Sanitisers in the Food Industry

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Sanitisers in the Food Industry

A White Paper, by HACCP International

Introduction

Sanitisers are used to reduce micro-organisms and create hygienic surfaces in food handling, food preparation and food processing areas.

Sanitisation is a key pillar of food safety. Food businesses must regularly clean and sanitise their premises, equipment and utensils to ensure the safety of consumers. There are many microorganisms that can cause food poisoning, and they can be present on surfaces, hands and food. Cleaning and sanitising help to remove these, which protects consumers, customers and food brands.

Sanitisation is performed after cleaning, which removes the food debris, dirt and grime where micro-organisms can harbour.

There are many different types of sanitisers available, and the most appropriate one will depend on the type of surfaces that need to be sanitised. When used correctly, cleaning and sanitising can help to reduce the risk of food poisoning.

In this white paper we discuss what sanitisers are, how they work and how they are used by food businesses.

What *exactly* is a sanitiser?

Sanitiser is a food industry term used for chemicals that remove and reduce the microbial load on surfaces or hands to a hygienic or acceptable level.

In some countries, the word sanitiser has a legal definition, in others, it does not.

Sanitisers are not necessarily the same as disinfectants, although the two terms are sometimes used interchangeably. There are actually a number of different words used to describe treatments that reduce or eliminate microorganisms, and each has a different meaning.

Below is a list of words used for various types of microbial-reduction chemicals. Each of these words has a slightly different definition. In addition, the purpose and efficacy expectations for each type of chemical is also different. Table 1 contains definitions of common industry terms for sanitisers and related products. Their purposes and uses are described in Table 2.

- sterilant,
- disinfectant,
- germicide,
- biocide,
- antiseptic,
- steriliser and
- general purpose cleaners

Chemicals that are designed for direct food contact, such as fruit and vegetable washes are not 'sanitisers', even if they are intended to reduce microbes on the foods. Because these chemicals directly touch foods, they are considered to be 'indirect food additives' or 'food processing aids' rather than 'sanitisers' by the food industry.

Table 1. Definitions of sanitisers, disinfectants, biocides, sterilants and other related terms

Sanitiser	Disinfectant	Biocide	Sterilant
'A sanitiser is a substance or mixture of substances that reduces the bacteria population in the inanimate environment by significant numbers but does not destroy or eliminate all bacteria.' (US EPA)	A disinfectant is 'a substance or mixture of substances that destroys or irreversibly inactivates bacteria, fungi and viruses but not necessarily bacterial spores, in the inanimate environment.' (US EPA) And '[Disinfectant is a] Group of biocidal product-types used for disinfection and hygiene purposes.'	A biocide is 'Any substance or mixture…with the intention of destroying, deterring, rendering harmless… any harmful organism by any means other than mere physical or mechanical action.' (EU)	'A sterilant is a chemical that is applied to inanimate objects to kill all microorganisms as well as spores. Ethylene oxide, glutaraldehyde, hydrogen peroxide gas, and peracetic acid are examples of sterilants.' (Hoffman, et al. (2014)[i])
Antibacterial	**Antimicrobial**	**Antiseptic**	**Cleaners**
Antibacterial products sometimes fit the definition of a sanitiser. The term antibacterial is also often used for additives or surface treatments, for example, silver-based additives for plastics and coatings. Antibacterial products are effective against bacteria, usually bacterial vegetative cells, but may not be effective against other microorganisms such as yeasts, moulds or viruses.	Antimicrobial is a word used for soaps (e.g., 'antimicrobial soap') and surfaces (e.g., copper utensils may be described as being antimicrobial). Antimicrobial products may be effective against yeasts, moulds, viruses as well as against bacteria.	Antiseptics are medical products such as topical creams: 'a chemical that is applied to living tissue to kill or inhibit microorganisms[ii]'.	Cleaners are products that remove dirt, soil from surfaces. They are not regulated, and their performance is not tested.

Sanitisers versus other antimicrobial products

Sanitising is a term used mostly in the food industry. In other industries, such as in hospitals or commercial settings, the term disinfecting is more often used for processes that reduce the microbial load on surfaces. Disinfectants sometimes have more stringent performance criteria than sanitisers, although this varies with jurisdiction.

The process of sanitising is usually understood to mean the removal of vegetative bacterial cells. That is, spores and viruses are not necessarily inactivated by sanitisers. This is reflected in the performance criteria rules for sanitisers which usually only consider a products effect on bacterial vegetative cells. Biofilms are generally quite resistant to chemical sanitisers too.

