SPICE AND HERBS PROCESSING
Level-II

Based on May 2019, Version 2 Occupational standards

Module Title: - Operating a Spice and Herbs Cleaning & Inspection Process

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LG #27	LO #1- Prepare the spices and herbs clean equipment and process for operation

Instruction sheet

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

- Confirming raw materials
- Identifying and confirming cleaning machinery and equipment
- Fitting and adjusting cleaning machine components and related attachments.
- Entering processing/operating parameters
- Setting up the bin system to meet production requirements.
- Checking and adjusting equipment performance
- Carrying out pre-start and service

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:

- Confirming raw materials
- Identifying and confirming cleaning machinery and equipment
- Fitting and adjusting cleaning machine components and related attachments.
- Entering processing/operating parameters
- Setting up the bin system to meet production requirements.
- Checking and adjusting equipment performance
- Carrying out pre-start and service

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 raw materials

1.1 Introduction

The process of separating pure spice and herbs from unwanted materials is referred to as “cleaning”, which encompasses all similar terms such as classifying, separating, and reconditioning. Cleaning is a preparatory unit operation which removes foreign matter and contaminants e.g., soil, insects, animal excreta, chemicals, etc. from the surface of raw material via wet and dry cleaning processes. Signs of poor sanitation and health hazards include not only such items as stones, stems, and foreign seeds, but also insects, excreta, mold, bacteria, hair, and illegal chemicals. The following information concentrates on systems and equipment that remove or reduce the percentage of extraneous materials such as excreta, foreign seeds, leaves, stones, hair, stems, insects, metal, wood, glass, etc. This learning guide covers the knowledge, skills and attitude required to set up, operate, adjust and shut down a cleaning process to screen impurities from the spices and herbs prior and inspecting quality of commodity to the coming process.

1.2. **Confirming raw materials**

- Raw materials in cleaning operation include the following spice and herbs such as:
  - ✓ Cardamom,
  - ✓ Cinnamon,
  - ✓ Cloves,
  - ✓ Coriander,
  - ✓ Cumin Seed,
  - ✓ Dill Seed,
  - ✓ Fenugreek,
  - ✓ Ginger (Whole & Split),
  - ✓ Parsley,
  - ✓ Rosemary Leaves,
  - ✓ Thyme,
  - ✓ Turmeric etc.

The physical properties of the product being cleaned and the physical properties of the contaminants in these products must also be known. Raw materials should be trimmed to remove any damaged, rotten or moldy material. Spices and aromatic herbs or their source plants should not be accepted by the establishment if they are known to contain contaminants which will not be reduced to acceptable levels by

normal processing procedures, sorting or preparation. No raw material or ingredients should be accepted by an industry if it is known to contain parasites, undesirable pathogens, pesticides, drugs, or toxic ,decomposed or extraneous substances that would not be reduced to an acceptable level by normal sorting and / or processing where appropriate specifications for raw materials and ingredients should be identified and applied.

Raw materials or ingredients should, where appropriate, be cleaned, inspected and sorted prior to processing. Where necessary laboratory tests shall be performed to establish fitness for use only sound, suitable raw materials or ingredients should be used. The accepted/confirmed raw materials stored in spice and herb processing industry shall be:

- Maintained under conditions that will prevent spoilage,
- Protected against contamination by pests, physical, chemical or microbiological hazards and other objectionable substances;
- Protected from detrimental changes to temperature and or other physical parameters that may be caused by crushing, abrasion and vibration;
- Not processed or used unless inspected for contamination, spoilage and moulds before processing and found to be in compliance with the accepted criteria in this standard.
- Clearly labeled with all the relevant details to ensure traceability.

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: Write the name of spice in space provide (6 point)

_____

_____

_____

_____

_____

_____

Note: Satisfactory rating ≥3 points Unsatisfactory <3 points

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

Information Sheet 2- Identifying and confirming cleaning machinery and equipment

Before moving on to the types of equipment that are used, it must be stated that these cleaning operations do cost money. There is the cost of cleaning equipment, the labor, and most importantly the loss of product that inherently comes with the cleaning operation. Spice crops are quite often contaminated by dust, dirt, pesticides, insects, animal hair and droppings and a range of microbes. The crop must be cleaned before processing. After the differences between the spice and the contaminants are determined, machines that will make the most efficient separation can be selected and confirmed. Many models and types of machines with a wide range of capacities are available to spice cleaning/processing. On a small scale, the dried spices are generally cleaned manually by winnowing or by use of blowers, etc., so that the heavier and bolder berries of pepper separate out from the dust, stalk and pinheads, which, being lighter, are blown away.

Small enterprises generally use electric powered winnowers which have a variable speed fan and adjustable baffles that separate stones from sound material and light material (chaff, dust). Dry Cleaning is the preferred means of cleaning spices. Dry cleaning involves the use of tools such as vacuum cleaners, brooms and brushes. List of equipment capable of removing the physical impurities that can contaminate raw spices and herbs are:

- Aspirator (Air separator)
- De-stoner
- Vacuum gravity separator (Air table)
- Cylinder separator (Indent)
- Rotary knife cutter
- Magnet
- Sifter Aspirator
- Plain sifter
- Spiral gravity separator
- Air screen separator
- Day bins
- Inspection on hand
- Intake equipment
- Scales
- Measurers/mixers
- Impact grinders
- Materials handling equipment

Table 2.1: Cleaning equipments for unprocessed spices and herbs

No	Name of spices and herbs	suggested equipments for the removal of:				
		whole insects dead	rodent excreta	other excreta	defiled insects	extraneous matter
1.	All spice	Spiral gravity separator	Spiral gravity separator	Spiral gravity separator	Rotary knife cutter and air screen separator	Spiral gravity separator
2.	Aniseed	Vacuum gravity separator (A.T)	Vacuum gravity separator (A.T)	Vacuum gravity separator		Vacuum gravity separator
3.	Basil	Cylinder separator (indent and destoner	Cylinder separator (indent and destoner	Cylinder separator (indent and destoner		Vacuum gravity separator and destoner
4.	Caraway seed	Vacuum gravity separator (A.T)	Vacuum gravity separator (A.T)	Vacuum gravity separator (A.T)		Vacuum gravity separator (A.T)
5.	Cardamom	air screen separator	air screen separator	air screen separator	aspirator & air screen separator	air screen separator &destoner
6.	Celery seed	vacuum gravity separator (A.T)	vacuum gravity separator (A.T)	vacuum gravity separator (A.T)		vacuum gravity separator (A.T)
7.	Chillies	air screen separator	air screen separator	air screen separator	rotary knife cutter and screen separator	air screen cutter and separator

8.	Coriander seed	spiral gravity separator	spiral gravity separator	spiral gravity separator	rotary knife cutter and screen separator	spiral gravity separator
9.	Cumin seed	vacuum gravity separator	vacuum gravity separator	vacuum gravity separator	-	vacuum gravity separator
10.	Ginger (whole and split)	air screen separator	air screen separator	air screen separator	rotary knife cutter & screen separator	rotary knife cutter & air screen separator & destoner
11.	Bay leaves	plain sifter	plain sifter	plain sifter	rotary knife cutter & plain sifter	rotary knife cutter & plain sifter & destoner
12.	Mace	air screen separator	air screen separator	air screen separator	rotary knife cutter & screen separator	air screen separator
13.	Marjoram	cylinder separator (indent) and destoner	cylinder separator (indent) and destoner	cylinder separator (indent) and destoner	-	cylinder separator (indent) and separator
14.	Nutmeg(broken)	air screen separator	air screen separator	air screen separator	-	air screen separator
15.	Nutmeg(whole)	plain sifter	plain sifter	plain sifter	rotary knife cutter and air screen separator	air screen separator
16.	Organo	cylinder separator (indent) and destoner	cylinder separator (indent) and destoner	cylinder separator (indent) and destoner	-	cylinder separator (indent) and destoner
17.	Parsley	air screen separator	air screen separator	air screen separator	-	air screen separator & destoner

