MODULE 8

CLEANING AND MAINTENANCE OF EQUIPMENT
OBJECTIVES

a) Define the following terms: cleaning, detergent, disinfection, sanitiser, sterilisation
b) State the need for, and the benefits of, cleaning and disinfection
c) State the principles of systematic cleaning and disinfection
d) Explain the procedures and methods employed in cleaning and, if necessary, disinfecting equipment, work surfaces and premises
e) Explain the importance of choosing the right equipment for the informal sector in order to ensure safety and hygiene
8.1 INTRODUCTION

It is vital that any food business is kept in a clean and hygienic condition. As well as the structure, this will include the equipment and worksurfaces used during food handling. It is therefore the responsibility of the food handler or owner of the food business to make sure that proper cleaning is regularly carried out.

8.2 CLEANING DEFINITIONS

**Cleaning**

The process of removing visible food debris, dirt, soil, grease from all surfaces, fixtures, utensils and equipment.

**Disinfection**

The destruction of potentially harmful micro-organism to a safe level but not spores.

**Sterilization**

The process of removing all micro-organisms and spores.

**Detergent**

A chemical used to remove dirt, grease and food particles. Detergents do not kill micro-organisms. They are available as powders, liquids, foams or gels.

**Disinfectant**
A chemical used to reduce micro-organisms to a safe level.

**Sanitiser**

A detergent and disinfectant combined. Sanitisers are used to clean and disinfect at the same time.

Figure 1 below is a diagrammatic representation of the cleaning definitions.
DIRTY UTENSIL (before cleaning)

UTENSIL AFTER CLEANING  (with detergent, hot water & physical effort)

UTENSIL AFTER DISINFECTION

UTENSIL AFTER STERILIZATION

Figure 1 : Cleaning Definitions

8.3 REASONS FOR CLEANING

Reduce the risk of food poisoning

Removes grease and dirt
### 8.4 COST EFFECTIVE CLEANING

Effective cleaning requires a combination of energy forms:

- **Thermal energy** - Hot water
- **Kinetic energy** - Physical: Manual labour & Mechanical: machines
- **Chemical energy** - Detergents, disinfectants, sanitizer.

Normally a combination of two or more energy forms is required for effective cleaning.

The correct energy balance is essential for cost effective cleaning.

### 8.4.1 Factors influencing cleaning cost effectiveness

Cost effectiveness of the whole cleaning operation depends on:

- Choice of the correct chemical
- The temperature of application and concentration
• The time of application
• Use of the correct equipment

The correct mix of the above will reduce the work required and this can be illustrated by a simple graphic called the Sinner wheel as illustrated in Figure 2 below.

The Sinner Wheel

![Figure 2: The Sinner Wheel](image)

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Increased temperature improves cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical action</td>
<td>Increased mechanical action removes soil particles and improves cleaning.</td>
</tr>
<tr>
<td>Chemical action</td>
<td>A minimum concentration is required for cleaning</td>
</tr>
<tr>
<td>Time</td>
<td>Chemicals must be given sufficient time to act</td>
</tr>
</tbody>
</table>

**Use of correct Equipment**

A growing range of specialist equipment is available for cleaning operations and the correct choice will ensure that the most cost effective cleaning is carried out.

Common types and systems include:

- manual cleaning aids e.g cloths, brushes, mops and buckets
It is worth mentioning that scientific tests have proved that cleaning cloths are the most common cause of contamination in the kitchen. This is because bacteria can multiply quickly in moist conditions. These bacteria may then be transferred from one surface particularly after use on raw food preparation surfaces and lead to the contamination of food and possible food poisoning.

Cleaning cloths should be designated for certain areas of the kitchen be disinfected at least daily. Figure 3 below illustrates useful ways of managing cleaning cloths.

**Figure 3** : Useful ways of managing cleaning cloths

| Colour coding cloths for separate uses | Use of disposable paper towels where possible | Disinfection of cloths between use by soaking the cloth in a properly diluted disinfectant |

Mechanical cleaning aids e.g floor scrubbers, rotating washers, vacuum cleaners and power washers

### 8.5 DISINFECTION

Effective cleaning ensures that a surface is clean to the naked eye and free from residues but does not destroy the micro-organisms present on that surface.