Sanitisers are used on surfaces and hands in the food handling areas of food premises, while disinfectants, and other products are used in other places such as toilets, hospitals and homes. Table 2 describes the various uses for sanitisers and related products.

Table 2. Purposes and uses for sanitisers and related product types

	Cleaner	Antiseptic	Sanitiser	Hand sanitiser	Disinfectant	Sterilant
Removes dirt and soil from surfaces	✔	✘	✘	✘	✘	✘
For skin or other living tissues	✘	✔	✘	✔	✘	✘
Reduces the number of bacteria	May physically remove bacteria from a surface, but this is not the primary purpose	✔	✔	✔	✔	✔
Effective against viruses	✘	✘	✘	✘ & ✔*	✘	✔
Effective against bacterial spores	✘	✘	✘	✘	✘	✔
Effective against yeasts and moulds	✘	✘	✘	✘	✘	✔

* Some, but not all hand sanitisers, are effective against viruses

Where can sanitisers be used?

Different sanitisers are designed for different surfaces, so it is important to always check the label before using a sanitiser.

Many different types of surfaces can be sanitised. However, soft, absorbent and porous

surfaces, include textiles, soft furnishings, carpets, unsealed concrete and unsealed wood are more difficult to sanitise than hard surfaces.

While it is possible to remove and reduce microorganisms on soft and porous surfaces, it is both more difficult to achieve a sanitary result and also more difficult to quantify the result compared to hard surfaces. For that reason, sanitiser instructions, performance criteria and test protocols often specify 'for hard surfaces'.

Many of the most commonly used sanitisers are suitable only for use on hard, non-porous, non-absorbing surfaces. However, some are designed for use on other surfaces such as textiles or hands. Table 2 describes places that can be sanitised in food handling facilities.

Table 2. Areas and surface types where sanitisers are used in a food facility

Food Contact Surfaces	Hard Surfaces	Non-porous, Non-absorbing, Flexible Surfaces	Soft, Woven and Porous Surfaces	Single Use (Disposable)
All food contact surfaces (excluding single-use items) must be sanitised prior to use.	All hard surfaces in food facilities should be sanitised on a regular basis.	Flexible, non-food-contact surfaces should also be sanitised on a regular basis.	Portable textiles such as uniforms, aprons, tea towels can be sanitised with an appropriate laundry cycle. Other woven, absorbing or porous surfaces can be difficult to sanitise, and their use should be avoided in food handling areas.	Single use items do not need to be sanitised prior to use (unless specified on the label). Discard when visibly soiled or after touching contaminated surfaces such as raw foods, garbage or money.
Examples				
Utensils, cookware, equipment, chopping boards	Floors, walls, ceilings	Rubber gloves	Textiles	Disposable gloves
Serving ware, eating utensils, glassware	Benchtops	Boots	Carpets, soft furnishings	Wipes, paper towelling
Reusable gloves	Shelves and racking	Flexible conveyor belts	Wood	Single use packaging such as bags, pails
Grills and griddles		Squeegees	Unsealed concrete	Disposable utensils and serving ware
Conveyor belts, bulk handling equipment				Non-returnable drums and totes
Tanks, vats, tubs				

Sanitiser regulations

In the United States of America, sanitisers are defined and regulated by the US Environmental Protection Agency (EPA). However, their use in the food industry is codified in the rules of the US Food and Drug Administration (FDA).

In Australia, the Therapeutic Goods Administration (TGA) sets rules for the performance and naming of antimicrobial products such as sanitisers, disinfectants and skin disinfectants.

In the United Kingdom, there are British Standards that cover the rules for chemical disinfectants. Food Standards Agency (FSA) recommends food businesses use disinfectants that comply with the British Standards.

Across Asia, regulations and expectations for sanitising and for chemical performance vary from country to country.

HACCP International's performance criteria for sanitisers are based on international best practice and align with the regulations of the USA FDA and the Australian Therapeutic Goods Administration. As well as addressing performance criteria, HACCP International requires all sanitisers to undergo an independent assessment of toxicity of all ingredients, plus an investigation into the manufacturing practices and processes.

HACCP International's evaluation process also includes a consideration of efficacy, potential for incorrect use, consequences in case of accidental contamination of food or food handling areas, presence of suitable, unambiguous instructions for use and suitability of labels and safety data sheets (SDSs) to meet food industry standards and expectations.

What is a food safe sanitiser?

A food safe sanitiser is one that has been designed to be safe for consumers when it is used on food contact surfaces in accordance with the manufacturer's instructions.

Note that food washes like fruit or vegetable washes are not considered to be 'sanitisers', but rather are treated as food processing aids or ingredients within a food safety programme. Their status as 'food safe' is implied in their usage application.

