Spice and Herbs Processing Level-II

Based on May 2019, Version 2 Occupational standards

Module Title: - Operating a Heat Treatment Process

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LG #58	LO #1- Prepare the heat treatment process for operation

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Confirming materials for heat treatment
- Identifying and confirming cleaning and maintenance requirements and status
- Entering processing/operating parameters
- Checking and adjusting equipment performance
- Carrying out pre-start service checks

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Confirm materials for heat treatment
- Identify and confirm cleaning and maintenance requirements and status
- Enter processing/operating parameters
- Check and adjust equipment performance
- Carry out pre-start service checks

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets”
7. Perform “the Learning activity performance test” which is placed following “Operation sheets”
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go

back to “Operation sheets”.

Information Sheet 1- Confirming materials for heat treatment

1.1. Introduction

Heat treatment is a common lethality process control. Heat treatments generally fall into in to the following two categories:

- Heat treatment that leads to commercial sterility: heat processing at high temperatures (> 212^{o}F (100°C)) under pressure with the objective of killing all forms of microorganisms, including the spores of bacteria. The treated products are shelf-stable without refrigeration. (Lower temperatures can lead to products that are shelf-stable in some cases, e.g., when the pH is low enough to prevent growth of surviving spore formers.)
- Heat treatment that reduces microbial pathogens but does not lead to commercial sterility: heat processing at lower temperatures (e.g., 158°F (70°C) to 212°F (100°C)), with the processes designed to kill the vegetative forms of microorganisms with little to no effect on the spores of bacteria. The treated products are not shelf-stable and require controls such as refrigeration to control spores of bacterial pathogens. Different Heat treatment materials can be confirm by a

- Autoclave
- Dry heat
- Chemical sterilization
- Ethylene oxide
- Nitrogen dioxide
- Microwave
- Oven dry
- Saturated steam
- High pressure
- Dry heat,
- Ultraviolet radiation,
- Gas vapor sterilants,

A. Nitrogen dioxide

Nitrogen dioxide (NO_2) gas is a rapid and effective sterilant for use against a wide range of microorganisms, including common bacteria, viruses, and spores. The unique physical properties of NO_2 gas allow for sterilant dispersion in an enclosed environment at room temperature and atmospheric pressure. The mechanism for lethality is the degradation of DNA in the spore core through nitration of the phosphate backbone,

which kills the exposed organism as it absorbs NO_2. This degradation occurs at even very low concentrations of the gas.

B. Steam

A widely used method for heat sterilization is the autoclave, sometimes called a converter or steam sterilizer. Autoclaves use steam heated to 121–134 °C (250–273 °F) under pressure. To achieve sterility, the article is placed in a chamber and heated by injected steam until the article reaches a temperature and time set point. Almost all the air is removed from the chamber, because air is undesired in the moist heat sterilization process (this is one trait that differs from a typical pressure cooker used for food cooking).

C. Chemical sterilization

Chemicals are also used for sterilization. Heating provides a reliable way to rid objects of all transmissible agents, but it is not always appropriate if it will damage heat-sensitive materials such as biological materials, fiber optics, electronics, and many plastics. In these situations chemicals, either in a gaseous or liquid form, can be used as sterilants. While the use of gas and liquid chemical sterilants avoids the problem of heat damage, users must ensure that the article to be sterilized is chemically compatible with the sterilant being used and that the sterilant is able to reach all surfaces that must be sterilized (typically cannot penetrate packaging). In addition, the use of chemical sterilants poses new challenges for workplace safety, as the properties that make chemicals effective sterilants usually make them harmful to humans. The procedure for removing sterilant residue from the sterilized materials varies depending on the chemical and process that is used.

D. Ethylene oxide

Ethylene oxide (EO, EtO) gas treatment is one of the common methods used to sterilize, pasteurize, or disinfect items because of its wide range of material compatibility. It is also used to process items that are sensitive to processing with other methods, such as radiation (gamma, electron beam, X-ray), heat (moist or dry), or other chemicals. Ethylene oxide treatment is the most common chemical sterilization method,

used for approximately 70% of total sterilizations, and for over 50% of all disposable medical devices

E. Nitrogen dioxide (NO_2)

NO_2 gas is a rapid and effective sterilant for use against a wide range of microorganisms, including common bacteria, viruses, and spores. The unique physical properties of NO_2 gas allow for sterilant dispersion in an enclosed environment at room temperature and atmospheric pressure. The mechanism for lethality is the degradation of DNA in the spore core through nitration of the phosphate backbone, which kills the exposed organism as it absorbs NO_2. This degradation occurs at even very low concentrations of the gas.

F. Use of Time-Temperature

Temperature is an essential factor that affects the growth of bacteria. Bacterial growth can occur over a wide range of temperatures from about 23°F (-5°C) to 194°F (90° C).

- Thermophiles grow at hot temperatures above 131°F (55°C).
- Mesophiles grow at or near room temperatures.
- Psychrophiles grow at or near refrigeration temperatures.
- Psychrotrophs are capable of growth at refrigeration temperatures, but their optimal growth temperature is in the mesophilic range

G. Use of Refrigeration as a Time-Temperature Process Control

Refrigeration works well for controlling the growth of most pathogenic bacteria. However, some pathogens, like *L*. *monocytogenes* and *Yersinia enterocolitica*, can grow at temperatures close to freezing. Refrigeration has the added advantage of slowing down biological and chemical processes that result in spoilage, oxidative rancidity, and other quality defects. Control of temperature during storage can be accomplished in several ways, such as ice, chemical coolant gel packs, and mechanical dry refrigeration (e.g., in a cooler). Controlling temperature with ice or gel packs can be effective if there is an adequate amount of ice or gel packs. Therefore, you should monitor the control by checking whether an adequate amount of coolant is present on the product at all times, including when it is shipped and when it is received and

checking the temperature of the food with a thermometer or temperature recording device.

Table 1.1: Classification based on optimum temperature and pH for vigorous growth

Approximate temperature(^{o} C) for vigorous growth	**Acidity**	
	Acid	Low acid
Thermophilic (35-55^{o}C)	*B. Coagulans* *S. thermophilus* *L. bulgaricus*	*C. thermosaccharolyticum* *C. nigrificans* *B. stearothermophilus*
Mesophilic 20 to 45 °C (68 to 113 °F)	*C. butyricum* *C. pasteurianum* *B. mascerans* *B. polymyxa*	*C. botulinum,* *C. Sporagenes* *B. licheniformis* *B. subtilis*
Psychrophilic (−20 °C to +10 °C)	*Pseudomonas* *Micrococcus*	*C. botulinum* *S. aureus*

Table 1.2: Effect spice and herbs heat treatment

Spice and Herbs	**Treatment condition**	**Observed Effect**
All spice	130℃ for 5 min	(-) TPC, DPPH RSA, FRP, TBARS
Anise	Drying at 70℃ 30 min microwave 75 s	(-) Safe role (-90%) Safe role
Basil	Microwave, 30-70 watt/KG for 15 min	(- 32%) DPPH RSA
Cloves	Boiling 100℃ for 30 min	(*I*) lipid peroxidation
Cinnamon	Boiling 100℃ for 30 min	(*I*) lipid peroxidation
Cumin	Drying at 70℃ 30 min microwave 75 s	(-) Safe role (-90%) Safe role
Garlic	Boiling 100℃ for 30 min	(*I*) lipid peroxidation
Ginger	Boiling 100℃ for 30 min Boiling and frying	(*I*) lipid peroxidation (- 32%) DPPH RSA

	Drying at 70℃ 30 min microwave 75 s microwave-, oven-, sun-drying	(-) Safe role (-90%) Safe role (-58% to 91%) TPC, antioxidaint activity, FRP
Extract	37℃	(+) TBARS
Oil	120℃ for 1 hour	(+) DPPH RSA
Mint	Boiling 100℃ for 30 min	(*I*) lipid peroxidation
Nutmeg Oil	Heating up to 180℃	(+) DPPH RSA
Onion	Boiling 100℃ for 30 min	(*I*) lipid peroxidation
Oregano	130℃ for 5 min Microwave, 30-70 watt/KG for 15 min	(-) DPPH RSA, FRP, TBARS and TPC (+20%) TPC

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Filling the blank.