For a surface to be free from high levels of harmful germs, it must be disinfected. All surfaces must be cleaned prior to disinfection. Disinfection is not a substitute for cleaning.
8.5.1 Methods of disinfection

**Heat Disinfection**
The application of heat is the most reliable and effective means of destroying micro-organisms, although it may not be the most practicable, especially for surfaces. Thermal disinfection can be achieved by immersing utensils, crockery and equipment in hot water at $82^\circ$C for 30 seconds.

**Steam Disinfection**
Steam jets may be used in large food factories to disinfect machinery or surfaces which are difficult to reach.

**Chemical Disinfection**
Chemicals used for the disinfection of surfaces and equipment must be food grade i.e. will not have an adverse effect on food, equipment or food handlers.

Common chemical disinfectants include bleach (hypochlorite), quaternary ammonium compounds and alcohols.
8.5.2 Where to disinfect

All surfaces where the presence of micro-organisms will have an adverse effect on food safety must be disinfected:

► Direct food contact surfaces – e.g Chopping boards, knives
► Hand and hand contact surfaces – e.g handles of doors, cupboards, drawers, refrigerators, water-taps
► Cleaning materials and equipment – mops, cloths
► Any surface or area that may sustain pest proliferation e.g garbage bins
8.6 **THE CLEANING AND DISINFECTION PROCESS**

Six basic stages are involved for any cleaning to be effective. These steps apply to all types of food establishments and include the cleaning of equipment, floors, walls and surfaces and are illustrated in Figure 4.

![Diagram of cleaning process]

- **PRE CLEAN**: Remove excess food waste by sweeping, wiping or pre-rinsing
- **MAIN CLEAN**: Loosen surface waste and grease using a detergent
- **RINSE**: Remove loose food waste grease and detergent
- **DISINFECT**: Destroy micro-organisms with disinfectant residues
- **FINAL RINSE**: Remove all moisture e.g by air drying
- **DRY**: Remove the disinfectant residues

*Figure 4: The cleaning and disinfection process*
8.6 WHEN TO CLEAN?

The two main concepts defining when the cleaning process should be carried out are:

1. «Clean as you go»
2. The Cleaning Schedule

8.6.1 «Clean as you go»

The «Clean as you go» concept is based on cleaning that must be done immediately after soiling occurs and not leaving the cleaning to be done at the end.

Examples:

- Washing and sanitising chopping board immediately after use
- Cleaning up of a floor spillage immediately after it has happened

All food handlers must be encouraged to «Clean as they go». A «Clean as you go» policy is an important part of good housekeeping and contributes towards maintenance of high standard of hygiene, prevents cross-contamination and helps to keep the workplace clean and tidy.
8.6.2 The Cleaning Schedule

A Cleaning Schedule is a written procedure that will give clear instructions to staff on what is required to achieve effective cleaning / disinfection by specifying:

- What is to be cleaned – (cooking utensils, refrigerator…)
- When is it to be cleaned (after use, daily, weekly, monthly)
- How is it to be cleaned (method, chemicals and equipment to be used)
- Who is to clean it
- What protective clothing will be born and precaution to be taken

To be successful, the cleaning schedule must be:

- clearly and concisely written
- without ambiguity
- ensure that instruction are easy to follow
- result in the objective of the schedule being achieved

The example below shows how a simple cleaning schedule can be written:

<table>
<thead>
<tr>
<th>Who</th>
<th>What</th>
<th>When</th>
<th>How</th>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chef</td>
<td>Chopping board</td>
<td>After each use</td>
<td>Sanitiser / hot water</td>
<td>Protective Gloves</td>
</tr>
</tbody>
</table>

A cleaning schedule can be used by the owner of a food business to check the standard of cleanliness each day.

Factors determining the frequency of cleaning:

- Structure of the building, wall, floor and ceiling finishes.
• Type of equipment.
• Type of soiling.
• The available water pressure and drainage system.
• Time constraint, manpower and training needs.
• If cleaning is necessary during food preparation.
• Whether or not disinfection is required.
• The requirements of health and safety at work.
• The overall cost including labour, equipment, chemicals, water and heat.