Manufacturers design food safe sanitisers with the following criteria:

- Pure, traceable and verifiable ingredients
- Low or no toxicity to humans
- Low or no residues when used as directed
- Appropriate performance against microorganisms when used as directed
- Clear instructions for use
- Low or no fragrance, odour or lingering smell or taste when used as directed
- Traceable and produced under controlled systems.

How do sanitisers work?

Sanitising can be achieved with heat, chemicals, and gasses, or a combination.

Most sanitisers work by breaking or disrupting the cell membranes of bacteria. The damaged membranes become leaky and the cells burst and so 'die'. Many chemical sanitisers are powerful oxidisers which react with molecules on the outer cell membranes of bacteria, damaging them irreparably.

Heat-mediated sanitising, such as washing in very hot water, causes the proteins in bacteria to become denatured, which destroys the ability of the cells to function.

The spores and endospores of bacteria, yeasts and moulds are much tougher than bacterial vegetative cells. They have thick outer layers and strong exterior structures that can be resistant to chemicals and even heat. As a result, many spores are resistant to most sanitisers.

Bacteria and other microorganisms can 'hide' or harbour in soils, food debris, grease, grime and biofilms. When these things are present, they can protect the microorganisms from damage by oxidisers, heat and other sanitisers.

For this reason, it is very important that surfaces are completely clean before any sanitising activities are attempted. Surfaces that are not visibly clean and free from grease, dust, dirt and debris cannot be effectively sanitised. Sanitising processes in food facilities should be a 'two-step' process. The first step is cleaning to remove all surface soils. The second step is sanitising to remove microorganisms from the clean surface.

Surfaces must be completely clean before any sanitising activities are attempted.

Surfaces that are not free from grease, dust, dirt and debris cannot be effectively sanitised.

Sanitising is a **'TWO STEP'** process.

1. CLEAN

2. SANITISE

Types of sanitisers

There are many classes of sanitisers. Chemicals and heat are the most commonly used in the food industry.

Other types of sanitisers include gasses, electronically active components (ions), electromagnetic radiation and cold, as well as those with biologically active ingredients.

Each type has its own set of benefits and drawbacks. Some are more effective than others, and some are more expensive. Ultimately, the best type of sanitiser for your food business depends on your specific needs.

Chemical sanitisers

Quaternary Ammonium Compounds ('Quats')

Quaternary ammonium sanitisers (Quats) are a vital part of the food industry, considered safe, reliable and cost-effective. Quats are commonly used in kitchens, restaurants and other commercial food preparation areas.

The most common type of quat is Benzalkonium chloride (sometimes shortened to BAC), which is effective against a wide range of bacteria, including *Escherichia coli* and *Staphylococcus aureus*. Quats are used in an aqueous solution as a spray or wipe, and they can also be added to mop water or dishwashing solutions. Some quat-based sanitisers can be used without rinsing, with the residue providing ongoing antimicrobial activity.

In order to be effective, quats must be used at the correct concentration and contact time. This means that it is important to follow the instructions on the product label carefully. When used correctly, quats are an important tool in the fight against foodborne illness.

Like most sanitisers, quats are not effective against spores and do not work in the presence of heavy soils.

Chlorine-based Sanitiser Chemicals

Chlorine-based sanitisers are used extensively in the food industry, usually in the form of sodium hypochlorite solution (bleach) to maintain high standards of hygiene.

Chlorine-based sanitisers can be effective against bacteria, viruses and fungi, making them ideal for preventing the spread of food-borne illnesses. However, they can pose a risk to workers if used improperly. As a result, it is important to use chlorine-based sanitisers according to manufacturers' instructions and only in well-ventilated areas.

Chlorine-based chemicals can also be corrosive or damaging to some surfaces, especially metals. A too high concentration of free chlorine will damage surfaces, while a too low concentration will not be effective as a sanitiser.

The temperature of the solution, its pH and its contact time all have significant impacts on the antimicrobial efficacy of chlorine-based sanitisers. Once diluted, they lose their efficacy quickly.

Hypochlorites

Sodium hypochlorite is a chlorine compound that is commonly used as a disinfectant or bleaching agent. In the food industry, it is used to sanitise surfaces and equipment, as well as to treat drinking water. It is also used in some swimming pool chlorination systems.

When used in food applications, sodium hypochlorite is typically purchased as a concentrated liquid, then diluted with water to create a weak bleach solution. This solution can be used on hard surfaces, including food contact surfaces, to kill bacteria, mould, and other microorganisms that can contaminate food. In addition, sodium hypochlorite is an authorised food additive or processing aid in some countries, where it is used to whiten or brighten food products such as flour or sugar.

