation the concentration can vary between 0.01% and 0.1%. For disinfecting the concentration can vary between 0.5% and 3.0%.

FREEBAC D-150 can be applied in cases where the bacteriological quality of the product is vital and can be used in various fresh, deep-frozen, dried and other sorts of preserved foods, like diced or precooked vegetables, dairy products, mussels, shrimps, various other fish and fish products, meat and meat products and ready-made meals.

Other possible applications are the treatment of edible and hatching eggs, stables and areas where food products are prepared, processed, packed and stored.

FREEBAC D-150 has broad disinfection potential. It destroys gram positive as well as gram-negative bacteria, viruses, yeasts, algae and fungi and it prevents the build-up of slime and foam.

3. SYSTEMS

The following application possibilities are described below:

- 💧 FREEBAC D-150 added to processing water (section 3.1)
- 💧 FREEBAC D-150 applied as a spray (section 3.2)
- 💧 FREEBAC D-150 applied as an aerosol (section 3.3)

3.1 Washer

Industrial washers are used in almost every factory within the fish and vegetable/fruit processing industry. These washers are used to cool the product and/or to remove organic pollution. At the start of the process the washer is filled with clean and cool processing water. This water is circulated by means of a conveyor-belt or air injector. A clean water supply constant refreshes the water. During the process the circulating water becomes organically polluted and contaminated with micro-organisms, with result that the processed food products also become contaminated. To avoid contamination there are several solutions in which FREEBAC D-150 can play an important role.

When using FREEBAC D-150 during the washing process, which often is one of the first steps in manufacturing, the accent is on the preventative action and not on the corrective action of reducing existing bacteria later on in the manufacturing process. FREEBAC D-150 is able to keep the bacterial count of the food product at an acceptable level by leaving a minimal (non-detectable) coating of FREEBAC D-150, which protects the product from re-infection during processing.

How to use FREEBAC D-150 during the washing-process

To avoid contamination, the water can be refreshed continuously instead of being re-circulated. This would require enormous quantities of water. As an alternative, FREEBAC D-150 can be injected into the washer during fill-up. The ideal location for injection is into the washer just above the air-injection. Here, a maximum mixture throughout the washer is assured. With the exception of the formed coating on the product the surplus of FREEBAC D-150 will be flushed away by the sprayers above the outlet conveyor belt.

Another solution is to inject FREEBAC D-150 directly into the water, which is supplemented by the sprayers above the outlet conveyor belt to shower the washed products with a fresh FREEBAC D-150 solution. The surplus flows into the washer where FREEBAC D-150 continues its work. To provide an optimum FREEBAC D-150 concentration in the washer, the FREEBAC D-150 injection can be directed by a flow meter measuring the flow of FREEBAC D-150 supplemented water through the sprayers.

Injection into supplemented water

a) Constant

In the case of a constant flow the processing water is constantly refreshed. A steady amount of FREEBAC D-150 is injected into a tube or tank by using a dosing-pump.

b) Variable

In the case of a variable flow, for example by production interruption or when only a part of the total capacity is used, the FREEBAC D-150 injection has to be adapted to prevent the concentration of FREEBAC D-150 in the system from becoming too high.

Methods for injection into water

Flow-dependent pumps with variable concentration

This pump is also called a 'non-electric flow-proportional feeder'. The injector works fully automatically: it injects more FREEBAC D-150 if more water passes by.

Complete dosing installation

Metering-pump directed by the pulses of a contact water-flow meter.

Injection into circulation-water

In case of circulation or recycling of processing water, the first question to answer is whether the flow is constant or variable and if flow-dependent injection is necessary. FREEBAC D-150 decomposes as a consequence of the oxidation of organic and bacteriological contamination. In most cases, the processing water will still contain FREEBAC D-150 after circulation. To prevent the concentration of FREEBAC D-150 from accumulating, a concentration-dependent injection system should be used.

The number of free oxygen radicals is directly related to the concentration of hydrogen peroxide. These free radicals can be measured with peroxide test-strips (see section 5.2).

3.2 Spraying

A spraying-system can be applied where no processing water is used or in those situations where the product cannot totally be immersed in water. In the case of a spraying-system FREEBAC D-150 is sprayed in a certain concentration above a conveyor belt directly onto the product.