1. A widely used method for heat sterilization is the autoclave, sometimes called a …… sterilizer.
2. …… use steam heated to 121–134 °C (250–273 °F) under pressure.
3. …… gas is a rapid and effective sterilant for use against a wide range of microorganisms, including common bacteria, viruses, and spores.

Test II: Matching

_____1. Thermophiles	A. Boiling 100℃ for 30 min
_____2. Mesophiles	B. Ethylene oxide treatment
_____3. Psychrophiles	C. Grow at hot temperatures above 131°F (55°C).
_____4. Radiation	D. Moist or dry
_____5. Heat	E. Grow at or near room temperatures.
_____6. Chemicals	F. Grow at or near refrigeration temperatures.
_____7. Cloves, cinnamon, ginger, garlic and onion	G. Gamma, electron beam, X-ray

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information Sheet 2- Identifying and confirming cleaning and maintenance requirements and status

Autoclave, microwave, oven dry etc. cleaning and maintenance requirements and status should identify. It is important to carry out a series of checks before using a piece of equipment. This is particularly important in situations in which a number of people use the same machine. Larger companies and organisations usually have a system of checks, and a maintenance department that will deal with reported defects. Individuals working alone or in small teams will be responsible for checking and maintaining their own machines. Learners should be able to follow a checklist to ensure that they complete all the necessary checks. This may mean using either a pre-set format like the one shown on the focus page or the list from an operator manual.

Cleaning is the removal of dirt and soil from a surface. A cleaner is a formulated chemical system or product, dispersed in water, which removes unwanted dirt, soil, grease, and other similar matter from a surface.

Cleanliness is a relative term. The total process dictates the degree of cleanliness. For example, a part is being cleaned during various states of manufacture to remove chips or machinery fluids. The cleaner leaves behind a residual rust protective film, and although there is residual film on the part, it is considered clean. In the case of electroplating, blackening, or enameling, the part must be chemically clean, often referred to by the term “water-break free.” After cleaning, if a part is rinsed in clear water, the water should run down the part in a continuous unbroken film, which indicates a water-break free part. A film that is interrupted indicates some soil remains on the surface.

Cleanliness should be determined by the customer. During a cleaner trial, it is good policy to allow the customer to make the initial comments concerning cleanliness. A part that may appear to be dirty to an operator could be quite acceptable to the final customer.

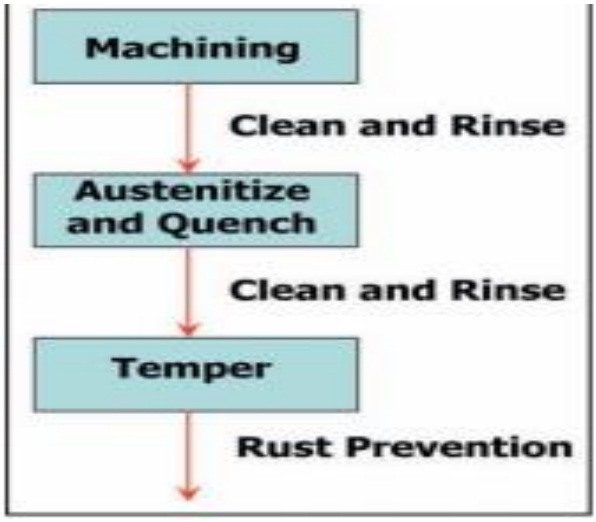

Figure 1.1: Typical cleaning process schematic for heat treating

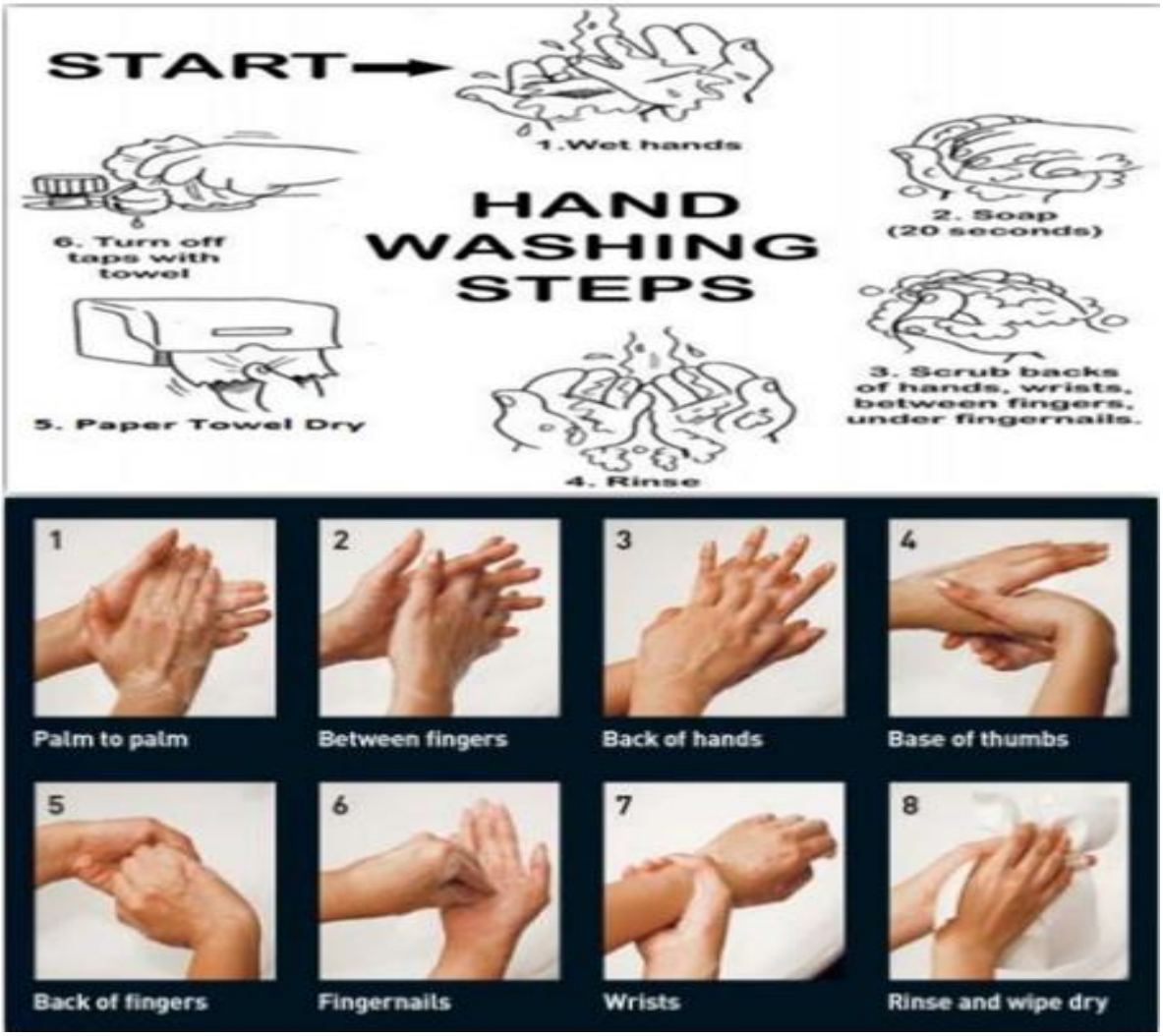

Figure 2.1: How to wash hands

Figure 2.2: When to wash your hands

Raw materials

1. No raw material or ingredient thereof shall be accepted by an establishment if it is known to contain parasites, undesirable micro-organisms, pesticides, veterinary drugs or toxic items, decomposed or extraneous substances, which would not be reduced to an acceptable level by normal sorting and/or processing
2. All raw materials, food additives and ingredients, wherever applicable, shall conform to all the Regulations and standards laid down under the Act
3. Records of raw materials, food additives and ingredients as well as their source of procurement shall be maintained in a register for inspection
4. All raw materials should be checked & cleaned physically thoroughly
5. Raw materials should be purchased in quantities that correspond to storage/ preservation capacity
6. Packaged raw material must be checked for 'expiry date'/ 'best before'/ 'use by' date, packaging integrity and storage conditions.
7. Receiving temperature of potentially high risk food should be at or below 5 ºC
8. Receiving temperature of frozen food should be -18 ^{0}C or below.