The chlorine ions in hypochlorites can combine with proteins and other organic materials when they come into contact with food debris and other soils. This can result in the formation of dioxins and other toxic compounds.

Hypochlorous Acid

In the food industry, hypochlorous acid is used as a sanitiser on food contact surfaces and equipment. It is effective against a broad range of microorganisms, including bacteria, yeasts, and moulds. Hypochlorous acid is also used in poultry processing plants to control microbiological growth in chiller water and on carcasses.

Hypochlorous acid can be made on-site using electrolysis, with special equipment. See electrolysed water for more information.

Aqueous Chlorine Dioxide

Like other chlorine-based chemicals, aqueous chlorine dioxide has broad spectrum efficacy against microbes. It has a short shelf life and needs to be made on-site just prior to use. See also, chlorine dioxide gas.

Iodophors

Iodophors are a type of sanitiser that use reactive iodine ions to deactivate microorganisms. Iodophors are often used in hospitals and other healthcare settings because they are quick-acting and can be used on a wide range of surfaces. In the food industry they are used in beverage and dairy manufacturing facilities. They are relatively inexpensive and persist longer on surfaces than chlorine-based sanitisers. However, they can cause irritation to the skin, eyes, and respiratory system, so it is important to use them carefully. In addition, iodine can stain some surfaces.

Like chlorine-based sanitisers, iodophors can be corrosive to metals and they should not be used on aluminium or copper surfaces.

Peroxyacetic Acid

Peroxyacetic acid is used in food processing and healthcare facilities as a broad-spectrum sanitiser. Peroxyacetic acid can be used as a spray or fog and is also used as a dip or soak for small food items. It is sometimes used in combination with hydrogen peroxide. It is sometimes considered more environmentally friendly than other sanitisers because it quickly degrades to acetic acid (the acid that is in vinegar), oxygen and water. It is less corrosive to metals than hypochlorites.

Potassium Peroxymonosulfate

Potassium peroxymonosulfate is a highly reactive compound and is fast-acting when used as a sanitiser in food processing applications. It is prepared from powder and the solutions last about 7 days. It is a strong oxidizing agent that can be effective against range of microorganisms, including non-enveloped viruses[iii]. Potassium peroxymonosulfate is safe for use on food contact surfaces, and it is not corrosive to metals. However, it can be irritating to the skin and eyes, so it is important to follow the safety instructions on the label and wear gloves and eye protection when using it.

Alcohol and alcohol-based sanitisers

Ethanol, isopropanol and n-propanol are alcohols used for sanitising in the food industry. These alcohols are used for sanitising hard surfaces and equipment and as active ingredient in many hand sanitisers and wet wipes. The different alcohols are effective at different concentrations in aqueous solution, with higher concentrations not necessarily more effective.

Alcohols evaporate quickly from surfaces and so are useful where no-residue, no-rinse sanitisers are needed.

Oxygen-based sanitisers

Sodium percarbonate is often called ‘oxygen bleach’. It is usually sold as a white powder, in which form it is relatively stable. When mixed with water it becomes aqueous hydrogen peroxide solution, a powerful oxidiser. It quickly breaks down to harmless by-products, water and sodium carbonate.

Aqueous Ozone

Dissolved ozone is an oxidising chemical that can be efficacious against viruses[iv] as well as bacteria when used at the correct concentration. It quickly degrades to water and oxygen gas, making it an ideal no-rinse sanitiser.

Aqueous ozone has a short shelf life and needs to be made just prior to use, by bubbling ozone gas through water. If the ozone concentration is too high, it can cause corrosion on some surfaces. Dissolved ozone is often measured by measuring the oxidation reduction potential (ORP) of the solution, in millivolts.

Hydrogen Peroxide

Like many other common chemical sanitisers, hydrogen peroxide is a strong oxidising agent. It can be used in an aqueous solution alone or with other chemicals to make it more stable. It is also used as a sterilant vapour. Unless chemically stabilised, hydrogen peroxide solutions have a very short shelf life, degrading rapidly into the harmless by-products water and oxygen gas.

Natural plant extracts and oils

A number of plant oils contain compounds that exhibit antimicrobial effects[v]. They can be expensive and so are not used commonly for large scale sanitising operations in the food industry. However, some can have residual antimicrobial properties.

Tea tree (Melaleuca alternifolia) oil contains terpinol and cinnanol which have inhibitory effects. Other oils that contain compounds with antimicrobial properties include rosemary, clove, and citrus peel oils.