The amount and concentration of FREEBAC D-150 to be sprayed depends on both the bacteriological contamination and organic pollution of the food as well as on the vulnerability of the food towards FREEBAC D-150 (hydrogen peroxide). It is important that sufficient FREEBAC D-150 is sprayed onto the food to protect against all micro-organisms.

It is advantageous to spray in an enclosed space, so the FREEBAC D-150 will be used optimally and can be recollected to be re-used. The length of the spraying tunnel and the number of nozzles depends on the speed of the conveyor belt and the contact time which needs to be achieved.

The spraying-system is based on water pressure. A vacuum pump or an electric dosing pump, directed by a flow meter, ensures the correct concentration is applied. The amount of sprayed solution can vary between 60 l/h (nozzle) and 200 l/h (shower).

FREEBAC D-150 dosage for washer or spray:

1. Use 1 litre of FREEBAC D-150 for 1,000 kg of product
2. 0.1% -0.5% concentration
3. Effectiveness is determined by combination of concentration and contact time
4. The longer the contact-time with FREEBAC D-150 and the higher the turbulence of the wash water the better the result

3.3 Aerosol

An aerosol/air-humidifying system is based in the principle of moistening the air with microscopic droplets of FREEBAC D-150 solution (~1-10 micron) in gasiform. As an aerosol, FREEBAC D-150 can be applied to products which are not permitted to become visibly moist in air circulation systems and in accommodations or other situations where clean air is desired.

There are two ways of moistening air:

- 💧 FREEBAC D-150 is atomised in very small drops (aerosol) by an atomiser by means of air pressure; for example into an air-supply pipe.
- 💧 Adiabatic moistening. According to the rotation principal, a very fine water-aerosol of 5-15 microns is produced. The heat of room temperature evaporates these drops.

When using FREEBAC D-150 as an aerosol the dissolution is very high. The preserving or disinfecting action of the air is fast and very effective. We advise spraying to disinfect surfaces (e.g. the walls and machinery in the room) by FREEBAC D-150 aerosols to maintain an optimal hygienic climate in accommodations (e.g. stables, hatcheries, storage rooms).

4. DEPLOYMENT

In any (new) application of FREEBAC D-150 the following choices have to be made:

- 💧 Which concentration?
- 💧 Which system?

The optimal concentration of FREEBAC D-150 has to be determined experimentally. The following overview gives some guidelines to determine the starting value.

It is not possible to express the action time of FREEBAC D-150 in absolute terms. The action time depends on different factors including exposure to organic pollution and ambient temperature.

In case of higher temperatures (above 20 degrees Celsius) the processing of hydrogen peroxide will occur faster and therefore more stabiliser should be used. If the temperature drops below zero degrees Celsius there is no multiplication of the bacteria and no decomposition of FREEBAC D-150. FREEBAC D-150 will not dissolve spontaneously in a medium that is free from bacteria or any organic matter.

4.1 Which concentration?

The concentration of FREEBAC D-150 determines how much active substance (H_2O_2) is present. It is important to consider the difference between disinfection and preservation (section 2).

Three different categories are distinguished:

1. Living organisms
mussel, eel;
0,01% -0,05%
2. Food
vulnerable surface { fish fillet);
0,1% -0,25%
less vulnerable surface (oranges);
0,25% -0,5%
3. Non food
Equipment, accommodation
0,5% -3%

In each category different systems are distinguished:

- 💧 dipping / rinsing
- 💧 spraying
- 💧 atomising (aerosol/air humidifying systems)

Within a certain range the concentration can be optimised depending on the following factors:

Condition	Concentration
High bacteriological contamination	Higher
Low bacteriological contamination	Lower
Much organic pollution	Higher
Little organic pollution	Lower
Shorter exposure time	Higher
Longer exposure time	Lower
Higher turbulence	Lower
Lower turbulence	Higher
Higher temperature	Lower
Lower temperature	Higher

Factors that influence the efficacy of FREEBAC D-150:

- 1 **Bacteriological contamination:** the count-plate is a measure for the bacteriological contamination. The higher the count-plate, the more bacteria are present, and the more active substance is needed to reduce the count-plate sufficiently.
- 2 **Organic pollution:** not only bacteria, but also organic pollution is oxidised by FREEBAC D-150. The more organic pollution (e.g. blood, meat rests), the more dissolution of FREEBAC D-150. Therefore it is important that the equipment and accommodation is thoroughly cleaned before being disinfected with FREEBAC D-150.
- 3 **Contact time:** the contact-time is the time that the surface to be treated is in contact with a 'fresh' solution of FREEBAC D-150.
- 4 **Turbulence:** by means of turbulence you can make sure that the active substance is in optimum contact with the surface to be treated.