18.	Black pepper	special gravity separator	special gravity separator	special gravity separator	-	air screen separator & destoner
19.	Poppy seed	vacuum gravity separator	vacuum gravity separator	vacuum gravity separator	-	vacuum gravity separator & destoner
20.	Rosemary leaves	plain sifter	plain sifter	plain sifter	-	plain sifter & destoner
21.	Sage	air screen separator	air screen separator	air screen separator	-	air screen separator & destoner
22.	Savory	plain sifter	plain sifter		-	
23.	Tarragon	plain sifter	plain sifter		-	
24.	Thyme	vacuum gravity separator	vacuum gravity separator	vacuum gravity separator	-	vacuum gravity separator & destoner
25.	Turmeric	plain sifter	plain sifter	air screen separator	rotary knife cutter & air screen separator & destoner	

2.1. **Description of equipment**

Aspirator (Air separator): Many different types of air separators are manufactured for spice processing. There are both aspirators and pneumatic separators, but all use the movement of air to divide materials. As aspirators use a significant amount of air, it is important that there is a filtration system to ensure that this air does not introduce potential foreign bodies. Each spice has a size, shape, and density that react to an air current. For aspiration, a steady stream of material is subjected to a steady flow of air. The air pressure can be regulated so that the heavier materials will fall and the lighter materials will be drawn forward. Generally, there are several aspiration steps in a cleaning process.

There are various types of aspirators, scalping, fractionating, and pneumatic separation, which all work on the same principles, differing only in the location of the air moving unit. Aspirators can be used alone or in combination with other machines such as sifters, spirals, vacuum gravity separators, and cylindrical separators. Aspirators are used to remove such items as feathers, dust or dirt, stems, and sometimes insect fragments from spices.

Figure 2.1: Air screen separator

De-stoner: A de-stoner is effective for removing stones. The principle used is similar to that of a gravity air table, but it simply sorts heavies and lights. The basic principle of the de-stoner involves flowing dry material over an inclined, vibrating, and screen covered deck. Air from a pressure fan located in the body of the machine below the deck is forced up through the deck and through the bed of material. This steady air flow holds the material in stratified flotation. The lighter material stays in the upper strata as it flows down the inclined vibrating deck. The heavier material, such as stones, coarse sand, glass, and metal, travels up the inclined vibrating deck and out. The fine sand falls through the screen and into the body of the de-stoner where it is removed. The tilt of the table and the air velocity can be varied to adapt to different density materials. De-stoning eliminates contaminants and improves purity of the product and is essential before grinding because items such as stones and sand can wear out various mills and reduce the efficiency of these pieces of equipment.

Figure 2.2: De-stoner with a vibratory sifter, bucket elevator and motors

Figure 2.3: Raw pepper

Figure 2.4: clean pepper

Vacuum gravity separator (air table): The vacuum gravity separator or air table separates material on the principle of density. Three basic rules of gravity separation are:

- Particles of the same size but different densities can be separated.
- Different size particles of the same density can be separated.
- A mixture of particles of different sizes and densities cannot be separated.

The essential device mechanism consists of a perforated, vibrating deck or screen through which an air current is blown. The angle at which the screen is set, the frequency of vibration and the air velocity are adjusted to achieve the desired separation. The oscillation of the deck “walks” the heavy material, such as dirt or stones uphill, while light material, such as stems and leaves, float on the air and go down the table. The medium density material, usually the intended product, goes to the center. By means of movable splitters, the discharge can be divided into a number of density fractions. Separation efficiency is dependent on air distribution through the deck, inclination and movement of the deck and deck covering. The rate of the material entering the gravity deck greatly affects operational efficiency. Optimum rates vary according to the difference in density or specific gravity of the mixture components. This machinery requires constant monitoring of product flow and subsequent operating adjustments.

Figure 2.5: Vacuum gravity separator (air table)

Cylinder Separator (Indent): Indent cylinders use centrifugal force and length differences to lift material from a seed or leaf mass, making a length size separation. The indent cylinder consists of a rotating, horizontal cylinder and a movable, horizontal separating trough. The inside surface of the cylinder has small, closely-spaced, semispherical indentations. In operation, the seed or leaf masses to be separated lie on the bottom of the cylinder.

As the cylinder rotates on its axis, the short seeds or leaves in the mass are lifted from the mixture by the numerous indents. At some point before reaching the top of the rotation, the good seeds or leaves drop from the indents and are received by an adjustable trough or vibrating tray to the discharge conveyor. It is not unusual for a facility to have more than one indent cylinder with differing indent sizes to allow for the effective cleaning of materials given the natural variability of the product. The speed of the cylinder shell must be properly controlled to ensure that good separation is maintained. Too high a speed will hold the long or heavy contaminants against the side of the cylinder. Too long and low speed will not hold the small materials long enough.

Figure 2.6: Indent cylindrical separator

Sifter aspirator: The sifter aspirator combines the use of air movement with sifters to separate materials. Initially the material passes through a sieve which rejects oversize particles and then feeds through to a second sieve which removes undersize particles. The resultant material is then fed into the aspiration channel over an oscillation conveyor. A vibrating motor causes the feeder table to swing horizontally. At the same time, the weight of the material being cleaned opens the feeder uniformly and a thin stream along the entire width of the aspirator is discharged. In the aspiration channel, the adjustable stream of suction air passes vertically upward through the thin horizontally-fed stream of material and carries the undesirable materials (dust, husk particles, light seeds, etc.) into the expansion chamber. The cleaned product then falls directly out of the aspirator and is ready for further processing. The back wall of the aspiration channel is adjustable to obtain optimum separating action. The double-valve airlock discharges materials without difficulty which would normally adhere to surfaces.

Sifter/Sieves: A sifter separates dry materials by particle size, allowing for the removal of undersize and oversize materials. The sifter mechanically shakes a sieve or sieves. The sieve screens can be the same size or can be various sizes, depending on how many separations are to be made. In the sifter, the finer material drops through the screen, and the coarser material rides over and is discharged. The

opposite will sometimes occur where the material required remains on the sifter deck and dust and small particles pass through the screen and are removed. Sieves/sifters can be located in various places in the production flow.

There are numerous types and shapes of sifters, and they can be floor mounted or suspended in other locations. Hole shapes in the sifter sieve can be round, slotted, triangular, or square. The larger number of the screen mesh the smaller the hole size, as the mesh number relates to the holes per inch. Alternatively mesh screens are sometimes classified by their micro size and this relates to the size of the hole in the screen. Sifters are dependable equipment requiring little maintenance. They provide dependable continuous performance and allow for removal of contaminants such as large stems, bits of paper, or plastic and/or dust. The screens within a sifter should be inspected to ensure that they are undamaged both prior to use and after processing a batch of material. A damaged screen not only indicates that a batch may have been contaminated but it could also mean that is was not processed correctly.