Self-Check – 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions (2 points)

1. When we clean machine?
2. Draw typical cleaning process schematic for heat treating?
3. How to wash hands?

Note: **Satisfactory rating -6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet 3- Entering processing/operating parameters

Important heat process parameters:

- Temperature,
- Time,
- Dose of spices,
- Heat transfer surface,
- Rotation speed heat power

Pasteurization

- Destruction of pathogenic microorganims
- Mild heat treatment (temperature applied from 55^{o}C – 100^{o}C)
- For low acid (pH > 4.5/4.6) foods
  - ✓ immediate cooling below 4^{o}C within 2 h after processing is important
  - ✓ temporary shelf-life extension (2 weeks)
- For high acid foods (pH< 4.5/4.6) no need of refrigeration after processing
- Associated also with hermetically sealed packaging

Sterilization or Appertisation

- Commonly done for low acid foods (pH > 4.5/4.6)
- Application of heat for shelf life extension & promotion of safety
- More severe heat treatment (100 -150^{o}C), T= 121oC reference temp.
- Long term preservation (up to 2 years)
- Associated with strong hermetically sealed packaging
- Commonly storage below 30^{o}C (usually at room temperature)
- Environment in the food will prevent the growth of microorganisms of public health concern & spoilage types

Self-Check – 3	Written test

Name…… ID…… Date……..

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: choose the best answer. (1 point)

1. Important heat process parameters:
   A. Temperature,
   B. Time,
   C. Dose of spices, and Heat transfer surface,
   D. Rotation speed heat power
   E. All of the above
2. Which of the following is a not true about sterilization or appertisation
   A. More severe heat treatment (100 - 150^{o}C), T= 121^{o}C reference temp.
   B. Long term preservation (up to 2 years)
   C. Associated with strong hermetically sealed packaging
   D. Commonly storage below 30^{o}C (usually at room temperature)
   E. Environment in the food will prevent the growth of microorganisms of public health concern & spoilage types
   F. Destruction of pathogenic microorganims
3. Which of the following is a not true about pasteurization
   A. Mild heat treatment (temperature applied from 55^{o}C – 100^{o}C)
   B. immediate cooling below 4oC within 2 h after processing is important
   C. temporary shelf-life extension (2 weeks)
   D. For high acid foods (pH< 4.5/4.6) no need of refrigeration after processing
   E. Associated also with hermetically sealed packaging
   F. More severe heat treatment (100 -150^{o}C)

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet 4- Checking and adjusting equipment performance

1.1. Introduction

The industrial equipment used in the thermal processing of foods is divided into two broad categories, in-container sterilizers and continuous flow processing equipment. The majority of canned foods are still produced by various in-container retorts (sterilizers). Pasteurization of liquid foods is practiced with continuous flow pasteurizers, while aseptic processing, using continuous flow sterilizers, has found many applications in fluid foods. The simplest form of pasteurizer is a hot water bath in which bottles are immersed. A more advanced pasteurizing unit includes:

- Plate heat exchangers
- Tubes through which the liquid to be pasteurized passes.

1.2. Cooling

Cooling of large (e.g., No. 10) and flat cans with water requires overriding air pressure to prevent the bulging, i.e., mechanical distortion of the cans, due to excessive internal pressure, particularly during the initial stage of cooling. The high pressure developed within the cans is due to the increased pressure of water vapor at high temperatures and the pressure of the entrapped air or other gases.

Cooling of the cans with water, after retorting, should be fast, so that the inside can temperature should reach quickly a temperature of about 38 ^{o}C, in order to prevent the growth of any surviving thermophilic bacteria. However, lower temperatures should be avoided, since the metallic cans may be corroded (rusted), due to the condensation of moisture on the can surface (in humid climates).

The still retorts have the basic disadvantage of low heating rates of the cans, due to low heat transfer coefficients of natural convection between the heating medium (steam or water) and the cans. Improvement of the heat transfer rate is achieved by forced convection of the heating medium and/or agitation of the food containers. Fast-heating retorts include the batch rotary sterilizers, and the special sterilizers.

1.3. In-container Sterilizers

In-container retorts (sterilizers) are used extensively in canning several food products in various hermetically sealed containers, made of metallic cans (tinplate or aluminum), glass, and plastic materials (rigid or flexible pouches). The heating medium is usually saturated steam, steam/air mixtures, and hot water. Heating of the cans in still retorts by sprays of hot water provides faster heating and a good temperature control.

1.4. Batch Sterilizers

Batch sterilizers (retorts) are used in many small- and medium-size food processing plants, because of their low cost and simple operation. The batch sterilizers include the still retorts, the rotary batch retorts, the crateless retorts, and the retorts for glass and flexible container. Two types of still retorts (autoclaves) are commonly used, the vertical and the horizontal units.

The vertical retorts consist of a steel cylindrical vessel of dimensions about (1.5 m diameter) * (2.5 m length), with a hinged large top cover, which can be closed hermetically during processing. They are equipped with all the necessary piping, valves, and instruments, specified by regulations and technical publications for the canning industry (NFPA). The retorts should be constructed following special mechanical and safety specifications, such as those of the ASME code for unfired pressure vessels.

Efficient use of the retorts must meet certain construction and operation requirements, established by experience, some of them general and some specific. Thus, the steam in still retorts is introduced through steam spreaders, i.e., perforated pipes located at the bottom. Vents, i.e., valves for removing air from the retort, are always placed opposite to the steam spreaders, usually at the top of the retorts. Bleeders (small valves of diameter 1.6–3.2 mm) should be placed on the top and near the instrument wells for letting a small amount of steam to escape continuously into the atmosphere during thermal processing. The purpose of bleeding is to remove any amount of air that may be introduced into the retort with the steam during processing. Air piping and valves are required for air-overpressure processing (equalizing the container pressure during cooling, especially of glass containers). The retort temperature should be measured with a mercury thermometer, installed at a specified location on the retort, and recorded

in a recorder/controller. A pressure gauge and a pressure relief valve are also required. Thermocouples are also used in temperature recording and control.

Self-check 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Choose the best answer (2 point)

1. What is batch sterilizer?
2. What is In-container retorts (sterilizers?
3. What is pasteurization?

Note: **Satisfactory rating -6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet 5- Carrying out pre-start service

5.1. Pre-start checks of equipment and machine

A responsible operator, running a pre-start check on your plant or machinery before you start the day is the best way to ensure the job gets done safely and without delay. Undertaking a pre-start check on your machine before you start a day work happens in three stages.

- Visual inspections of important features prior to starting the machine
- Visual & function tests while the machine is turned on but stationary
- Testing the machine's functions during a short drive

Check all the tools and equipment before use.

- Are all the tools and equipment functional and sufficient enough in number?
- Are all free from any contaminants?
- Is there any tools and equipment which needs maintenance?
- Is the tools and equipment function coincides with the given task?

Then check and report to your supervisor the condition of these tools and equipment. After reporting the condition of tools and equipment, your supervisor will guide you what to do if there is insufficient of tools and equipment to perform this particular work.