The oil-based nature of these extracts is not compatible with traditional test methods for antimicrobial efficacy, which poses a challenge for companies that wish to use these natural products.

Silver ions and silver colloids

Silver's antimicrobial properties have been known for centuries and it is said to be effective against a wide range of bacteria, including those that are resistant to antibiotics. Silver-based additives are used in plastics and other materials to impart antibacterial properties to surfaces. Solutions containing silver ions have been shown to be effective against important food-borne pathogens Staphylococcus aureus and Escherichia coli[vi].

Electrolysed water

Electrolysed water or electrochemical sanitiser is a sanitising liquid made on site in a special device. Electrolysed water devices pass an electric current through salt water. This process creates either one or two types of solution. The sanitising solution contains chlorine ions which provides an oxidising effect that can deactivate bacteria.

Electrolysed water devices create sanitising and liquids, and some also create cleaning liquids. The liquids are produced on site which reduces the need for food businesses to purchase packaged cleaning and sanitising chemicals. The concentration of the chlorine solution produced by electrolysed water machines can vary and needs to be checked to make sure that the liquid will be efficacious as a sanitiser.

Biological sanitisers

Biological sanitisers use enzymes, either on their own, or within a solution of living organisms to break down soils and 'attack' harmful bacteria.

Enzymes are proteins that break down grime, food debris and microorganisms by destroying proteins, fats, starches and cellulose. When used as a cleaning agent, enzyme sanitisers work by breaking down the bonds that hold dirt and grime together. This allows the dirt and grime to be easily rinsed away, leaving surfaces clean. Enzymes are commonly found in laundry products. Enzyme sanitisers can be used on a variety of surfaces, including floors, walls, counters, and even carpets. Unlike some chemical sanitisers, they are considered to be environmentally friendly and biodegradable, however they are more expensive and may require significantly longer contact times.

Enzymes and 'live' biological sanitisers may be more effective against biofilms on some surfaces[vii] than traditional chemical sanitisers. Some biological sanitisers are designed to provide a residual effect in places like drains, where biofilms can develop and be difficult to remove.

Wipes

Sanitising wipes are 'ready to use' products that do not require any preparation, such as mixing or dilution. They usually take the form of a polymer substrate, such as rayon or PET, that is wet with a sanitising liquid, often one that contains an alcohol.

The efficacy of sanitising wipes depends on whether or not all of the surfaces being treated can be fully wetted with the liquid, and whether the contact time is sufficient. The liquid used in wet wipes must be suitable for no-rinse applications if they are to be used on food contact surfaces.

Gasses and air-borne sanitisers

Ozone

Ozone gas is capable of sanitising surfaces and areas, but in the food industry, it is more commonly dissolved in water for sanitising because gaseous ozone is dangerous to workers.

Hydrogen Peroxide Gas

Hydrogen peroxide gas has a wide range of sanitising applications but is more commonly used in medical establishments than food facilities, as the gas is hazardous to workers. It is applied with a fogging machine that evenly distributes the hydrogen peroxide gas throughout a space.

Hydrogen peroxide gas quickly breaks down into water and oxygen after application, making it ideal to use for strong sanitising treatments without the need for a rinse step.

Sulphur Dioxide

Sulphur dioxide is a colourless, odorless gas that, when mixed with water, forms a solution that can be used to sanitize surfaces or clean fruits and vegetables. As a gas it is effective against yeasts and moulds as well as bacteria, so is used to sanitise corks and wine barrels in the wine industry.

Chlorine Dioxide

Chlorine dioxide is a powerful oxidiser that must be manufactured at the point of use. It can be used as a gas or dissolved in water.

Cold plasma

Cold plasma is a mix of electrically charged atoms and molecules in air. It is created when an electrical discharge is passed through a gas, causing the gas to ionize. This process creates a charged ions that can damage the cell membranes of microorganisms. It needs to be manufactured at the point of use. Cold plasma machines can be used in hospitals food handling areas where low levels of ions in the air can reduce the overall microbial load on surfaces and in the environment.

Ultraviolet radiation

Ultraviolet light sanitisation is delivered by devices that emit ultraviolet light, which deactivates microorganisms by damaging their DNA. Hospitals and laboratories use UV lamps to sanitise equipment and surfaces. In the food industry they have a role in water treatment and have also been used to reduce the microbial load on reusable protective clothing such as rubber boots. Ultraviolet only works for parts of equipment and surfaces that are exposed to the light, so coverage and shadowing is an important factor in ultraviolet sanitisation.