Figure 2.7: Vibrating sifter

Spiral gravity separator: The spiral separator is a device used primarily for separating round seeds from fractures, shriveled kernels, or other impurities. It consists of a number of descending spiral chutes around a central column. The spiral separators separate seeds according to shape and their ability to roll or slide. To operate, material is dropped from a feed hopper into the top of the inner most steel

spiral at a steady rate. The uniformly pitched slides of the separator carry the material down by gravity. After attaining optimum speed, the faster moving spherical seeds, roll toward the outer edge of the slide and are discharged. The flatter kernels and oddly shaped contaminants discharge near the center. The equipment has no moving parts, is easy to clean, is compact and takes up little floor space. The spiral will operate steadily with little maintenance.

Figure 2.8: Gravity separator

Air Screen separator: The air screen separator separates materials based on differences in spice size, shape, and density. The separators use three cleaning elements:

- Aspiration, in which light material is removed.
- Scalping, in which material larger than the product desired is removed;
- Grading, in which separation of the product can be classified as either large or small.

The separator units come in a variety of models with two to eight vibrating screens. Material to be separated falls through the inlet onto the top sieve, which scalps and removes such impurities as string, straw, and stones. Air streams remove the trash and impurities, and the product moves into the second sieve which holds acceptable material allowing sand and smaller impurities to fall through. Numerous types and sizes of screens are available. The rate of feed, airflow, oscillation of the screens, and the screen pitch are adjustable. Screens must be checked to ensure they do not clog because of faulty cleaning. Additionally, the outlets of the separators should be

checked to see that are no leaks in the screens, and the aspirator tip outlets and separator dust collector outlet must be monitored to determine that the air is adjusted properly.

Figure 2.9: Pepper air screen cleaning machine

Magnets: The most common and simplest devices used for cleaning ferrous metal are magnets. Magnets come in many forms but all are designed to remove iron metals from materials and product flows. Magnets are placed at raw material inlets and usually before and after milling equipment. They can also be installed in chutes, spouts, ducts, feed tables, and housing as well as in suspension over non-magnetic screens. The equipment is dependable and provides economical protection against tramp iron damage in processing lines. Magnets catch and remove damaging iron contamination from material flows. They help prevent machinery damage and costly shutdowns, spark-caused fires and explosions, and product contamination.

When installing magnets, it is important to ensure that they are correctly positioned, so that the product flows over or through them at a constant rate. The gap between the magnet and the product should be small enough to ensure that magnetic materials remain within the magnet's magnetic field. They should be designed so that they are easy to remove for cleaning purposes, as trying to clean a magnet in place

risk contaminating the production unit. Magnets come in many different shapes and sizes. Self-cleaning grates eliminate the need to shut down product lines in order to remove, clean, and reinstall magnetic elements. Easier, more frequent cleaning prevents excessive iron contamination buildup on the magnets and assures maximum separating efficiency. Magnetic tubes within stationary stainless steel tubes are used in the self-cleaning grate.

To clean the grate, the magnetic elements are withdrawn from the stationary housings in the area of product flow. A powerful circuit within the inner tubes produces highly magnetic gaps that pull the entrapped iron contamination sideways along the surface of the stationary tubes. At a point outside the product flow, contamination is discharged. The entire cleaning operation takes place within a few seconds. A one finger pull on the smooth-sliding moveable tubes of the manually operated model is all that is required to clean the magnetic elements. The automatic model, designed for hard-to-reach locations or for installations that require very frequent cleaning, is pneumatically operated and equipped with a timer so the cleaning cycle can be adjusted to the amount of contamination to be removed. Self cleaning drum magnets are also an effective way to remove tramp metal. They are often located within the structure of a conveyor belt, where the magnet is the final drum of the conveyor belt. Using this design, the product falls vertically from the end of the conveyor but the magnetic materials are still attracted to the magnetic drum. As the conveyor belt start to pull the magnetic material way from the drum magnet it falls into a separate chute and is removed from the product stream

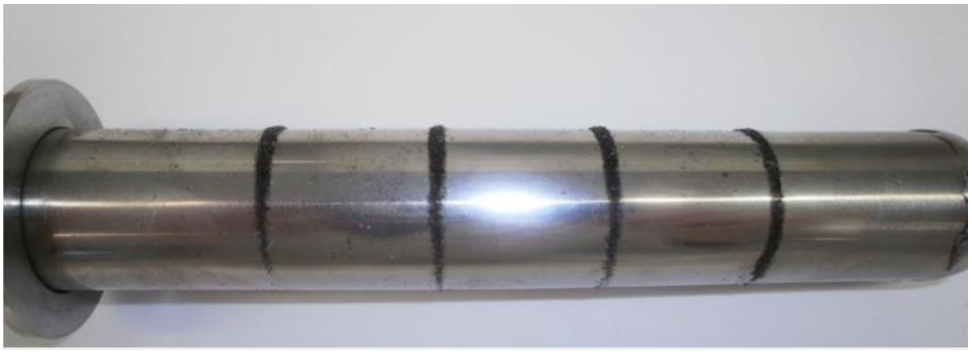

Figure 2.10: Magnet dust

Metal detectors: Metal detectors are used to detect all types of metals, both magnetic (iron), and non-magnetic, such as aluminum and other non-ferrous metals, including stainless steel. These devices operate on the inductive measuring principle. A high frequency electromagnetic alternating field is generated. If a metal object passes through the metal detector, the detector experiences a change in the field based on the magnetic and electrical properties of the metal object. Metal detectors, like magnets, are used in various locations in the production stream. Most common areas are raw material inlets, before and after milling, and as close as possible to the end of the production flow.

Consideration needs to be given to the possibility of recontamination after the metal detection process and this is what often drives the location of the metal detector to being close to the end of the production line. Metal detectors help protect both the processors and end consumer from metal contaminates. It is important that metal detectors are checked for operational effectiveness on a regular basis. This should be done at least once every shift, however, an hourly check is preferred. This check is carried out by inserting a calibrated test piece into the induction coil and ensuring that the test piece is rejected correctly or the belt stops, dependent upon the type of equipment. Calibration with the test piece is best performed while product is flowing through the detector to allow for the background signal that the product will have. The date and time the metal detector is calibrated and then checked should be recorded. Auto rejection devices are preferred, as the process flow continues while the foreign material is separated.

The size of metal particles allowed is driven by customer specifications, but there are U.S. Federal standards for foreign material, including metal. Metal detectors with smaller apertures generally will have better sensitivity than one with larger apertures. For example a metal detector which is in flight (designed within a vertical drop of a product stream) or one that is detecting individual retail spice containers, will normally have a detection sensitivity of less than 1 mm Ferrous particles. Metal detectors that are testing the final industrial pack, for example a 10 kg paper sack of herbs, will probably have sensitivity closer to 2.5mm for ferrous particles.

Figure 2.11: Metal detector machine

Color/laser sorters: The principle of operation for a color sorter is that material is fed into channels that pass through an imaging camera. Various light and laser lamps can be used in this unit to help highlight a difference between the reflected light of the contaminant and that of the product. A good product flow is essential for this unit to work correctly. Through the use of a PLC or Computer control panel the required reflective 'color' of the product is establish and if material of another 'color' is detected by the camera the particle is rejected through the use of compressed air. Usually a system is in place to regularly check both accepted and rejected materials to ensure that the unit is working correctly throughout the production run.