In case of dipping food, turbulence is created by continuously supplying a 'fresh' solution of FREEBAC D-150 to keep the rinsing-basin at the right concentration. It is beneficial to move the product through the solution or inject air in the basin.

In case of atomising accommodations, care should be applied to ensure that there is a large enough blast of air (e.g. by means of a fan).

- 5 **Temperature:** at higher temperatures, FREEBAC D-150 will dissolve faster, but bacterial growth will also be stimulated. To prevent FREEBAC D-150 from dissolving too fast, more carrier can be used, which influences the amount of the active ingredient. In order to compensate for this effect and for the faster bacterial growth, a higher concentration is needed when FREEBAC D-150 is used at higher temperatures.

4.2 Which system?

When should you dip, rinse, spray or atomise?

Dipping

- 💧 if the food to be treated is so convoluted that it is impossible to apply FREEBAC D-150 to the entire surface
- 💧 if a substantial exposure time is required, as in the case of high bacteriological or organic pollution or when the product is sensitive to higher concentrations of FREEBAC D-150

Rinsing

- 💧 if the accessibility of a system prevents spraying, such as in conduct pipes

Atomising

Spraying is based on water pressure; atomising works on the basis of air pressure. When atomising you will obtain microscopic droplets of water in gaseous form.

- 💧 if the surface must not become visually moist
- 💧 air-disinfection, to prevent the product being contaminated by micro-organisms present in the air or transferred through the air

Spraying

- 💧 all other cases

5. SAMPLING

5.1 Micro-organisms

The measured bactericide effect of FREEBAC D-150 depends on the concentration, contact time, action time, temperature, pH, type, the amount of present organic contamination, the number and the sort of micro-organisms present.

Increasing measure of efficacy:

Bacterial spores: Bacillus cereus/subtilis, Clostridium botulinum/perfringens, etc.

Gram-positive bacteria: Lactobacillus plantarum, Listeria monocytogenes, Micrococcus, Pediococcus, Staphylococcus aureus, Streptococcus, etc.

Gram-negative bacteria: Aeromonas, Campylobacter, E.coli, Pseudomonas, Salmonella, Shigella, Vibrio, Yersinia, etc.

When FREEBAC D-150 is tested on a lab-scale or when samples are to be taken from the production process same action time has to be taken into account. This time is needed to let the FREEBAC D-150 work. In the table below the action time per category is given.

Table

FREEBAC D-150 distinguishes itself by a mild and long-lasting effect. This means that it takes the same action time to realise significant reduction of the count-plate.

	Contact time	Action time
Sampling surfaces	spraying [0.5%]	min. 30 minutes
Sampling food	dipping [0.2%]	min. 1 hour

It is very important that sufficient hydrogen peroxide contacts the product during the contact time to oxidise the organic and bacteriological contamination during the action time. When spraying, the surface should be totally moistened. When dipping, the efficacy depends most on the combination of contact time and concentration. When the contact time can only be short from a practical point of view, then a higher concentration has to be applied. When the concentration can only be low from a sensorial point of view, then a longer contact time is needed. For determining bacteriological reduction it is important to take a minimum action time into account. The action time is the time which FREEBAC D-150 needs to kill a significant amount (log2) of bacteria. Including the contact time FREEBAC D-150 needs a minimum action time of 30 minutes. The results should be monitored for a few days. The required action time depends on the organic and bacteriological contamination of the product.

5.2 Peroxide test strips

Measuring range peroxide test-strips:

[H₂O₂] range: 0 -25 ppm (0.0025%)

In relation to the composition of FREEBAC D-150:

[FREEBAC D-150] = [H₂O₂] x 2.3

Dip the test strip briefly into an aqueous solution. Within the range of 25 ppm the intensity of the colour (blue) depends on the concentration of the hydrogen peroxide. If the concentration of hydrogen peroxide is higher than 25 ppm the test strip will always colour dark blue.

To measure higher (>0.0001%) peroxide concentrations with these test strips the solution has to be diluted.