5.2. Service checking of tools, equipment and machinery

Tools, equipment and machinery shall be kept in proper operating condition and used only for the purpose for which they were designed. If proper and safe tools are unavailable, this should be reported to the supervisor. All tools, equipment and machineries should be inspected at regular intervals, and any tool that develops defects while in use shall be taken from service, tagged and not used again until restored to proper working condition.

Self-Check –5	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. List the importance of service checking of tools, equipment and machinery? (1pts)

Test II: Write true if the statement is correct and false if the statement is incorrect

1. Tools, equipment and machinery shall be kept in proper operating condition and used only for the purpose for which they were designed. (2pts)

2. All tools, equipment and machineries should be inspected at regular intervals, and any tool that develops defects while in use shall be taken from service and not used again until restored to proper working condition. (2pts)

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

LG #59	LO #2- Operate and monitor the heat treatment process

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Starting and operating spice and herbs heat treatment process
- Monitoring heat treatment equipment
- Identifying variation in equipment operation and reporting maintenance requirement
- Monitoring the process
- Confirming temperature specification
- Identifying, rectifying and reporting out-of-specification product/process outcomes
- Meeting workplace housekeeping standards
- Maintaining workplace records

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, **you will be able to**:

- Start and operate spice and herbs heat treatment process
- Monitor heat treatment equipment
- Identify variation in equipment operation and reporting maintenance requirement
- Monitor the process
- Confirm temperature specification
- Identify, rectify and report out-of-specification product/process outcomes
- Meet workplace housekeeping standards
- Maintain workplace records

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5. Ask from your trainer the key to correction (key answers) or you can request your

trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide.

If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Starting and operating spice and herbs heat treatment process

The irradiation treatment of foods and plant products, especially of herbs and spices, is considered to be a standard and safe sterilization technique, utilization of which was recently accepted also by international authorities. In dependence on the absorbed dose of radiation, various positive effects can be achieved, including reduced storage losses, extended shelf life and/or improved microbiological and parasitological safety of foods. On the other hand, higher doses of ionizing radiation may result in irreversible changes in the structure, physical, chemical or biochemical properties of foods preserved in that way. Therefore, exact studies of gamma-irradiation food processing and its effects on safety, nutritional and organoleptic properties are necessary.

Heat treatment is a common lethality process control. Heat treatments generally fall into in to the following two categories:

- Heat treatment that leads to commercial sterility: heat processing at high temperatures (> 212^{o}F (100°C)) under pressure with the objective of killing all forms of microorganisms, including the spores of bacteria. The treated products are shelf-stable without refrigeration. (Lower temperatures can lead to products that are shelf-stable in some cases, e.g., when the pH is low enough to prevent growth of surviving spore formers.)
- Heat treatment that reduces microbial pathogens but does not lead to commercial sterility: heat processing at lower temperatures (e.g., 158°F (70°C) to 212°F (100°C)), with the processes designed to kill the vegetative forms of microorganisms with little to no effect on the spores of bacteria. The treated products are not shelf-stable and require controls such as refrigeration to control spores of bacterial pathogens.

Some terms and concepts used to describe the thermal destruction of microorganisms include:

- TDT (Thermal Death Time) is the time necessary to kill a given number of microorganisms at a specified temperature. The TDT is obtained by keeping

temperature constant and measuring the time necessary to kill the amount of cells specified.

- D Value (the decimal reduction time) is the time required to kill 90% of the microorganisms. Another way of expressing this is the time required at a specific temperature and under specified conditions to reduce a microbial population by one decimal (sees discussion below).
- z Value refers to the degrees in Fahrenheit required for the thermal destruction curve to cross one log cycle (i.e., for reducing the D value by a factor of 10)

Pasteurization

A process named after scientist Louis Pasteur which uses the application of heat to destroy human pathogens in foods.

For the food industry, the terms "pasteurization", "pasteurized" and similar terms shall mean the process of heating every particle of food product, in properly designed and operated equipment, to one (1) of the temperatures given in the following chart and held continuously at or above that temperature for at least the corresponding specified time: Pasteurization Type

- 63ºC (145ºF)*30 minutes Vat Pasteurization
- 72ºC (161ºF)* 15 seconds High temperature short time Pasteurization (HTST)
- 89ºC (191ºF) 1.0 second Higher-Heat Shorter Time (HHST)
- 90ºC (194ºF) 0.5 seconds Higher-Heat Shorter Time (HHST)
- 94ºC (201ºF) 0.1 seconds Higher-Heat Shorter Time (HHST)
- 96ºC (204ºF) 0.05 seconds Higher-Heat Shorter Time (HHST)
- 100ºC (212ºF) 0.01 seconds Higher-Heat Shorter Time (HHST)
- 138ºC (280ºF) 2.0 seconds Ultra Pasteurization (UP)

If the fat content of the milk product is ten percent (10%) or more, or if it contains added sweeteners, or if it is concentrated (condensed), the specified temperature shall be increased by 3ºC (5ºF)

The original method of pasteurization was vat pasteurization, which heat milk or other liquid ingredients in a large tank for a at least 30 minutes. It is now used primarily in the dairy industry for preparing milk for making starter cultures in the processing of cheese, yogurt, and butter milk and for pasteurizing some ice cream mixes.

The most common method of pasteurization in the United States today is High Temperature Short Time (HTST) pasteurization, which uses metal plates and hot water to raise milk temperatures to at least 161° F for not less than 15 seconds, followed by rapid cooling.

Higher Heat Shorter Time (HHST) is a process similar to HTST pasteurization, but it uses slightly different equipment and higher temperatures for a shorter time.

For a product to be considered Ultra Pasteurized (UP), it must be heated to not less than 280° for two seconds. Ultra Pasteurized of pasteurization results in a product with longer shelf life but still requiring refrigeration. Another method, aseptic processing, which is also known as:

- Ultra High Temperature (UHT), involves heating the milk using commercially sterile equipment and filling it under aseptic conditions into hermetically sealed packaging
- The product is termed "shelf stable" and does not need refrigeration until opened.

Technological principles of pasteurization: Physical and chemical factors which influence pasteurization process are the following:

a. Temperature and time;
b. Acidity of the products;
c. Air remaining in containers.

Pasteurization processes. In pasteurizing certain acid juices for example, there are two categories of processes:

a) Low pasteurization or Low Temperature Long Time (LTLT).

- The temperature used is fairly low and the food is held at this temperature for several minutes.

- There are three distinct phases of treatment: heating to the desired temperature, holding at this temperature for the required time, cooling the product.
- Two typical time and temperature combinations used for fruit juices are as follows: 63-65°C for 30 minutes 75°C for 8-10 minutes this is the method of pasteurisation most regularly used by small-scale processors as it requires very little equipment and produces a safe product.

b) High Temperature Short Time (HTST)

- High temperature short time pasteurisation has fewer damaging effects on the nutritional value, especially on the vitamin content of foods.
- However, it requires more accurate temperature control and slightly more sophisticated equipment.
- Depending on the pH of the food, the type of product and the result required, there are a number of different combinations of time and temperature that are commonly used. 88°C for 1 minute 100°C for 12 seconds 121°C for 2 seconds

Pasteurization temperature and time will vary according to:

- Nature of product; initial degree of contamination;
- Pasteurized product storage conditions and shelf life required.

In this first category of pasteurization processes it is possible to define three phases:

- Heating to a fixed temperature;
- Maintaining this temperature over the established time period (pasteurization time);
- Cooling the pasteurized products:
  - ✓ Natural (slow) or
  - ✓ Forced cooling.

Rapid, high or flash pasteurization is characterized by a pasteurization time in the order of seconds and temperatures of about 85° to 90° C or more, depending on holding time. Typical temperature/time combinations are as follows:

- 88° C (190° F) for 1 minute;
- 100° C for 12 seconds;
- 121°C for 2 seconds.

While bacterial destruction is very nearly equivalent in low and in high pasteurization processes, the 121° C/2 seconds treatment give the best quality products in respect of flavour and vitamin retention. Such short holding times, however, require special equipment which is more difficult to design and generally is more expensive than the 63-65 °C for 30 minute's type of processing equipment.