Figure 2.12: sesame seeds color sorter

X-Ray detection: Similar to the x-ray units within a hospital, the principle of operation are that via x-ray technology it is possible to detect items of differencing densities, under x-ray conditions. Rejection systems are somewhat similar to some metal detection units. Through the use of this technology items can be detected that are not rejected by a metal detector or via color sorting. Item such as hard plastic and stones etc. can be rejected, provided they have a different density to the product. As with a metal detector the unit is usually supplied with test pieces that are used on a regular basis to ensure the unit is working correctly.

There is no single piece of equipment that can do all jobs. Properly operated, these machines allow the removal of contaminants, which differ from the desired product in size and dimension, shape, specific gravity, different behavior in air currents, and magnetic properties. To use the machines effectively, the processor must understand the working principle of each equipment and machine with its maintenance requirement, its capacities, and its proper place in the overall processing operation. Equipment should be subject to a program of planned maintenance that ensures it is kept in safe and effective working condition. Day bins- are ideal for storing both raw materials and finished product. Material handling equipment is mechanical equipment used for the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal. Scales-is a device to measure weight of the spices and impurities.

Figure 2.13: Portable scale

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 I: Short Answer Questions (10 points)

1. Write down and describe the spice and herbs cleaning equipments.
2. What are the main purpose of cleaning spices and herbs?

Note: Satisfactory rating-≥5 points Unsatisfactory-<5 points

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

Information Sheet 3- Fitting and adjusting cleaning machine components and related attachments

The spice and herbs to the machines should be best suited for separation. A general guide and actual equipment should be selected on a case by case basis. Color/laser sorters and X-ray equipment can be used on any herb or spice. There are a number of equipment manufacturers and their marketing materials, available on-line, includes photographs and diagrams detailing the function of the equipment. So the cleaning operator must be understood the fitness and adjustment of cleaning machine components and related attachments even with spices and herbs. Equipment should be designed to facilitate cleaning and disinfection with little or no water and, when wet cleaning is required, to allow thorough drying before reusing the equipment for spices and herbs. Alternatively the design should allow disassembly such that parts can be taken to a room designed for cleaning and disinfection, when applicable.

Table 3.1: Some spice and herbs with suitable cleaning equipment and machine

Spice and herb	Cleaning equipments								
	Mag	RK	DS	Asp	GT	IC	Spir	Siev	MD
Allspice	X			X			X	X	X
Anise	X		X	X				X	X
Annatto	X								X
Sweet Basil	X			X	X	X		X	X
Caraway	X		X	X				X	X
Cardamom	X		X	X				X	X
Cassia/Cinnamon	X	X		X				X	X
Celery Seed	X		X	X				X	X
Chillies whole	X			X				X	X
Chillies crushed	X	X	X	X				X	X
Cloves	X		X	X				X	X
Coriander	X		X	X				X	X

Cumin Seed	X		X	X				X	X
Dill Seed	X		X	X				X	X
Fennel Seed	X		X	X				X	X
Fenugreek	X		X	X				X	X
Ginger (Whole & Split)	X	X		X				X	X
Laurel (Bay) Leaves	X							X	X
Mace	X	X		X				X	X
Marjoram	X			X	X	X		X	X
Nutmeg (Broken)	X	X						X	X
Nutmeg (Whole)	X								X
Oregano	X			X	X	X		X	X
Parsley	X			X	X	X		X	X
Pepper, Black	X		X	X			X	X	X
Pepper, White	X		X	X			X	X	X
Poppy Seed	X		X	X				X	X
Rosemary Leaves	X		X		X			X	X
Sage	X		X		X			X	X
Savory	X		X		X	X		X	X
Sesame Seed (Natural & Hulled)	X		X	X				X	X
Tarragon	X		X		X			X	X
Thyme	X		X		X	X		X	X
Turmeric	X	X	X	X				X	X

Key:-

Asp = Aspirator (Air Separator) RK=Rotary/Knife Cutter DS = Destoner GT = Gravity Separator (Air Table) IC = Cylinder Separator (Indent) Siev = Sifter / Sieve Spir = Spiral Gravity Separator Mag = Magnets MD = Metal Detectors

The equipment design should be as simple as possible, with a minimal number of parts and with all parts and assemblies easily accessible and/or removable for inspection and adjusting.

Components of gravity table separator

1. Intake pre-storage hopper
2. Electro-magnetic feeder
3. Cascade
4. Partial dust hopper
5. Full dust hood

6a. Discharge hopper for heavy product

6b. Vibrating discharge trough for heavy product with stone trap

7a. Vibrating discharge trough for light product

7b. Bagging off type hopper

Figure 3.1: Component adjustment of gravity table separator

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: Short Answer Questions (6 points)

1. Why fitting and adjusting cleaning equipment components.

Note: Satisfactory rating ≥ 4 points Unsatisfactory<4 points

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

Information Sheet 4- Entering processing/operating parameters

Plant matter that is damaged or other plant waste material should be disposed of properly and removed from the cleaning area in order to minimize the potential for it to serve as a source of mycotoxin-producing moulds. If possible, only the amount that can be processed in a timely manner should be picked in order to minimize growth of mycotoxin-producing moulds prior to processing. When the amount harvested exceeds processing/cleaning capabilities, the excess should be stored under appropriate conditions. Confirmed raw materials should be inspected and sorted prior to processing (foreign matter, odor and appearance, visible mould contamination). Laboratory tests, for moulds or pathogens such as, Salmonella, should be conducted when necessary and ready to cleaning/ further processing.

A spice and herb processing technician must have the ability to plan, organize, prioritize and handle the process. The individual must possess reading, writing and communication skills. In addition, the individual must have personal and professional hygiene. During operate primary processing/cleaning of spice and herbs, enterprise work procedures describe how to do the various operations / tasks on primary processing of spice and herb to be used is based on good practice. In some case these processers are handed down by 'word of mouth' but now in most large processing area the procedures are documented to ensure that all operators know what to do and that work is done using the correct procedures. Your supervisor or line manager will be able to provide advice and guidance about the procedures to use and your role will be organizing activities and ensuring that all the enterprise work procedures are followed correctly by yourself and your supervisor.

The requirements of the client and the target market will determine the standards to be used for various primary processing operations, e.g**.** quality of raw materials, produce accepted and type of processing to be used. For some markets these requirements may be defined in law but for others buyer preference dictates the price and raw material producer respond to their requirements to secure good price. For contract sales, client requirements will be listed in the contract.

Self-Check-4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test: Choose the best answer (4 points)

1. When the amount harvested exceeds processing capabilities, the excess should be _____ under appropriate conditions.
   a. Store b. Remove c. A&B d. None
2. The requirements of the client and the target market will determine the standards to be used for various primary processing operations such as:
   a. produce accepted
   b. quality of raw materials
   c. type of processing to be used
   d. all

Note: Satisfactory rating-≥2points Unsatisfactory-<2 points

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

Information Sheet 5- Setting up the bin system to meet production requirements

The equipment should be installed so as to allow access for cleaning and to minimize transfer of dust particles to other pieces of equipment or to the environment. The bin/containers should be set near to the cleaning equipment to put the cleaned spices immediately after cleaning. the bins may be different in size according to the type, nature and variety of spices and herbs.