Heat and cold

Temperature-based sanitising is used very commonly in food facilities, most often through the use of very hot water. Dishwashers and laundry equipment both make use of hot water sanitising, sometimes in combination with chemical sanitisers, to create hygienic results for utensils, serving ware and workers uniforms.

Heat sanitising has the advantage of leaving no residues and requiring no chemicals. Both dry heat and wet heat are used in the food industry, with the temperatures required varying depending on the type of equipment and the desired reduction in microorganisms.

Cold-based sanitising is most often achieved through the use of dry ice. The dry ice makes surfaces extremely cold, which deactivates microorganisms. It then sublimates to carbon dioxide gas, and so leaves no residue. Dry ice cleaning is suitable for areas that need to remain completely free of moisture.

Hand sanitisers

Hand sanitisers are formulated to provide both antimicrobial effects and be safe and suitable for use on human skin. Many, but not all, use alcohol as the active ingredient.

Some hand sanitisers, including those that have only alcohol as the active ingredient perform poorly against viruses. The norovirus virus is capable of causing extremely large food poisoning outbreaks and these outbreaks usually occur due to faecal-oral contamination routes.

Hand washing is effective at removing viral particles from hands when done correctly, and so prevents faecal-oral contamination with norovirus. However the use of hand sanitiser alone, without hand-washing may not prevent norovirus transmission. Some hand sanitisers are formulated to be effective against norovirus and these should be used in food handling facilities.

Test methods and performance criteria for sanitisers

The required performance criteria for sanitisers varies between different jurisdictions. However, sanitisers are usually classified, tested and approved according to their ability to deactivate specific indicator bacteria. The most common indicator bacteria are Staphylococcus aureus and Escherichia coli, which represent Gram positive and Gram-negative organisms.

Most performance criteria specify that a sanitiser has to achieve a certain number of log reductions of the chosen indicator bacteria. A log reduction is the ratio of numbers of microorganisms before and after a decontamination event, expressed as a common logarithm. Many sanitiser criteria require a reduction of 5 logs, which is equal to a reduction by five factors of ten, or a reduction of 99.999%, of the original number of microorganisms.

Other performance criteria are based not on a log reduction but on a most probable number test, which makes use of a series of dilutions of a suspension of microorganisms to describe how many are present after a decontamination event.

Most sanitiser performance tests are performed by adding the sanitiser liquid to a test tube – called in vitro - that contains a known number of indicator bacteria, then measuring the number that survive.

For spray-and-wipe style sanitisers and sanitising wipes, tests called hard surface carrier tests are used instead. These are performed by inoculating a hard surface, such as a stainless-steel coupon, with bacteria and comparing how many survive on a control coupon compared to how many remain viable after the test coupons have been wiped or sprayed-and-wiped with the sanitising product.

Sanitiser performance standards often specify a contact time in which the decontamination effect needs to occur. For example, the US FDA rules for sanitisers require that a 5-log reduction is achieved within 30 seconds for sanitisers that will be used on food contact surfaces. For non-food contact surface sanitising, the standard is less strict, with only a 3-log reduction being required.

Hand sanitisers are regulated for their performance criteria in most countries. Some hand sanitiser efficacy tests make use of in vitro methods, while others involve swabbing the hands or fingers of test subjects. Like liquid sanitisers, efficacy is most often tested by checking the hand sanitiser's ability to reduce the number of indicator organisms.

Shelf life of sanitisers

Many sanitising solutions degrade quickly after they have been prepared or if storage conditions are not optimal. If the sanitiser solution is too old, or has been stored incorrectly, it will not work effectively, which poses significant food safety risks.

For purchased sanitiser solutions, storage conditions should be displayed on the label. The length of time that a diluted or prepared solution can be used is also part of the instructions. Always observe the storage conditions and 'discard after' instructions provided by a sanitiser manufacturer.

For sanitisers made on-site such as ozone-in-water solutions and electrolysed water and for sanitisers that are reused or recirculated, it is important to test the solutions frequently. Most made-on-site sanitisers remain effective for only short periods, so they should not be stored in spray bottles or other containers for longer than a few days.

In your food facility:

How To Choose a Sanitiser

When it comes to keeping your food business and its customers clean and safe, choosing the right sanitiser is crucial. But with so many types of sanitising available, it can be difficult to choose. Most food businesses use a combination of different sanitising activities to achieve clean, hygienic surfaces.

Here are a few things to consider when selecting a sanitiser for your food business:

- **Surfaces:** What kind of surfaces will you be cleaning? Metal surfaces, particularly reactive metals like aluminium and copper should not be exposed to some sanitisers. For food contact surfaces, you will need to choose a sanitiser that is easy to rinse off or is formulated for no-rinse applications.

