

WATER SUPPLIES FOR FOOD PROCESSING



Introduction

Food and water are two of the relatively few items that people take into their bodies each day in order to stay alive (air and sometimes medicines being others). It is therefore essential, that food processors take the utmost care to prevent their products from becoming contaminated and causing illness or even the death of their customers.

Foods are naturally contaminated with a wide range of bacteria, moulds and other organisms that can cause illness, but these are destroyed or prevented from growing during food processing when it is properly carried out.

Three potential sources of contamination that can make properly processed foods unsafe are water supplies, unclean equipment and the operators in the production unit. This technical brief examines ways of ensuring that the risk of contamination from these sources is minimised.

Most countries have laws governing the hygienic requirements of food factories and food handlers. These should be checked during the planning stage of a food processing project.

Water supplies

Water is used for cleaning equipment, cooling containers and as a component of some foods. In each case only potable water should be used, it may therefore be necessary to treat water before it is used. There are two types of treatment: removal of suspended soils and removal/destruction of micro-organisms.

Suspended soils can be removed by allowing them to settle out in settling tanks, see Figure 1 and/or filtering the water through specially designed water filters, see Figure 2. Both processes are relatively slow and large storage tanks are necessary if water is needed for washing or incorporation into the product. Water for cooling can be re-circulated. Although some types of water filters also remove micro-organisms, the easiest way of destroying them is to add chlorine solution (5-8ppm final concentration of chlorine obtained by diluting bleach to 0.02-0.04%). Lower chlorine levels (eg 0.5ppm) are needed if the water is to be used in a product to prevent 'off' flavours.

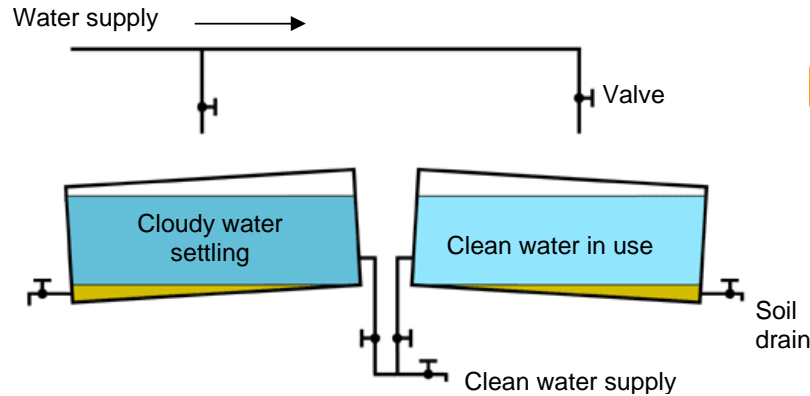


Figure 1: Double settling tanks arrangement. Clean water is taken from one tank while impurities are left to settle in the other.

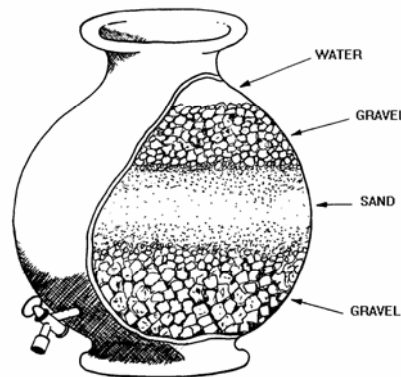


Figure 2: Small-scale sand filter

technical brief

Chlorination of water supplies can be simply arranged by allowing bleach to drip, at a fixed rate, into storage tanks or pipelines. The rate of bleach addition is found by experiment, using simple chlorine paper or more sophisticated probes to check the chlorine concentration. A less suitable alternative is to boil water to sterilise it. Water should be heated to boiling and then boiled vigorously for at least 10 minutes. This of course has a high fuel requirement and will therefore increase processing costs.

Processing equipment

The frequency and type of cleaning depends very much on the type of food being processed. Equipment for dry foods and powder does not require more than a simple brushing down each day whereas equipment that processes meat, milk and some vegetable products may need careful cleaning with both detergents and sterilants every few hours (because these foods can support the growth of potentially dangerous bacteria whereas dry foods cannot).

The type of cleaning depends on the nature of the soils on the equipment. In general, any equipment in which foods are deposited on the surfaces and then heated will be heavily soiled and difficult to clean. Table 1 shows examples of soils which are easy or hard to remove.

Soil	Solubility in water	Ease of removal	Typical foods
Sugar	Soluble	Easy	Preserves, fruit juices
Fat	Insoluble	Difficult	Meat, dairy products
Protein	Insoluble	Very difficult	Meat, dairy products
Mineral	Variable	Easy to difficult	Milk
Salts	Most soluble in acids	Depending on solubility	
Starch	Soluble if not heated	Easy to difficult depending on heating	Vegetables

Table 1: Soil removal

Detergents and sterilants

Detergents help remove the types of soils shown in Table 1 and different types are available for different soils. They do not however, destroy bacteria or sterilise the equipment. Sterilants destroy bacteria but do not help remove soils. It is therefore important, for proper cleaning, that soils are first removed with a detergent and the surface of the equipment is then sterilised with a sterilant.