Information Sheet 6- Checking and adjusting equipment performance

All spice cleaning equipment takes advantage of a physical difference between the spice and the foreign material being removed. Most often these physical differences revolve around shape and density. The closer in shape and density the foreign materials is to the spice in question, the more difficult it is to remove. The specification has to be checked from time to time to ensure that the equipment is working properly. Here, some very simple checks can work well. One simple check is to drop about a pound of black pepper into a beaker and use a steam of water to flush the pepper berries out, leaving any rocks or heavier foreign material in the bottom of the beaker. If anything is found, the system needs some adjustment. Some sort of laboratory examination of the product is needed to really determine if the cleaning equipment is working correctly.

Prior to starting cleaning, it is important to evaluate the performance of cleaning equipment to ensure it is working correctly with respect to accuracy and precision. Cleaning equipments should be properly check and adjust to meet great achievement. Equipment should not have pits, cracks, corrosion, crevices, recesses, open seams, gaps, lap seams, protruding ledges, inside threads, bolt rivets, or dead ends. Hollow areas of equipment as well as cracks and crevices should be eliminated whenever possible or permanently sealed. Items such as bolts, studs, mounting plates and brackets should be continuously welded to the surface and not attached via drilled and tapped holes. Welds should be ground and polished smooth. Push buttons, valve handles, switches and touch screens should be designed to ensure product and other residues do not penetrate or accumulate in or on the enclosure or interface. The risk of contamination from equipment should be assessed and controlled. Testing equipment should be tested regularly to ensure it provides the level of protection required. Testing intervals will depend on several factors including:

- the frequency of use
- the environment in which it is being
- Manufacturer's advice.

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 (10 points)

1. What are the factors that determine the frequency of testing cleaning equipment?
2. Why the cleanliness specification to be checked from time to time?

Note: Satisfactory rating ≥ 5 points Unsatisfactory <5 points

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

Information Sheet 7- Carrying out pre-start and service checks

7.1. Carrying out pre-start checks

Before starting a processing in your work place refer to the standard operating procedure. The processing/cleaning equipment must be thoroughly checked, and standard operating procedures must be followed for safe startup. The operator may be required to coordinate startup with other processing areas. Like any task you are about to perform, preparation is the key to success. Before starting any task of the work you should go through each step to make sure you know what is expected. This will allow you to be prepared for the job and have all the required paperwork, tools and equipment and any PPE ready. Check workspaces and walkways to ensure no hazards are present.

Conducting pre-start checks, such as inspecting equipment condition to identify any signs of wear, selecting appropriate settings and/or related parameters, cancelling isolation or lock outs as required, confirming that required screens are fitted and related equipment is clean and correctly configured for spices and herbs cleaning process requirements, positioning sensors and controls correctly, ensuring any scheduled maintenance has been carried out, and confirming that all safety guards are in place and operational are very important prior to starting the operation. If pre-start inspections are a critical safety element, then the process should be investigated every time there is an incident, regardless of whether there was any equipment failure.

7.2. Carrying out service check

The facilities are essential services that play a vital role to industry. Quality facilities and utilities provided in spice processing particularly in spice cleaning includes water, power, vacuum compressed and instrumentation air hygiene facilities etc. are prerequisite in an effective spice cleaning operation. Adequate natural or artificial lighting should be provided throughout the factory to enable personnel to operate in a hygienic manner. Only potable water should be used for all process related activities

are including washing and cleaning of machines/equipment that come in contact with food and hand washing.

- Pre-startup checks can minimize the following problems during startup:
  - ✓ Waste raw materials and energy
  - ✓ Produce excessive amounts of product that is off-specification
  - ✓ Cause equipment damage and lost production time
  - ✓ Cause injury to personnel
  - ✓ Waste time due to failure in identifying the requirements for the work

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: Short Answer Questions (15 points)

1. Why equipment pre startup check is important?
2. What are the services require during spice and herb cleaning?
3. List equipment components required prestart-up check before cleaning of spices and herb.

Note: Satisfactory rating-≥7.5 points Unsatisfactory-<7.5 points

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

LG #28	LO #2- Operate and monitor the spices and herbs cleaning process

Instruction sheet

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

- Damping spice and herbs into cleaning machine
- Transferring qualified and cleaned spice and herbs for further processing and removed by-product
- Monitoring Spices and herbs cleaning equipments
- Identifying variation in operation of equipment and processes and reporting maintenance requirements
- Identifying, rectifying and/or reporting product/process outcomes
- Maintaining the cleaning work area
- Conducting work
- Maintaining workplace records
- Following workplace information requirements and procedures

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**:

- Damp spice and herbs into cleaning machine
- Transfer qualified and cleaned spice and herbs for further processing and removed by-product
- Monitor spices and herbs cleaning equipments
- Identify variation in operation of equipment and processes and reporting maintenance requirements
- Identify, rectify and/or report product/process outcomes
- Maintain the cleaning work area
- Conduct the work
- Maintain workplace records
- Follow workplace information requirements and procedures

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- Damping spice and herbs process into cleaning machine

The main motive of spice cleaning is to strengthen the quality on the spice and allow it to be storable to longer period of time without deterioration. The first step of handling is known as ‘’damping’’ the produce from the field container. Damping must always be done gently, whether you are using water assisted methods or dry damping. Wet damping can decrease bruising and abrasions by using moving chlorinated (100-150ppm) water (pH 6-7) to receive the spice and herbs. Water temperature should be close to the temperature of in-coming spices and herbs to avoid infusion of cold water (along with decay organisms). Wet damping can reduce mechanical damage, since water is gentler on produce than a hard surface of sorting table or a conveyer belt.

The dust and dirt can remove using a winnowing basket. This can be made locally from bamboo, palm or other leaves. Winnowing is carried out to remove stones, chaff, dust, broken seeds, etc. from dry spices. This may be carried out very simply using a winnowing basket and allowing the wind to blow away light material such as dust or chaff. Stones are removed by hand. Such simple methods are only suitable for very small quantities of raw material. Cleaning of leafy herbs has to be done manually and any unsound material or foreign matter removed.

Figure 1.1: Traditional cleaning through winnowing and manual sorting

When using dry damping, having sloped ramps or moving conveyor belts will decrease injuries to spices and herbs. The field container should be emptied slowly and gently onto a tiled ramp with padded edges. Pre-sorting is usually done to eliminate injured, decayed or defective spice and herb before damping. These unmarketable units are sometimes ‘’culls’’. Pre-sorting will save energy and money because culls will not be handled, packed or transported. Removing decaying produce items is especially important, since this limit the spread of infection to other units during handling. All confirmed and available spices and herbs could be damped in cleaning equipments properly and accurately. Sieves, grading tables, flotation tanks and screens can all be used to ensure that the quality standards are met and an even line of high quality spice is obtained.

The spices and herbs should be washed in clean, potable water. Washing should be quick so that the spice is not soaked in water as this reduces the quality. The washing water must be changed regularly to prevent recontamination of spices by dirty water. It is essential that clean water is used as spices are not heat treated later on during processing. Dirty water introduces more bacteria, many of which cause food poisoning. Treating whole bulk commodities and intermediate fresh products as gently as possible during processing is important to minimize unnecessary bruising and stress which may reduce product quality and shelf life. Spices and herbs products are sometimes received with caked on dirt or dust. Washing and even scrubbing, some commodities and then rinsing in cold chlorinated water may be necessary to remove dirt and reduce microbial population before processing. The rotary drum washer can speed up the cleaning of large amounts of small sized produce. Immediately removing any spices and herbs that show signs of decay from the processing line will also help keep reduce microbial contamination and help to proper grading.