In flash pasteurization the product is heated up rapidly to pasteurization temperature, maintained at this temperature for the required time, then rapidly cooled down to the temperature for filling, which will be performed in aseptic conditions in sterile receptacles. Taking into account the short time and rapid performance of this operation, flash pasteurization can only be achieved in continuous process, using plate heat exchangers. Industrial applications of pasteurization process are mainly used as a means of preservation for fruits and vegetable juices and especially for tomato juice.

Thermo penetration

The thermo penetration problem is extremely important, especially in the case of the pasteurization of products packed in glass containers because it is the determining factor for the success of the whole operation. During pasteurization it is necessary that a sufficient heat quantity is transferred through the receptacle walls;

- This is in order that the product temperature rises sufficiently to be lethal to micro-organisms throughout the product mass.

The most suitable and practical method to speed up thermo penetration is the movement of receptacles during the pasteurization process. Rapid rotation of receptacles around their axis is an efficient means to accelerate heat transfer, because this has the effect, among others of rapidly mixing the contents. The critical speed of for this movement is generally about 70 rotations per minute (RPM). This enables a more uniform heating of products, reducing heating time and organoleptic degradation. Heating may precede or follow packaging. These principles of different temperature time combinations very largely determine the design parameters for heat preservation equipment and commercial practices.

The food processor will employ no less than that heat treatment which gives the necessary degree of micro-organism destruction. This is further ensured by periodic inspection by local sanitary authorities or by the importing countries sanitary services. However, the food processor also will want to use the mildest effective heat treatment to ensure highest food quality.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions

1. What is High Temperature Short Time (HTST)?
2. What is flash pasteurization?
3. What is Ultra High Temperature (UHT)?
4. What is Ultra Pasteurized?

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 2- Monitoring heat treatment equipment

Temperature is an essential factor that affects the growth of bacteria. Bacterial growth can occur over a wide range of temperatures from about 23°F (-5°C) to 194°F (90°C).

A. Use of Refrigeration as a Time-Temperature Process Control

Refrigeration works well for controlling the growth of most pathogenic bacteria. However, some pathogens, like *L. monocytogenes* and *Yersinia enterocolitica*, can grow at temperatures close to freezing. Refrigeration has the added advantage of slowing down biological and chemical processes that result in spoilage, oxidative rancidity, and other quality defects. Control of temperature during storage can be accomplished in several ways, such as ice, chemical coolant gel packs, and mechanical dry refrigeration (e.g., in a cooler).

Controlling temperature with ice or gel packs can be effective if there is an adequate amount of ice or gel packs. Therefore, you should monitor the control by checking whether an adequate amount of coolant is present on the product at all times, including when it is shipped and when it is received and checking the temperature of the food with a thermometer or temperature recording device.

B. Time/Temperature

When food is removed from refrigeration, the temperature of the food gradually increases and can reach the temperature associated with the growth range specific to particular pathogens. Bacterial pathogens go through a lag phase, where little or no growth occurs as the microorganisms adjust to their new environment. Depending upon the ambient temperature, it is possible that food can stay out of refrigeration for at least a couple of hours with no risk of significant pathogen growth.

C. Cooling after Cooking

Cooling after cooking can be a critical function influencing the safety of a food (FDA, 2013). Depending upon the food and ingredients, cooked foods can still have viable

pathogenic bacteria present. For example, the spores of spore forming pathogens such as *C. botulinum* can survive cooking processes.

D. Use of Freezing as a Time-Temperature Process Control

Foods are microbiologically stable when held at temperatures below 17.6°F (-8°C). During frozen storage, populations of viable microorganisms in most foods will decrease; however, some microorganisms remain viable for long periods of time during frozen storage. Most viruses, bacterial spores, and some bacterial vegetative cells survive freezing unchanged. Some of the other microorganisms are sensitive to the freezing and thawing process (i.e., freezing, frozen storage, or thawing). Since multi-celled organisms (such as such as parasitic protozoa, nematodes, and trematodes) are generally more sensitive to low temperatures than are bacteria; freezing and frozen storage are good methods for killing these organisms in various foods.

Self-Check – 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Filling the blank

1. Dried turmeric is …… to remove the outer dirty skin, roots and soil particles, and transformed into relatively smooth, bright and yellowish rhizomes. (1 points)
2. …… can be done by hand or by beating the rhizomes in a gunny bag. (1 points)
3. …… and …… are two primary processes for quality enhancement. (2 points)
4. ……turmeric rhizomes in a rotary machine were useful for efficient washing and bruising. (1 points)
5. Polishing drums are being used at many places of the world for …… and …… of various agricultural products. (2 points)

Note: **Satisfactory rating - 7 points** **Unsatisfactory - below 7 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 3- Identifying variation in equipment operation and reporting maintenance requirement

Fault reporting is a maintenance concept that increases operational availability and that reduces operating cost through three mechanisms.

- Reduce labor-intensive diagnostic evaluation
- Eliminate diagnostic testing down-time
- Provide notification to management for degraded operation

This is a prerequisite for Condition-based maintenance. Active redundancy can be integrated with fault reporting to reduce down time to a few minutes per year.

- Passive redundancy
- Active redundancy

Principle maintenance requires three actions.

- Fault discovery
- Fault isolation
- Fault recovery

Fault discovery requires diagnostic maintenance, which requires system down time and labor costs. Down time and cost requirements associated with diagnostics are eliminated for every item that satisfies the following criteria.

- Automated diagnostic
- Instrumented for remote viewing
- Displayed in the viscidity of supervisory personnel

Implementation

Fault reporting is an optional feature that can be forwarded to remote displays using simple configuration setting in all modern computing equipment. The system level of reporting that is appropriate for Condition Based Maintenance are critical, alert, and emergency, which indicate software termination due to failure. Specific failure reporting,

like interface failure, can be integrated into applications linked with these reporting systems. There is no development cost if these are incorporated into designs.

Benefits

The historical approach for Fault discovery is periodic diagnostic testing, which eliminates the following operational availability penalty. Fault reporting eliminates maintenance costs associated manual diagnostic testing.

Labor is eliminated in redundant designs by using the fault discovery and fault isolation functions to automatically reconfigure equipment for degraded operation. Maintenance savings can be re-allocated to upgrades and improvements that increase organizational competitiveness.

Reliability-centered maintenance (RCM) is a concept of maintenance planning to ensure that systems continue to do what their user requires in their present operating context. Successful implementation of RCM will lead to increase in cost effectiveness, reliability, machine uptime, and a greater understanding of the level of risk that the organization is managing. It is generally used to achieve improvements in fields such as the establishment of safe minimum levels of maintenance, changes to operating procedures and strategies and the establishment of capital maintenance regimes and plans. Successful Implementation of RCM will lead to increase in cost effectiveness, machine uptime, and a greater understanding of the level of risk that the organization is managing.

Types of maintenance

Traditionally, 5 types of maintenance have been distinguished, which are differentiated by the nature of the tasks that they include:

- Corrective maintenance: The set of tasks is destined to correct the defects to be found in the different equipment and that are communicated to the maintenance department by users of the same equipment.
- Preventive Maintenance: Its mission is to maintain a level of certain service on equipment, programming the interventions of their vulnerabilities in the most

opportune time. It is used to be a systematic character, that is, the equipment is inspected even if it has not given any symptoms of having a problem.