- **Cleaning-sanitising methods:** manual cleaning, like mopping floors or handwashing dishes, needs different types of sanitisers than automated cleaning, such as that which occurs in a commercial dishwasher. Clean-in-place (CIP) methods require different sanitisers too. Each should be formulated for the method of application and use.

- **Equipment:** If you're cleaning sensitive equipment, like brewing or distilling equipment, make sure to choose a sanitiser that is designed for that type of equipment.

- **Regulatory requirements:** Sanitisers that will be used without a rinse-step need to be approved for use in some countries. Check with the manufacturer to make sure they are suitable to meet the regulatory requirements of the food markets where the food will be sold.

- **Soil types:** All surfaces need to be clean before they can be sanitised. Make sure that the cleaner is suitable for the soil type and is compatible with the sanitiser that will be used after the cleaning step.

- **Contact time:** Not all sanitisers are fast-acting. Choose one that will be effective within your chosen cleaning-sanitising protocols.

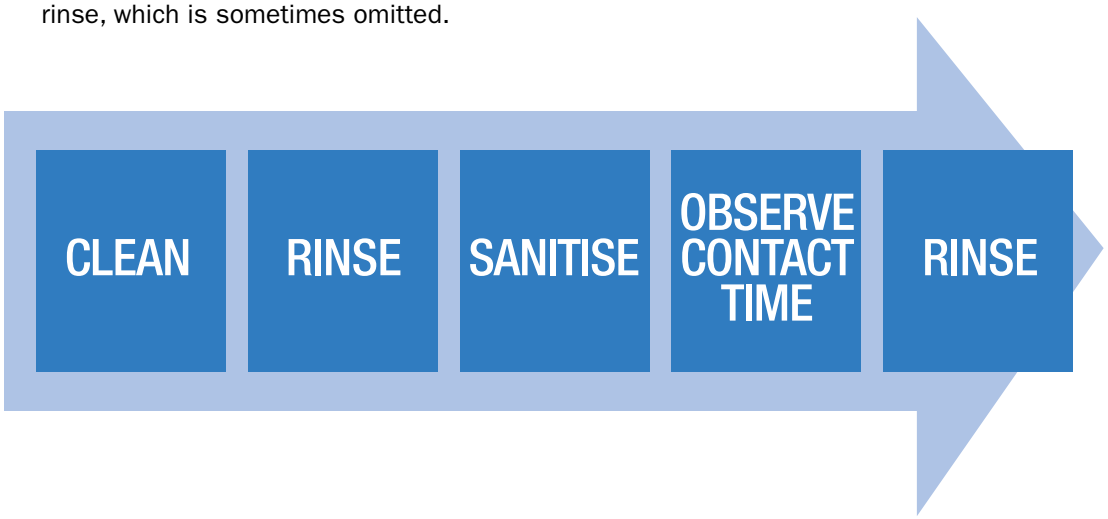
- **Environmental credentials:** The environmental characteristics of a sanitiser include the packaging; transport miles and its long term effect on wastewater. If your food business makes claims about environmental or sustainable practices, or if it manufactures under an organic certification then be sure to choose sanitisers that meet the correct criteria.

- **Worker health and safety:** Many chemical sanitisers can cause worker illness or injury if used incorrectly or without appropriate protective clothing. This should be factored into sanitiser choice.

- **Cost:** The cost of sanitisers is always a trade-off between ease-of-use, efficacy and environmental characteristics. Energy and labour costs for using the sanitiser or creating it on site should be considered in the overall cost analysis for any sanitising method.

How To Sanitise

All sanitising processes are based on the steps below, with the exception of the final rinse, which is sometimes omitted.



For safe and effective sanitising in your food facility, observe the points below.

1. Select sanitisers with care
2. Store sanitisers away from food and in accordance with manufacturer's instructions.
3. Discard sanitisers upon expiry. Do not use old sanitisers.
4. Take care when decanting and diluting sanitisers, to avoid spills and injuries. Handle chemicals in areas well away from open/exposed foods. Wear the protective clothing and equipment specified on the label.
5. Follow all instructions provided by the manufacturer.
6. Do not guess dilution rates for sanitisers, but measure correctly.
7. Do not mix sanitisers with other chemicals.
8. Label all chemical containers correctly, including spray bottles.
9. Train and retrain all workers who handle or use sanitisers.
10. Sanitisers for critical operations should be checked to make sure they are efficacious before use or once per shift, for example with chlorine test strips.
11. Heat sanitising processes, such as automated dishwashing, should have the temperature monitoring and chemical dosing equipment calibrated on a regular basis.
12. Dispose of sanitisers with care, following environmental and waste-water rules.