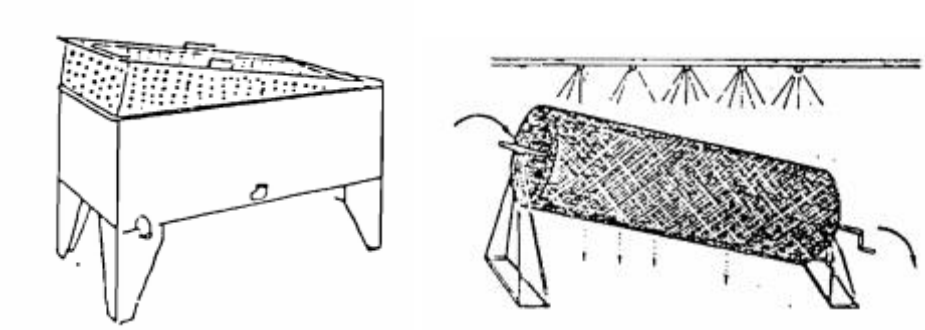

Figure 1.2: Rotary drum washer

Some crops (e.g. spices) may be cold washed before drying to remove dust, foreign matter and other debris. Once the product has been removed from the water, it is best practice to remove any excess water as quickly as possible so that the combination of excess water and heat does not encourage microbial growth. Basins and perforate vessels used for washing and draining. Excess of water should be cleaned and sanitized between consecutive uses. Chlorine levels should be monitored to avoid flavor taints in the finished product and simple test kits are available. If available, special disinfecting/cleaning agents are superior to chlorinated water. These usually contain chemicals known as quaternary ammonium compounds that have a stronger, longer lasting action than chlorine. They are usually supplied pre-mixed with wetting detergents that produce better washing.

Figure 1.3: Basins and perforate vessels

Washing may be achieved at a small scale in large shallow tanks that allow operators to move the produce freely through the water. If concrete tanks are used they should ideally be tiled. Soil and other foreign matter are washed off the raw materials and frequent changes of water are therefore needed. A better method is to continuously circulate water through a filter. Ideally several tanks should be used, the first for removal of heavy soiling and subsequent cleaner tanks for final washing. Dry brushing-dry brushing is applicable for water-sensitive commodities. Ginger is, for example, brushed without using water to remove clods of soil. Small brushes are used to remove adhering dirt and insects on ginger rhizome root.

Damping of spices and herbs in magnetic separator: Spices and herbs are weighed on a scale which then passes through a magnet for removal of tramp metal. This removes impurities that are larger, finer and lighter than the main product itself. To be effective, the spice should flow in a loose stream over the magnet. Systems that bounce the spice particles over more than one magnet are the most effective. This machine is equipped with the air-recycling system that allows efficient aspiration of lighter foreign materials without requiring the energy as would be conventionally perceived. After the bulk of the foreign material is removed, it moves on to a de-stoner for removal of stones. The Spices and herbs are weighed again and ready for further processing.

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: Short Answer Questions

1. What is the main objective of spice and herb cleaning?
2. Why the spices and herbs should be washed in clean, potable water?

Test II: Choose the best answer

1. Winnowing is the process used to separate particles of_____.
   a. Heavier and lighter weight
   b. Only two heavier particles
   c. Only two lighter particles
   d. None of the above

Note: Satisfactory rating ≥3 points Unsatisfactory <3 points

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

Operation sheet 1- Cleaning of spices through winnowing method

Steps / Procedures to clean spices through winnowing method

Step 1. Prepare winnowing basket and spice (e.g. cumin)

Step 2. Add the dried cumin on the winnowing basket

Step 3. Start winnowing operation to remove the dirt, dust, leaves and twigs

Step 4. Put the clean cumin and waste separately

Step 5. Ready the cumin for further cleaning

Operation sheet 2- Cleaning of herbs through washing

Steps / Procedures to clean herbs through washing

Step 1. Carefully remove herbs from any packaging, including twist ties or from harvesting container

Step 2. Remove any damaged leaves or stems manually

Step 3. Rinse herbs under cool running water in basins with perforated vessels or concrete tanks, turning constantly until thoroughly clean

Step 4. Let herbs drip-dry for a moment over the sink

Step. Check and remove any remaining damaged leaves

Step 5. Place the clean herbs on clean suitable materials

Step. 6. Transfer to further cleaning methods (magnet, size separator) or in conducive storage area

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 3 hours. The project is expected from each student to do it.

Task-1 Clean spices through winnowing method

Task-2 Clean herbs through washing

Information Sheet 2- Transferring qualified and cleaned spice and herbs for further processing and removing by-product

2.1. Transferring qualified and cleaned spice and herbs for further processing

Only pure, well cleaned and well defined quantities of spices and herbs are transfer to further processing activities, such as peeling, slicing, drying and milling. Precautions should be taken to minimize the potential for contamination of the establishment and other products from materials that may be contaminated.

2.2. Removing by-product

Debris from culling and sorting should be periodically collected and stored away from the pre sorting, cleaning, drying, processing and packaging areas to avoid cross-contamination and attracting pests. Plants, parts of plants, spices and dried herbs suspected of being contaminated with animal or human fecal material should be rejected for human consumption. Special precautions should be taken to reject spices and dried aromatic herbs showing signs of pest damage or mould growth because of the potential for them to contain mycotoxins such as aflatoxins. The physical impurities and contaminants such as stones, hulls, peels, diseased leaves, seeds, decays and barks should be removed properly according to waste disposal procedures. The waste (by product) shall be collected in identifiable containers with lid and shall be removed from the processing areas either at the end of the operations or when the container is full. Waste storage facilities shall be:

- Away from the processing area
- designed to prevent access to waste by pests

Waste containers should be kept in designated area and constructed of impervious material which can be readily cleaned and sanitized. Facilities shall be designed to prevent access to waste or inedible material. Accumulation of waste should not be allowed in processing or storage areas. Removal frequencies should be managed to avoid accumulations, with a minimum daily removal. Records for the disposal should be available. If the waste disposal is outsourced, it has to be done through approved contractors only and the records should be maintained.

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. Mention some of by-products after completion of spice cleaning.
2. Why the spice processers/operator transfer the only pure and clean spice and herbs in to further processing after cleaning them?

Note: **Satisfactory rating ≥ 5 points** **unsatisfactory < 5 points**

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

Information Sheet 3- Monitoring spices and herbs cleaning equipments to identify variation

Numerous equipment performance parameters are monitored through a series of sensors by the control panel system so as to allow precise control over the principle elements of engine operation such as electric system fuel injection and emissions. By continuous monitoring variation data, performance degradation trends can be detected and corrective action taken to prevent imminent component or equipment failure. Monitoring equipment and systems process variables and performance is a condition-monitoring technique that predicts problems by monitoring changes in any combination of these variables such as; vibration speed, pressure, temperature, flow rate, electrical power consumption, fuel consumption, equipment/system power production or capacity, sieve size etc.