- Predictive Maintenance: It pursues constantly know and report the status and operational capacity of the installations by knowing the values of certain variables, which represent such state and operational ability. To apply this maintenance, it is necessary to identify physical variables (temperature, vibration, power consumption, etc.). Which variation is indicative of problems that may be appearing on the equipment. This maintenance it is the most technical, since it requires advanced technical resources, and at times of strong mathematical, physical and / or technical knowledge.
- Zero Hours Maintenance (Overhaul): The set of tasks whose goal is to review the equipment at scheduled intervals before appearing any failure, either when the reliability of the equipment has decreased considerably so it is risky to make forecasts of production capacity . This review is based on leaving the equipment to zero hours of operation, that is, as if the equipment were new. These reviews will replace or repair all items subject to wear. The aim is to ensure, with high probability, a good working time fixed in advance.
- Periodic maintenance (Time Based Maintenance TBM): the basic maintenance of equipment made by the users of it. It consists of a series of elementary tasks (data collections, visual inspections, cleaning, lubrication, retightening screws) for which no extensive training is necessary, but perhaps only a brief training. This type of maintenance is the based on TPM (Total Productive Maintenance).

Figure 3.1: Maintenance

Self-Check – 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. List seven principles of HACCP.
2. What are the major concepts of HACCP?

Test II: Short Answer Questions

1. Which one of the following is not including Good manufacfuring practice?
   - A. Plant grounds and building facilities emphasize pest control;
   - B. Equipment design provides ease in cleaning and maintenance;
   - C. Personal hygiene practices and facilities are set;
   - D. Storage and warehousing are free from contamination
   - E. None
2. Which one of the following is not including Sanitation Standard Operating Procedures (SSOP)?
   - A. Safety of water that gets in contact with food and food surfaces;
   - B. Measures to prevent contamination;
   - C. Employee hygiene practices;
   - D. Control of employee health conditions that could result in contamination of food and food surfaces;
   - E. None

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Information Sheet 4- Monitoring the process temperature

- A variety of microbial reduction techniques are routinely employed within the industry for reduction of pathogens. These techniques include: fumigants (ethylene oxide and propylene oxide), steam and irradiation. Each technique has advantages and limitations in effectiveness, quality impact and consumer acceptance.

- The world is changing; consumers want healthy foods which are not treated with a process that possible leave behind a chemical residue or create toxins. Therefore the Natural steam sterilization/pasteurization with pure steam has gained significantly in popularity. The very short contact (20-40 seconds) with high pressure steam at a temperature that may vary between 102°C and 122°C makes it possible to decontaminate heat sensitive herbs, powder and spices without adverse effect on quality.

Self-Check – 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Filling the blank

1. Turmeric rhizomes can be mechanically washed as well as polished in a portable, electric power operated, rotary drum type turmeric ……and …… machine.
2. The holding capacity of the turmeric polisher was generally kept 50% of volume of the drum to facilitate turning and proper mixing of dried rhizomes during polishing.
3. Turmeric is …… by abrasive hard surface and against rough perforated surface when the turmeric-filled drum rotates as well as by rubbing rhizomes against each other.

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 5-	Identifying, rectifying and reporting out-of-specification product/process outcomes

OOS (out of specification) is the comparison of one result versus predetermined specification.

What is means by out of specification OOS test results? The term OOS (out of specification), is defined as those results of in process or finished product testing, which falling out of specified limits, that are mentioned in compendia, drug master file, or drug application. This article describes a typical procedure that can be adopted to handle OOS results.

How do you do an OOS investigation? The objective of such an investigation should be to identify the root cause of the OOS result and take appropriate corrective and preventative action. Investigation should include a review of production and sampling procedures, and will often include additional laboratory testing. Colour coding for easy identification of quality status are shown below.

Figure 5.1: Colour coding for easy identification of quality status

Quality control is an important part of any food preparation process. It is particularly important in pickle making because poor quality control will result in an unpalatable product. The process begins in the field while the cucumbers are being harvested. Trained workers inspect the cucumbers for any signs of spoilage. If any spoiled cucumbers are found, they are discarded. Most manufacturers set specifications that the cucumbers must meet before use. During production, regular quality control measures include laboratory tests for the level of acid in the pickle liquor. This is done through a titration method using an automatic buret (test tube-like container). Other measurements that are taken on the final pickle liquor are pH, refractory sugar readings, and salt readings.

Self-Check – 5	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 6- Meeting workplace housekeeping standards

6.1. Maintaining work area housekeeping

On sites, for example, tidying up tends to be left until the end of the shift. But that just means you're exposing yourself and others to trip hazards all day long – and that's when the accidents will happen. So here are 10 housekeeping rules for a tidy site. Implement these, and you should see a reduction in slip and trip accidents and near misses to your workforce.

1. Designate an area for rubbish and waste: After all, if you want your work area free from waste materials, you need somewhere to put them. This could be a skip or other waste disposal bin depending on the amount of waste. Best practice is to segregate waste types for reuse, recycle or landfill.
2. Stack and store materials safely: You need materials and tools for use throughout the project, store them safely. Poorly stacked materials can block access routes or topple over causing crushing injuries or damage to property.
3. Maintaining a safe work area: Check your work area at regular intervals throughout the day and clear up as you go along. If trip hazards and mess is starting to build up, sort it out sooner rather than later.
4. Keep access routes clear: A safe work area includes access and egress. Do not leave materials/tools/benches in gangways/corridors where they might impede someone's escape or cause a trip hazard (it might be you or a colleague who needs to get out in a hurry).
5. Put tools away when you are done: If tools or equipment are out of use, put them away. It's easy to leave items lying around, but if you won't need them again in a hurry, put them away. If it's out of use, it should be out of sight, or at least out from under your feet!
6. Set a tidy: Just because it's not yours, doesn't mean it's not your responsibility. If you see anything lying on floors, stairways, passages that could cause people to trip and fall, pick it up and put it in a safe place – DON'T WAIT FOR SOMEONE ELSE TO MOVE IT.
7. If it is broken, fix it: Fix it, or ditch it. Good housekeeping is also about keeping things in good working order on site. Damaged tools or equipment must be taken

out of use and immediate steps are taken to have them repaired and put them somewhere safe.

8. Don't let cables trip you up: Trailing leads and cables from equipment are common trip hazards, particularly when using portable equipment. You may not have a socket close the working area, but make sure you route the lead away from walkways or access points. Route cables where they do not cause a trip hazard to you or to others.
9. Avoid fire risks: Make sure waste or the storage of materials does not build up in fire escapes as you may need to use these escapes at some point. Don't allow waste materials to be stored close to sources of ignition. If all rubbish is regularly collected and put into the skip, in the event of the fire, the danger is confined and more easily dealt with.
10. Make others aware: A tidy work area requires commitment from everyone. Raise awareness on site with our free good housekeeping toolbox talk. Gets everyone practicing the same good housekeeping techniques and you will be on your way to a tidy and safe site, for everyone.

6.2. Service checking of tools, equipment and machinery

Tools, equipment and machinery shall be kept in proper operating condition and used only for the purpose for which they were designed. If proper and safe tools are unavailable, this should be reported to the supervisor. All tools, equipment and machineries should be inspected at regular intervals, and any tool that develops defects while in use shall be taken from service, tagged and not used again until restored to proper working condition.

Self-Check – 6	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions

1. The surface colour of turmeric is determined using …… colour chart.
2. The …… displayed on the individual colour charts are of constant Hue, designated by a symbol in the upper right hand corner of the card.
3. ……., the colours become successively lighter from the bottom of the card to the top in visually equal step, their value increases.
4. …… they increase in Chroma from left to right.

Note: **Satisfactory rating – 4 points** **Unsatisfactory – below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 7- Maintaining workplace records

Maintain security and confidentiality when handling information. It is extremely important that you understand and follow your organization's requirements when handling confidential information. You need to be familiar with your workplace's policies and procedures on:

- Maintaining data security
- Sending confidential information
- Collecting, capturing and updating confidential information
- Filling secure information.

The Privacy Act 1988 (20th) protects people's privacy by placing access restrictions on personal information. Your workplace's policies and procedures will reflect the relevant common wealth and state or territory legislation in place.