Type of detergent	Action
Alkaline	Prevents mineral salt build-ups, removes fat.
Neutral	Used for surfaces that are damaged by other detergents.
Acid	Removes mineral salt scale.
Solvent	Removes fat.

Table 2: The types of detergent are shown in

The effectiveness of all detergents is increased by brushing and warming to 40-50°C (very high temperatures might cause soils to burn onto equipment and should therefore be avoided). Fats require temperatures above 70°C for removal. In practice the choice of detergent may be limited and it is best to try a small quantity of what is available to make sure that:

- it removes the soil
- it does not corrode the equipment
- it does not foam excessively
- it does not leave a taint in foods used afterwards.

Sterilants are also called sanitisers or disinfectants. In practice, the most widely available sterilant is chlorine solution (bleach or hypochlorite). Other types based on ammonia or iodine may be found.

The advantages of bleach are that it kills a wide variety of micro-organisms, and it is cheap and easy to use. The disadvantages are that it is corrosive, especially to aluminium, it may leave a flavour/odour on the equipment if not properly rinsed and is less effective if soils are present on the surface. It can also irritate skin and breathing, and is very dangerous if it contacts eyes or is swallowed. It must therefore be handled with extreme care.

The strength of chlorine solution should be 100-200ppm. If household bleach is used (which has about 5% sodium hypochlorite) it should be diluted by 1/250th to 1/125th to give 0.4-0.8% bleach (or 100-200ppm). If bleach is not available it may be possible to obtain sodium hypochlorite powder and dilute it to obtain similar concentrations.

An alternative, for small pieces of equipment and glass or metal packs is to sterilise them by heating. This can be done by immersing them in boiling water for 10-15 minutes, or setting up a steam generator and using the steam.

Operator hygiene

The risk of operators transmitting diseases and infections through foods to the customers depends on both the type of food and hygienic practices in the food processing unit. There is a lower risk of infection in foods that are packaged and then heated (eg bottle juices, canned foods). The foods that carry the greatest risk of infection from operators are those that are handled after they are cooked (eg fried snack foods, cooked meats) and those that are not heated before sale (eg sausages and other meat products, ice cream and other dairy products).

However, infection can be minimised by adopting the following rules in all food processing premises:

- Educate workers to show them the dangers of poor hygiene (books, films, videos etc are available).
- Do not allow people to work if they have a cough, serious cold or influenza, boils or other skin infections or stomach complaints (eg sickness or diarrhoea). It is not sufficient to cover skin complaints with a bandage or gloves. If necessary, insist on a medical examination of suspect workers.
- All employees should scrub their hands thoroughly (for more than 30 seconds) using non-perfumed soap and clean water before starting work. Particular attention should be paid to ensuring clean nails. Towels should be provided and washed regularly. For some types of processes (eg poultry processing) where food poisoning bacteria is likely to be present in high numbers, employees should wash their hands regularly throughout the day. Hands should always be washed after using a wc.
- All tools and work surfaces should be thoroughly and regularly washed with chlorinated water throughout the day.
- Smoking should not be allowed because bacteria from the mouth can be transferred via the cigarette to the hands and hence to the food. Spitting should be prohibited for similar reasons.

- All clothing should be clean. If necessary aprons or coats should be provided and regularly washed.

Useful contacts

WELL

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Website <http://www.lboro.ac.uk/well/>
Resource centre network for water, sanitation & environmental health

WaterAid

47-49 Durham Street
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Fax: +44 (0)20 7793 4545
E-mail: technicalenquiryservice@wateraid.org.uk
Website: <http://www.wateraid.org.uk>

Publications

- *Environmental Health Engineering in the Tropics: An Introductory Text*, Second Edition Sandy Cairncross Richard Feachem, Pub. John Wiley & Sons Ltd. ISBN 0 471 93885 8
- *Low-cost Sanitation* John Pickford ISBN 1 85339 233 2, ITDG Publishing
- *Food and drink manufacture - good manufacturing practice*, IFST, 5 Cambridge Court, 210 Shepherd Bush Road, London W6 7NL, United Kingdom.

Equipment suppliers

Note: This is a selective list of suppliers and does not imply endorsement by Practical Action.

Paper and probes for chlorine measuring
MERCK Limited
Broom Road, Parkstone
Poole, Dorset
BH12 4NN
United Kingdom

Water testing Kits
<http://www.celtic-eng.ie/>

WEDC
Equipment and addresses Information
<http://wedc.lboro.ac.uk/publications/pdfs/ews/ews05-3rd-ed.pdf>