Cleaning equipments can be monitored by collecting time associated with the operation, unavailability and maintenance, and costs associated with labor for operation, maintenance, repair, and spare parts procurement and storage, for the equipment and systems additional performance measures may be assessed and trended. This data can be used to assess additional aspects of performance such as specific fuel oil consumption, mechanical or thermal efficiency of targeted equipment, equipment availability, cleaning capacity and performance, system availability and revenue generation and costs associated with maintenance and repair and investments.

Condition-monitoring tasks are scheduled activities used to monitor machine condition and to detect a potential failure in advance so that action can be taken to prevent that failure. Condition monitoring involves the regular measurement of parameters such as vibration, temperature and sound in and around machines and equipment. Condition monitoring typically occurs in manufacturing environments and is considered to be a safer, more efficient alternative to preventative maintenance.
In preventive maintenance, there are fixed maintenance intervals during the course of which sometimes intact components such as bearings or shafts are replaced too early. This means that runtimes are shortened unnecessarily and assets are wasted.

Furthermore, with preventative maintenance, it is not always possible to recognize and locate defective components before failure. Defective components in running machines can cause considerable damage, variation in operation and downtime. In condition monitoring the equipment, also known as condition-based maintenance, component defects are recognized at an early stage and the remaining runtimes of bearings, shafts, etc. are utilized to the maximum. This helps prevent costly downtime. Moreover, costs are saved due to the complete utilization of the runtimes of important machine components. Thanks to the intelligent sensor technology used in many of today's condition monitoring practices, condition-relevant machine parameters such as machine vibration, temperature and sound are measured directly at the source and analyzed by software designed to employ proven mathematical methods.

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. Why cleaning equipments are monitor?
   a. To reduce process variation
   b. To adjust unexpected vibration
   c. To reduce out off specification products
   d. All
2. Condition-based maintenance can allow for consistent monitoring of general machine conditions as well as for regular monitoring of the conditions of individual cleaning machine components in real time.
   a. True b. False
3. Which one is not condition-relevant machine/equipment parameter among the following?
   a. Vibration b. Sieve size c. Sound d. All e. None

Note: Satisfactory rating ≥4.5 points Unsatisfactory<4.5 points

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

Information Sheet 4- Identifying variation in operation of equipment and processes and reporting maintenance requirements

4.1. Identifying variation in operation of equipment and processes

Variability is true in nature as well as in every processing operation. Variability in processing is traceable to two kinds of causes: (1) random or natural variability, which is variability naturally present in a system, and (2) assignable or special variability, which is variability due to specific identifiable causes. Examples of random variability include vibration in machines, slight variations in raw materials, and variability in taking measurements. Causes of special variability include equipment that needs adjustment, defective raw materials, or human error.

4.2. Reporting maintenance requirements

Maintenance requirements can be identify through inspection and risk assessment. The purpose of an inspection is to identify whether the equipment can be operated, adjusted and maintained safely with any deterioration detected and remedied before it results in health and safety risk. Not all work equipment needs formal inspection to ensure safety and, in many cases, a quick visual check before use will be sufficient. However, inspection is necessary for any equipment where significant risks to health and safety may arise from incorrect installation, reinstallation and inspection frequencies should be determined through risk assessment.

You should inspect the equipment if your risk assessment identifies any significant risk to operators and others from the equipment's installation or use. The result of the inspection should be recorded and this record should be kept at least until the next inspection of that equipment. Records do not have to be made in writing but, if kept in another form (e.g. on a computer), these should be held securely and made available upon request by any enforcing authority.

Work equipment that requires inspection should not be used, unless you know the inspection has taken place. Where it leaves your undertaking, or is obtained from another, it should be accompanied by physical evidence of the last inspection, such as an inspection report or, for smaller items of equipment, some form of tagging,

color coding or labeling system. Equipment can be inspected by anyone who has sufficient knowledge and experience of it to enable them to know:

- what to look at
- what to look for
- what to do if they find a problem

4.2.1. Steps of a maintenance program

1. Create a team: it consists, recruit maintenance managers, technicians and relevant people from the operations department. Then lay down the goals you want your team to achieve. These might include minimizing corrective repair costs and reducing downtime of the equipment.

2. Record the equipment: documenting assets are necessary. An accurate asset count is needed in order to know how many require maintenance. Add asset information like make/model, manufacturer ID, asset specification, and location. It is easy to update prerecorded data, and it also allows prioritizing maintenance activities.

3**.** Establish maintenance procedures: once you have a well-grounded inventory list, you need to determine how frequently you should service the assets. This can be done on a weekly, monthly, quarterly or a semi-annual basis depending on the item type. Additionally, outline the procedures for repair including the standard operating and repair guidelines or safety measures are need. Finally, prepare a list of internal or outsourced maintenance tools needed.

4. Prioritize maintenance tasks: it needs to categorize high, medium and low-priority repair tasks. Service sessions can take a lot of time so need to choose battles wisely. Start off with high value equipment and begin scheduling maintenance tasks with longer intervals first (annual then bi-annual) as they take up the most time and resources. Then focus on low-priority items that require less effort.

5. Train the team: developing and implementing a maintenance system is a lengthy process and proper adoption of the program is a key. To optimize their management strategy, companies should devise training schedules so that their team knows exactly how to deploy repair practices within different departments. Optimal use of the restorative plan will eventually lead to higher return on investment.

6. Seek improvements: industries evolve along with their assets over time. Due to this constant transition, it is important to analyze progress for future growth. Some equipment gets checked-in for maintenance more often than others. This can be concerning if the repair and replacement costs of the item exceed its actual worth. To tackle such incidents, assess your maintenance plan after regular intervals, and make any changes as necessary.

4.2.2. Types of maintenance

1. Planned maintenance: it refers to scheduled maintenance to cope with equipment failures before they actually occur.

   It can be broken down into preventive and predictive maintenance.

   - ✓ Preventive maintenance is carried out at predetermined intervals by following prescribed criteria. It is time-driven and based on the assumption that usability of a mechanical component will decline over its useful life-cycle. It includes activities like regular equipment inspection, partial or complete overhauls, oil changes and lubrication etc.
   - ✓ Predictive maintenance is different from preventive maintenance such that it depends on the working condition of the machinery rather than its average life expectancy. It requires monitoring equipment during its normal operations to see if it's working at its best. Some companies use periodic vibration analysis to continuously monitor high value assets and simply check them in for maintenance when their vibration fluctuates.

2. Corrective maintenance: this type of maintenance restores any failed pieces of equipment. It is typically performed at irregular intervals since technicians don't know when a certain machine will break down. The main aim here is to fix a problem in the shortest possible time using three steps: diagnosis, repair and verification.

3. Routine maintenance: it is not dependent on any broken parts or downtime; it includes some necessary activities such as cleaning, lubricating and replacing batteries on small-scale equipment. This is generally performed on a weekly basis.

Complete, thorough, and current documentation is essential to an effective maintenance requirements and maintenance program. Recommendations can be

converted into job plans or work orders. The maintenance recordkeeping system must be kept current so that a complete maintenance history of each piece of equipment is available at all times. This is important for planning and conducting an ongoing maintenance program. The availability of up-to-date drawings to management and maintenance staff is extremely important. Accurate drawings are very important to ongoing maintenance, testing, and new construction; but they also are essential during emergencies for troubleshooting. In addition, accurate drawings are important to the continued safety of the staff working on the equipment.

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

1. How process variations can occur.
2. Write down the steps of equipment maintenance program.
3. List and describe major maintenance methods.