Pitfalls to Avoid When Sanitising

Avoid the temptation to use more sanitiser or use sanitiser at a higher concentration than specified. Too much sanitiser can cause equipment to corrode or leave hard-to-remove residues.

Water quality is important in sanitising processes. Hard water, which has high concentrations of certain minerals, can render some chemical sanitisers less effective. It also affects the performance of on-site sanitiser-making equipment. Check with the manufacturer if your facility has hard water. Always clean, rinse and dilute chemicals with potable water.

Take care with drying and post-sanitising processes. For food contact surfaces it is best to air dry the equipment or surface that has just been sanitised. Wiping a sanitised surface with a dirty cloth will re-contaminate the surface.

Be aware of the risks from biofilms. Biofilms are communities of bacterial cells that stick together and often produce a protective layer of slime. Many different bacteria can form biofilms. Biofilms can resist most types of sanitising chemicals and protect the bacteria inside from being destroyed. They can be difficult to get rid of and should be handled by scrubbing with a cleaning agent and warm water. The physical action of scrubbing is needed to break down the protective layer that biofilms create.

Take care with contact times. Most sanitisers need at least 30 seconds, and many need more time to achieve a hygienic result. Design sanitising processes carefully to encourage workers to observe contact times, and not to rush through the sanitation procedure.

Sanitisers in Food Safety Management Systems

Sanitation is a key pillar of any food safety management system. Best practices for sanitising and for handling sanitising chemicals should be followed by all food businesses.

Best practices address the processes used to select and store sanitisers, including having designated, controlled storage areas, a list of approved products and an inventory of products that are on-site. Safety data sheets need to be available for all sanitisers and other chemicals. Only properly trained and authorised staff should have access to or use sanitisers. Concentrations need to be measured and recorded. The methods for sanitising need to be documented and operators need to be properly trained. After sanitising has been done, a verification step should be completed, which includes a written record that the sanitising has been performed correctly.

In conclusion

Food contamination can occur if utensils and surfaces are not cleaned properly, or if food is handled with unhygienic equipment. For this reason, sanitation is critical in all food businesses, from the smallest retail outlet to the largest manufacturing plant and all food businesses must have a cleaning and sanitisation programme in place. Sanitisation processes include regular cleaning and sanitising of all surfaces, equipment and utensils using appropriate cleaning products and methods.

Sanitisation is performed after cleaning, which removes the food debris, dirt and grime where microorganisms can harbour.

There are many different types of sanitisers available, and the most appropriate one will depend on the type of surfaces that need to be sanitised, as well as the types of food being handled in the area.

No matter which sanitiser is chosen it is important to follow best practices and all safety protocols to ensure the health and safety of your employees and consumers.

References

[i] Hoffman, R., Howland, M. A., Lewin, N., Nelson, L., & Goldfrank, L. (2014). *Goldfrank's Toxicologic Emergencies, Tenth Edition (10th ed.)*. McGraw-Hill Education

[ii] Hoffman, R., Howland, M. A., Lewin, N., Nelson, L., & Goldfrank, L. (2014). *Goldfrank's Toxicologic Emergencies, Tenth Edition (10th ed.)*. McGraw-Hill Education

[iii] Science Direct (2022) *Potassium peroxymonosulfate.* Accessed online: https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/potassium-peroxymonosulfate

[iv] Qing Wang, Sarah Markland, Kalmia E. Kneil on 08/01/2015 from Journal of Food Protection, Number 8, August 2015, pp. 1428-1617, pp. 1586-1591(6))

[v] F.J. Álvarez-Martínez, E. Barrajón-Catalán, M. Herranz-López, V. Micol, Antibacterial plant compounds, extracts and essential oils: An updated review on their effects and putative mechanisms of action, Phytomedicine, Volume 90, (2021), https://doi.org/10.1016/j.phymed.2021.153626

[vi] Jung, Woo Kyung et al. "Antibacterial activity and mechanism of action of the silver ion in Staphylococcus aureus and Escherichia coli." Applied and environmental microbiology vol. 74,7 (2008): 2171-8. doi:10.1128/AEM.02001-07

vii Iñiguez-Moreno M, Gutiérrez-Lomelí M, Avila-Novoa MG. (2021) Removal of Mixed-Species Biofilms Developed on Food Contact Surfaces with a Mixture of Enzymes and Chemical Agents. Antibiotics (Basel). 2021;10(8):931. Published 2021 Jul 30. doi:10.3390/antibiotics10080931

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