Other significant legislation with regard to information handling is the Occupational Health and Safety Act 1991 (20th). This act is important because the requirements of privacy and information protection laws must be considered against your employer's responsibility to protect the health, safety and welfare of all employees and those visiting the workplace. It is crucial that you are guided by your workplace policies and procedures and understand how these laws affect the way you work. Remember, if you are unsure; ask your supervisor or manager.

Maintaining workplace records

Readings should be made and legible records maintained for the following:

1. Temperature indicating device(s);
2. Temperature recorder at the final heater outlet (entering the hold section or tube);
3. Differential pressure recorder, if a product-to-product regenerator is used;
4. Back pressure recording, if a back pressure monitoring system is used;
5. Product flow rate
6. Proper performance of polisher
7. Machine speed

8. During pasteurization,
9. Time-temperature,
10. Physical appearances
11. Check for leakage;
12. The product formulation, pH, water activity or other factors of each batch of product (if critical to the process);
13. Production date and code mark of the containers;
14. Records of each diversion;
15. Cleaning and resterilization records for the system following diversion;
16. Other conditions or factors critical to the adequacy of the scheduled process.

Self-Check –7	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer 1.5 point

1. Your workplace's policies and procedures will need:
   A. Maintaining data security
   B. Sending confidential information
   C. Collecting, capturing and updating confidential information
   D. Filling secure information.
   E. All of the above

Test II: Write true or false

1. Your employer's responsibility to protect the health, safety and welfare of all employees and those visiting the workplace.

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

LAP TEST	Performance Test

Name……. ID……..

Date…….

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **20** days. The project is expected from each student to do it.

Task-

LG #60	LO #3- Shut Down the heat treatment process

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Identifying shutdown procedure
- Shutting down the process.
- Identifying and reporting maintenance requirements

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, **upon completion of this learning guide, you will be able to**:

- The appropriate shutdown procedure is identified
- The process is shut down according to workplace procedures
- Maintenance requirements are identified and reported according to workplace reporting requirements

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Identifying shutdown procedure

3.1. Shutting down the process

- Refer to your standard operating procedures for the correct way to operate each type of processing unit in your workplace.
- The standard operating procedures for each type of equipment must be adhered to when shutting a processing down.
- The types of shutdowns used in a plant unit are:
  - ✓ Scheduled shutdown
  - ✓ Maintenance shutdown
  - ✓ Emergency shutdown

3.1.1. Scheduled shutdown

- A scheduled shutdown is initiated by the operator during normal operation of the unit when, maintenance is required.
- The shutdown procedure will depend on the type of equipment and the process to be done.
- Some steps taken in a unit/process shutdown may include:
  - ✓ Shutting off the feeds to stop processes and heat generation particularly if processes are produce heat
  - ✓ Shutting off heating or cooling to the unit/ processing operation
  - ✓ Shutting off chopping and other mechanical operations
  - ✓ Removing or flushing waste materials from the processing workplace

3.1.2. Maintenance shutdown

- When maintenance to the polishing equipment is required, the equipment may need to be entered so that work can take place.
- The shutdown should be a scheduled or planned shutdown as per standard operating procedures where equipment is:
  - ✓ isolated (process, mechanical and electrical)
  - ✓ cooled and depressurized
  - ✓ cleaned

- ✓ Electric tested on a continuous basis prior to and during entry.

- A planned unit/plant shutdown will prevent:
  - ✓ plugging of lines or equipment
  - ✓ possible damage to equipment
  - ✓ Possible injury.

3.1.3. Emergency shutdown

- An emergency shutdown is initiated in the event of a fire, instrument failure, power failure, unexpected hazard or total loss of the processes.
- Emergency shutdown procedures must be followed during a shutdown sequence. Where a shutdown will affect upstream or downstream process units, advanced warning must be given to the appropriate personnel to allow them to prepare for, and react to, the changing conditions.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Choose the best answer

1. The types of shutdowns used in a plant unit are_____, _____, and _____. (3 points)
2. _____is initiated in the event of a fire, instrument failure, power failure, unexpected hazard or total loss of the processes. (2 points)
3. A planned unit/plant shutdown wills prevent_____, _____ and_____. (3 points)
4. _____ is initiated by the operator during normal operation of the unit when, maintenance is required. (2 points)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet 2- Shutting down the process

The polishing operation in spice and herb processing plant should be shut down after completion of work every day according to the standards and procedures of the industry. Cleaning and sanitizing steps are listed below:

- Remove heavy debris from floors with brooms or shovels and dry clean processing equipment, if needed
- Pre-rinse the equipment with adequate quality water
- Clean remaining debris from floor
- Rinse floor and drains with adequate quality water using a low pressure hose
- Use dedicated brushes to scrub floor and drains with an effective cleaner, applying adequate quality water as needed
- Foam and scrub the equipment with an effective cleaner and scrub using dedicated brushes
- Thoroughly rinse the equipment, floors, and drains with adequate quality water using a low pressure hose
- Remove excess water from floors
- Sanitize (according to manufacturer directions) the equipment and floors

Work from top down for cleaning and sanitizing activities. Some equipment may need to be disassembled before cleaning and sanitizing followed by reassembly.

Self-Check – 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions

1. Write the steps we follow during cleaning and sanitizing processing plant/workplace. (5 points)
2. Why equipments are disassemble before cleaning and sanitizing. (5 points)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet 2- Identifying and reporting maintenance requirements

- Any activities which require maintenance should be identified properly and reported immediately as soon as possible.
- Maintenance procedures and other work-related documents should identify preconditions and precautions, provide clear instructions for work to be done, and be used to ensure that maintenance is performed in accordance with the maintenance strategy, policies and programmes.
- The procedures should normally be prepared in cooperation with the designers, the suppliers of plant and equipment, and the personnel conducting activities for quality assurance and technical support.
- The benefits to be accrued from the implementation of a program of planned maintenance can be found in the efficient and economical operation of the plant and equipment and the utilization of resources (i.e. plant and equipment and manpower) while also maintaining a sound standard of safe working and environmental conditions for operators, other occupants and employees within the workplace.
- Maintenance systems vary, depending on the location of the plant and equipment and/or company policy.
- Systems can range from the complete maintenance of plant and equipment using all available methods to their replacement on failure.
- Planned maintenance is work having benefited from information issued by manufacturers and suppliers, the experience and knowledge of the service department staff, and reports and records from previous service visits.
- Preventive maintenance is work to be carried out at a specific frequency as indicated by potential failures or known reduction in efficiency of the plant and equipment, thereby avoiding failures or a decrease in performance.
- Scheduled maintenance is work based on known information, such as number of operations, hours run, etc., and can therefore be carried out at a predetermined time interval.

- Corrective maintenance is work carried out following the failure of the plant and equipment, and is so designed to return the component to its normal operating condition.
- Emergency maintenance is that work which is required to be performed without delay due to a failure of a component which, if not implemented, would lead to further failures or even permanent damage, resulting in the total loss of the plant and equipment. Plant and equipment in such a condition may also be dangerous to personnel.