8.7 **KEY POINTS**

1) Clean from top to bottom.
2) Clean from outside to centre.
3) Ensure staff are trained to "Clean as they go" and to clean up spillages immediately.
4) Never mix different chemicals. Some chemicals can react together and produce toxic gases that can be dangerous to the food handler.
5) Cleaning equipment must be cleaned regularly and stored clean and dry.
6) Store cleaning materials and equipment in separate cupboards or rooms away from food.
7) Never put cleaning materials into unlabelled containers or food containers.
8) All equipment should flow in one direction, from dirty to clean through a cleaning process.
9) Inadequate rinsing of detergents after main cleaning may reduce the efficiency of disinfectants and may not reduce the number of micro-organisms to a safe level.
10) Disinfect all items which come into direct contact with food (e.g meat slicers, work surfaces, chopping boards) or with the hands of food handlers (e.g refrigerator door handles)
11) Even though a food contact surface may look clean, it is always a good idea to disinfect it before it is used in food preparation.

12) All chemical disinfectants have a recommended contact time. This is the time needed for micro-organisms to be reduced to a safe level. Equipment must be in contact with disinfectants for at least the time recommended by the manufacturer.

13) Staff must receive training to use chemicals correctly.

14) Staff must wear appropriate protective clothing (e.g. gloves).

15) When drying, try and let the item air dry, but if this is not possible, then use paper towels or a clean dry cloth.
8.8 CHOICE OF EQUIPMENT

Frequent and thorough disinfection and cleaning of food processing equipments must be an on-going process in order to eliminate microbial contaminations and, hence, restricts the various constraints that it may represent to the food industry. It is, therefore, vital and of utmost interest for the food handlers to choose the right equipment designed in such a way as to minimize harbourage of soils, bacteria or pests and to enable them to be thoroughly cleaned and disinfected.

8.8.1 Definition

EQUIPMENT” means an article that is used in the operation of a FOOD ESTABLISHMENT such as freezer, grinder, hood, ice maker, MEAT BLOCK, mixer, oven, reach-in-refrigerator, scale, sink, slicer, stove, table, temperature MEASURING DEVICE for ambient air, VENDING MACHINE, or WATER ACTIVITY machine.

8.8.1 Reasons for choosing the right piece of equipment

Food equipment carefully, professionally and hygienically designed would present enormous advantages:

- An improved hygienic condition
- Safety protection
- Time saving
- Increased saving in the quantity of cleaning products
- Improved revenue

8.8.2 Reasons for hygienic design of equipment

Hygienic design of equipment is necessary to:
Avoid product contamination and

Facilitate cost-effective cleaning and, if necessary, disinfection (downtime for cleaning will be minimized).

Good design necessitates the consideration of a complete process, the environment and the methods of cleaning and maintenance and not just the equipment in isolation.

Poorly designed equipment, which cannot be dismantled, may be uncleanable, incapable of being chemically disinfected and may result in product contamination and pathogenic bacteria which will be disastrous in the case of high risk food.

Unhygienic design may make cleaning and disinfection prohibitively expensive.

8.8.3 Characteristics of hygienically designed equipment

- All surfaces and joints must be smooth, without ridges or crevices which could harbour organic materials.

- Projections, edges and recesses should be minimal. Continuous welding is preferable.

- Screws and rivets should not be used unless technically unavoidable.

- Contact surfaces must be easily cleaned and disinfected. The design of internal surfaces, angles must allow thorough cleaning.

- Cleaning surfaces must drain from equipment surfaces and pipework. There must be no retention in voids.
The design should prevent organic accumulations or insect infestation in uncleanable areas. The use of castors or alternatively sealed base is recommended.

Lubricants must not come into contact with product.

Equipment should be designed to prevent cross contamination

Instrumentation must be constructed from appropriate materials and any transmitting fluids should be approved for food contact. Hygienic installations of instruments is essential. Controls such as push buttons must also be of hygienic design so that they can be maintained in a clean condition and be capable of being cleaned by whatever system is in use. Dials which are fitted to machines must have adequate clearance to allow cleaning.

All pipelines, vessels and equipment should be self-draining, not only to enable liquid deriving from foodstuffs to be discharged but also for cleaning and rinsing fluids.

8.8.4 Safety of construction materials

Safety of consumers

Materials in contact with food must be non-toxic, non-tainting and constituents from their surfaces must not migrate into the food or be absorbed by the food in quantities which could endanger the health and safety of consumers. Materials must have adequate strength over a wide temperature range, a reasonable life, be corrosion and abrasion resistant and be easily cleaned and disinfected. All equipment should provide

Electrical safety

Loose electrical wiring or extension leads should be discarded as it can be hazardous to customers, especially in rainy season if food preparations are carried out in the open air.
**Gas safety**

Gas bottle if used should be not placed near source of fire as the rubber connecting the bottle can get soft with the heat and hence explosion can occur. In fact the bottle itself should not be placed next to a source of fire.