The following table shows dilution factors for different concentrations of FREEBAC D-150. If the solution is diluted by this factor, then the diluted solution will contain 1 ppm H₂O₂ (the strip will colour slightly blue).

Dilution-Factor:

CONCENTRATION FREEBAC D-150	DILUTION-FACTOR to 1 PPM H₂O₂
0.00023%	1:1
0.05%	1:215
0.1%	1:430
0.5%	1:2,150
1 .0%	1:4,300

Example

To check if there is still 0.1% concentration of FREEBAC D-150 in the process-water:

Dilute 10 ml of process water (into which FREEBAC D-150 has been injected) with tap water to 4,300 ml (half of a regular bucket). If the concentration of FREEBAC D-150 is 0.1%, the strip will colour light blue (1 ppm -see colour range on packaging strips). If the concentration of FREEBAC D-150 is less than 0.1% the strip will remain white. In that case the FREEBAC D-150 should be refreshed.

6. LEGISLATION

6.1 The Netherlands

As far as the use of FREEBAC D-150 in the Netherlands food industry is concerned, FREEBAC D-150 is not a regular disinfectant but a 'decontaminating agent'. A decontaminating agent is a processing aid that is applied to kill micro-organisms in direct contact with food products or beverages, but does not become an ingredient of the product.

Thanks to the introduction of FREEBAC D-150 a request for amending the food legislation in The Netherlands was filed on 1 January 1995. FREEBAC D-150 is only permitted to be used if a compelling technological reason for such use is present, on condition that a relevant process description is followed. A compelling technological reason could apply to situations in which, despite optimal hygienic circumstances, an unwelcome situation develops due to the presence of pathogenic micro-organisms.

6.2 Food and Drug Administration

FREEBAC D-150 applied as a decontaminating agent falls under the category of food additives, with specifications of a processing (technical) aid. Processing aids are chemicals that are necessary to perform a certain function during the preparation of food and beverages, but don't have any effect on the finished product. For this reason, the use of a processing aid doesn't have to be declared.

FDA does not register or issue certificates of authorisation or approvals of any kind for specific products intended to be marketed as food additives in Europe. It is the manufacturer's responsibility to ensure that their products comply with all appropriate regulations.

FREEBAC D-150 is a mixture of hydrogen peroxide and the stabilising gel, all ingredients being classified as food additives. No reaction products are formed as a result of this mixture.

In The U.S.A. both hydrogen peroxide and the ingredients in the stabilising gel are classified as GRAS-products (Generally Recognized As Safe).

The stabilising gel has no limitations other than Good Manufacturing Practice.
(regulation 21 CFR 182.1320)

Hydrogen Peroxide has its specific limitations including categories of foods, levels of use, and functional uses. (regulation 21 CFR 184.1366).

The use of FREEBAC D-150 is in full compliance with the limitations specified in the regulation. FREEBAC D-150 does not leave any detectable residue of hydrogen peroxide, when used in a proper way, as prescribed by the manufacturer.

App. I: Pure Food Act on the Preparation and Handling of Food Products

Bulletin of Acts, Orders and Decrees of the Kingdom of the Netherlands

857

Decree of December 2, 1994 amending the Pure Food Act Decree on the Preparation and Handling of Food Products.

SECTION 1

The Pure Food Act Decree on the Preparation and Handling of Food Products shall be amended in the following manner:

A

To section 1, subsection 1 shall be added, by replacing the full stop following clause by a semi-colon, clause e. which shall read as follows:

e. Decontaminating agent: a process auxiliary substance:

1° solely designed to kill micro-organisms living in direct contact with food products or beverages which are present on or in the product;

and

2° which does not become an ingredient of the product, but is solely present therein as an unintended but technically unavoidable residue.

D

Section 5a shall be inserted after section 5, and shall read:

Section 5a

1. In the preparation of food products and beverages and base materials, only a safe and effective decontaminating agent which has been approved by Our Minister is permitted to be used, if a compelling technological reason for such use is present, on condition that a relevant process description approved by Our Minister, acting on the advice of the Pure Food Act Advisory Committee is followed.
2. The process description referred to in the first subsection shall be drawn up by one or more sectors of the food and food products branch.
3. Our Minister shall publish the approved process description referred to in the first subsection, in the Netherlands Government Gazette (Staatscourant).