Self-Check – 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Choose the best answer

1. The benefits to be accrued from the implementation of a program of planned maintenance. (2 points)
   A. Efficient and economical operation of the plant equipment
   B. The utilization of resources
   C. Reduce personnel injury
   D. All
   E. None
2. _____ is work carried out following the failure of the plant and equipment, and is so designed to return the component to its normal operating condition. (2 points)
   A. Scheduled maintenance
   B. Corrective maintenance
   C. Preventive maintenance
   D. Emergency maintenance
3. Maintenance systems depends on: (2 points)
   A. The location of the plant
   B. The location of the equipment
   C. Company policy
   D. All
   E. None

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

LG #61	LO #4- Record information

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Recording workplace information.
- Signing all records
- Communicating the record information
- Keeping workplace information Record

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, **upon completion of this learning guide, you will be able to**:

- Record workplace information.
- Sign all records.
- Communicate the record information
- Keep workplace information Record

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Recording workplace information

The work place information will recording recommended sample temples are shown as follows:

Table 1: Process Information (Template)

S. No.	Description	Progress
1.	Is the house cleaned?	x
2.	Is the product pasteurized?	x
3.	Is the product pasteurized?	x
4.	Is motor repaired or replaced?	x
5.	Is power transmission systems repaired?	x
6.	Is valve repaired or replaced?	x
7.	Is pump repaired or replaced?	x
8.	Is microwave repaired?	x
9.	Is autoclave repaired?	x
10.	Is oven repaired?	x
11.	Is refrigerator repaired?	x

Table 2: List of Monitoring & Measuring Devices and Records of Calibration (Template)

S. No.	Name of Equipment	ID. No.	Location	Range	Least Count	Count Frequency of Calibration	In house calibration Done On	In house calibration Due On	Remarks	Sign

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Choose the best answer

1. Which one types of testing or testing for conformance of the machined.

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet 2- Signing all records

All records should be signed as follows:

Table 1: sample of signed records

S. No.	Description	Progress
1.	Is the house cleaned?	x
2.	Is the product pasteurized?	x
3.	Is the product pasteurized?	x
4.	Is motor repaired or replaced?	x
5.	Is power transmission systems repaired?	x
6.	Is valve repaired or replaced?	x
7.	Is pump repaired or replaced?	x
8.	Is microwave repaired?	x
9.	Is autoclave repaired?	x
10.	Is oven repaired?	x
11.	Is refrigerator repaired?	x

Name: Mr. z Signature: 

Self-Check – 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Write true or false.

1. Is the product pasteurized?
2. Is the product pasteurized?
3. Is motor repaired or replaced?
4. Is power transmission systems repaired?

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet 3- Communicating the record information

It is important to always let the supervisor know when the information recorded so that:

1. The house is cleaned
2. The product is pasteurized
3. The product is pasteurized
4. Motor is repaired or replaced
5. Power transmission systems is repaired
6. Valve is repaired or replaced
7. Pump is repaired or replaced
8. Microwave is repaired
9. Autoclave is repaired
10. Oven is repaired
11. Refrigerator is repaired

Figure 1: communicating the record information

Self-Check – 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Write true or false

1. It is not important that the supervisor to know whether power transmission systems are repaired or not.
2. It is important that the supervisor to know whether bush is repair or replace.
3. It is not important that the supervisor to know whether bush is shaft repair or replace
4. It is not important that the supervisor to know whether bush is shaft repair or replace
5. It is important that the supervisor to know whether Motor repaired or replaced

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet 4- Keeping workplace information records

Records management: – the control of the creation, receipt, maintenance, use and disposal of records in accordance with professional and international standards of practice. Records management is distinct from document management, which is typically concerned with the provision of access, collaborative working and version control of documents, rather than the management of authenticity, reliability, integrity and usability over time.

Electronic records management systems (commonly referred to as EDRMS or ERMS) or Electronic Records Management Systems – systems specifically designed to manage the maintenance and disposition of records. They maintain the content, context, structure and links between records to enable their accessibility and support their value as evidence. Electronic records management systems are distinguished from business systems, for the purpose of this document, because their primary function is the management of records.

Records management metadata – an inextricable part of records management, serving a variety of functions and purposes. In a records management context, metadata is defined as data describing the context, content and structure of records and their management through time (ISO 15489 – 1: 2001, 3.12). As such, metadata is structured or semi-structured information that enables the creation, registration, classification, access, preservation and disposition of records through time and within and across domains. Records management metadata can be used to identify, authenticate and contextualize records and the people, processes and systems that create, manage, maintain and use them, and the policies that govern them. Initially, metadata defines the record at its point of capture, fixing the record into its business context and establishing management control over it. During the existence of records or their aggregates, new layers of metadata will be added because of new roles in other business or usage contexts. This means that metadata continues to accrue information relating to the context of the records management and the business processes in which the records are used, and to structural changes to the record or its appearance. Metadata

can be sourced or re-used by multiple systems and for multiple purposes. Metadata applied to records during their active life may also continue to apply when the records cease to be required for current business purposes but are retained for ongoing research or other values. The purpose of records management metadata is to ensure authenticity, reliability, usability and integrity over time, and to enable the management and understanding of information objects, whether these are physical, analogue or electronic. However, metadata also needs to be managed as a record or as a component of a record.

Records Management has always involved the management of metadata. However, the electronic environment requires a different expression of traditional requirements and different mechanisms for identifying, capturing, attributing and using metadata. In the electronic environment, authoritative records are those accompanied by metadata defining their critical characteristics. These characteristics must be explicitly documented rather than being implicit, as in some paper-based processes.

Documentation and record keeping

- Why is it important?
  - ✓ Records are a management tool that can show trends and improve operational efficiency
  - ✓ Records are essential for reviewing the effectiveness of the HACCP plan
  - ✓ Records provide information for improving the HACCP plan
  - ✓ Record shows the operational process history and provides a proof of adherence to food safety plan

- What documents and records are required?
  - ✓ Documentation used in HACCP plan development
  - ✓ Documentation of methods and procedures
  - ✓ Records of CCP monitoring, verification, deviations and corrective action taken
  - ✓ Records of employee training programmes.

Documents used in HACCP plan development

- HACCP team members and their responsibilities
- The HACCP plan itself including the forms developed during its preparation
- Hazard analysis
- Data used to establish control measures, CCPs, critical limits, corrective measures, etc.
- Correspondence with consultants or other experts concerning HACCP plan development
- Description of the monitoring system for all CCPs, including critical limits and equipment used for monitoring
- Plans for corrective actions
- Description of record keeping, including copies
- Description of verification and validation procedures

HACCP system records

- Records of monitoring at all of the CCPs and GMP activities
- Records of any deviation and the corrective action taken
- Validation records such as in-house inspection, equipment testing and calibration
- These are official records – they must be accurately completed, clearly coded, signed, counter-signed and dated
- Records of who has received training and when
- Documentation related to training programme content and duration
- Employees must be trained to understand and correctly fulfil their roles in the HACCP system

Self-Check – 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions

1. …… the control of the creation, receipt, maintenance, use and disposal of records in accordance with professional and international standards of practice.
2. …… management systems are distinguished from business systems, for the purpose of this document, because their primary function is the management of records.
3. …… is distinct from document management, which is typically concerned with the provision of access, collaborative working and version control of documents, rather than the management of authenticity, reliability, integrity and usability over time.
4. …… can be sourced or re-used by multiple systems and for multiple purposes.
5. …… Management has always involved the management of metadata.
6. The electronic environment requires a different expression of traditional requirements and different mechanisms for ……, ……, ……and using metadata.

Note: **Satisfactory rating – 7 points** **Unsatisfactory - below 7 points**

You can ask you teacher for the copy of the correct answers.

Reference Materials

Book:

1. Moghe S. M., Zakiuddin K.S. and Giripunje M.S. (IJITR) INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH Volume No. 1, Issue No. 6, October - November 2013, 598 – 601.
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3. American Spice Trade Association, INC. (ASTA), “Good Manufacturing Practice (GMP) Guide For Spices” 2015 American Spice Trade Association, Inc., 1101 17th St. NW, Suite 700; Washington DC 20036
4. Jayashree E, Kandiannan K, Prasath D, Sasikumar B, Senthil Kumar CM, Srinivasan V, Suseela Bhai R and Thankamani CK. ***Turmeric - Extension Pamphlet.*** ICAR-Indian Institute of Spices Research, Kozhikode, Kerala. 2015.
5. Electronic records management systems - system specifications for public offices version 3 national archives of Malaysia 2011.
6. Dhawle Manuraj S, K. S. (2020). A Review on Post Processing of Turmeric Rhizome. *International Research Journal of Engineering and Technology (IRJET), 07*, 4800- 4803.

Web Addresses

http://www.indianspices.com/post-harvest-improvement-programme.html

http://www.celkau.in/crops/spices/Turmeric/processing.aspx

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