**Mechanical safety**

Hot oil filtering equipment shall be readily accessible for filter replacement and cleaning of the filter. Provision should also be made for a temperature measuring device as the flash point of cooking oil can always be checked and controlled.

**8.8.5 Preparatory equipment**

Preparation surfaces should be jointless, durable, impervious, the correct height and provide a firm base on which to work. If materials other than stainless steel are used, for example, plastic laminate, care should be taken to seal the edges and gaps which may harbour food scraps. They must be able to withstand repeated cleaning at required temperature without premature deterioration, pitting or corrosion. Flanged-lip designs for tables and shelves which harbour food residues, and are difficult to clean, should be avoided.

Cutting boards should be

- non-absorbent
- resistant to stains, heat and food acids
- Non toxic
- Durable

**8.8.6 Serving Equipment**
Ceramic, china, crystal UTENSILS, and decorative UTENSILS such as hand-painted ceramic or china that are in contact with food shall be lead-free or contain levels of lead not exceeding the limits of the following UTENSILS categories:

<table>
<thead>
<tr>
<th>UTENSIL CATEGORY</th>
<th>DESCRIPTION</th>
<th>MAXIMUM LEAD (MG/L (mg/L))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot BEVERAGE Mugs</td>
<td>Coffee mugs</td>
<td>0.5</td>
</tr>
<tr>
<td>Large Hollowware</td>
<td>Bowls &gt; 1.1 L</td>
<td>1.0</td>
</tr>
<tr>
<td>Small Hollowware</td>
<td>Bowls &lt; 1.1 L</td>
<td>2.0</td>
</tr>
<tr>
<td>Flat UTENSILS</td>
<td>Plates, Saucers</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Copper and copper alloys** such as brass may be used in contact with a FOOD that has a pH (pH) below 6 such as vinegar, fruit juices, or wine or for a fitting or tubing installed between a backflow prevention device and a carbonator.

**Galvanized metal** may not be used for UTENSILS or FOOD CONTACT SURFACES of EQUIPMENT that are used for BEVERAGES, acidic FOOD, moist FOOD, or hygroscopic FOOD.

**Gloves**
If used, single use gloves shall be used for only one task such as working with READY TO EAT FOOD or with raw animal FOOD, used for no other purpose, and discarded when damaged or soiled, or when interruptions occur in operation.

**8.8.7 Food temperature measuring devices**

Food temperature measuring devices may not have sensors or stems constructed of glass, except that thermometers with glass sensors or stems that are encased in a shatterproof coating such as candy thermometers may be used.
8.8.8 Dispensing Equipment

In equipment that dispenses or vends liquid FOOD or ice in unpacked form, it is important that:

- The delivery tube, chute, orifice, and splash surfaces directly above the container receiving the FOOD shall be designed in a manner, such as with barriers, baffles, or drip aprons, so that drips from condensation and splash are diverted from the opening of the container receiving the food.

- The delivery tube, the chute, and the orifice shall be protected from manual contact such as by being recessed.

- The delivery tube or chute and orifice of equipment used to vend liquid FOOD or ice in an unpacked form to self-service consumers shall be designed so that the delivery tube or chute and orifice are protected from dust, insects, rodents, and other contamination by a self-closing door if the equipment is:

  (1) Located in an outside area that does not otherwise afford the protection of an enclosure against the rain, windblown debris, insects, rodents, and other contaminants that are present in the environment or

  (2) Available for self-service during hours when it is not under the full-time supervision of a food employee; and

- The dispensing EQUIPMENT actuating lever or mechanism and filling device of consumer self-service BEVERAGE dispensing EQUIPMENT shall be designed to prevent contact with the lip-contact surface of glasses or cups that are refilled.

8.9 MAINTENANCE OF EQUIPMENT
Equipment must always be kept clean and in good working order. Efficiency and cost savings will be enhanced and overheads decrease.

By regular maintenance your equipment will

▷ last longer
▷ work better
▷ not present a fire hazard

No cleaning equipment is effective unless it is well maintained, cleaned and disinfected after use; otherwise neglect may result in:

- Damage
- Loss of efficiency
- Standard of cleanliness will fall

To perform maintenance tasks of cleaning equipment, the following should be observed:

❖ When to use equipment
❖ How to use equipment
❖ How to clean each equipment
❖ Explain the concept of ‘clean as you go’
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