Note: Satisfactory rating-≥5 points Unsatisfactory-<5 points

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

Information Sheet 5- Identifying, rectifying and/or reporting product/process outcomes

The process/cleaning out outcomes can be identify, rectify and report according to cleanliness specification. A specification needs to be written for how much foreign matter is allowed in the cleaned spice and herb. The American Spice Trade Association (ASTA) cleanliness Specifications establish limits for macroscopic extraneous matter for spices, seeds, and herbs. The Cleanliness Specifications also include microscopic filth limits (e.g., insect fragments, rodent hairs) for specific products as shown table 5.1. The ASTA cleanliness specification is popular and used by other spice producing, importing and exporting countries and organizations so this also applicable for Ethiopia. Therefore the contaminants cannot exceed the level of cleanliness specification. This can be identify and rectify by sample tests.

Table 5.1: ASTA Cleanliness Specifications for Spices and Herbs

Name of spice, seed, or herb	Δ Whole insects, dead	Excreta, mammalian	Excreta, other	Mold	Insect defiled/ infested	Extraneous/ foreign matter
	By count	By mg/lb	By mg/lb	% By Weight	% By Weight	% By Weight
Allspice	2	5	5.0	2.00	1.00	0.50
Anise	4	3	5.0	1.00	1.00	1.00
Sweet basil	2	1	2.0	1.00	1.00	0.50▪
Caraway	4	3	10.0	1.00	1.00	0.50
Cardamom	4	3	1.0	1.00	1.00	0.50
Cassia	2	1	1.0	5.00	2.50	0.50
Cinnamon	2	1	2.0	1.00	1.00	0.50
Celery seed	4	3	3.0	1.00	1.00	0.50
Chillies	4	1	8.0	3.00	2.50	0.50
Cloves*	4	5	8.0	1.00	1.00	1.00
Coriander	4	3	10.0	1.00	1.00	0.50
Cumin seed	4	3	5.0	1.00	1.00	0.50
Dill seed	4	3	2.0	1.00	1.00	0.50
Fennel seed	SF[2]	SF[2]	SF[2]	1.00	1.00	0.50
Ginger	4	3	3.0	SF[3]	SF[3]	1.00
Laurel leaves**	2	1	10.0	2.00	2.50	0.50
Mace	4	3	1.0	2.00	1.00	0.50
Marjoram	3	1	10.0	1.00	1.00	1.00▪
Nutmeg (broken)	4	5	1.0	SF[4]	SF[4]	0.50
Nutmeg (whole)	4	0	0.0	SF[5]	SF[5]	0.00
Oregano***	3	1	10.0	1.00	1.00	1.00▪
Black pepper	2	1	5.0	SF[6]	SF[6]	1.00
White pepper****	2	1	1.0	SF[7]	SF[7]	0.50

Poppy seed	2	3	3.0	1.00	1.00	0.50
Rosemary leaves	2	1	4.0	1.00	1.00	0.50▪
Sage**	2	1	4.0	1.00	1.00	0.50
Savory	2	1	10.0	1.00	1.00	0.50▪
Sesame seed	4	5	10.0	1.00	1.00	0.50
Sesame seed, hulled	4	5	1.0	1.00	1.00	0.50
Tarragon	2	1	1.0	1.00	1.00	0.50▪
Thyme	4	1	5.0	1.00	1.00	0.50▪
Turmeric	3	5	5.0	3.00	2.50	0.50

*Clove Stems: Less than 5 % allowance by weight for unattached clove stems over and above the tolerance for other extraneous matter is permitted.

**Laurel leaves/sage: 'Stems' will be reported separately for economic purposes and will not represent pass/fail criteria.

***Oregano: Analysis for presence of Sumac shall not be mandatory if samples are marked 'Product of Mexico.'

****White pepper: 'Percent Black Pepper' will be reported separately for economic purposes and will not represent pass/fail criteria.

(2) Fennel seed: In the case of Fennel Seed, if 20 % or more of the sub-samples contain any rodent, other excreta or whole insects, or an average of 3 mg/lb or more of mammalian excreta, the lot must be reconditioned.

(3) Ginger: More than 3 % mouldy pieces and/or insect infested pieces by weight.

(4) Broken nutmeg: More than 5 % mould/insect defiled combined by weight.

(5) Whole nutmeg: More than 10 % insect infested and/or mouldy pieces, with a maximum of 5 % insect defiled pieces by count.

(6) Black pepper: 1 % mouldy and/or infested pieces by weight.

(7) White pepper: 1 % mouldy and/or infested pieces by weight.

Δ Whole insects, dead: Cannot exceed the limits shown.

▪Extraneous matter: Includes other plant material, e.g. foreign leaves.

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 (10 point)

1. How products can identify, rectify and report in spice cleaning operation?
2. List and identify ASTA's cleanliness specification.

Note: Satisfactory rating-≥5 points Unsatisfactory-<5 points

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

Information Sheet 6- Maintaining the cleaning work area

Assessing the cleaning workplace and implementing safety measures are an excellent first step, but efforts must be maintained to keep workers safe and healthy. One of the best ways to maintain a safe facility and promote a safe culture is through visual communication. Training is an excellent strategy for maintaining safety in the workplace. Periodic training sessions should be held annually or throughout the year to keep workers up-to-date and refreshed on safety practices and procedures.

Another way to ensure your cleaning work areas safety is a priority is to establish a safety committee. Workers from different levels and different departments should be brought together to form a committee dedicated to safety. The committee can meet on a monthly-basis to review safety practices, evaluate safety procedures, assess issues, and to brainstorm safety solutions. During monthly company meetings, the safety committee prepare to share any safety related news and any employee feedback. So the cleaning area should maintain based on housekeeping standards.

The workplace environment influences employees' productivity, performance and well-being. Maintaining a clean workplace is vital for employers to reduce their workers compensation claims and keep efficiency high. A clean workplace is essential to safety**;** when employees work in a messy environment, they may not notice all hazards, which increase the risk of an accident. According to the Occupational Safety and Health Administration (OSHA), an occupational hazard is anything in the workplace that may cause harm. An occupational hazard is commonly caused by neglect on the part of the employer or a lack of awareness by workers.

Clean workplace is also crucial to health: Flu season is rapidly approaching and workplaces may see an increase in the number of employees using sick days if they become ill. Germs can spread quickly through the workplace if supervisors and employees don't adequately sanitize their hands and their workspaces. Another common health hazard of unclean workplaces is the germination of mold.

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 (10 point)

1. Mention the responsibilities of safety committee.
2. Write the importance of a clean work area in processing industries.

Note: Satisfactory rating-≥5 points Unsatisfactory-<5 points

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

Information Sheet 7- Conducting the work

When performing any operation good manufacturing practices should be practice. As always we should be aware of safety requirements and attempt to observe safety rules in order to eliminate serious injury to ourselves or others. Personnel working with machines must be aware of the risks involved and follow safe work practices. Basic cause of accidents is faulty attitude toward safety, failure to recognize danger and emotion. Machine operator should follow safety precautions required in terms of personal safety, work shop safety, and tools and equipment safety to avoid injuries. The spice and herb cleaning work should be carrying out according to company policies and procedures, regulatory and licensing requirements, legislative requirements, and industrial awards and agreements.

- Good manufacturing practices (GMPs) include:
  - ✓ Food safety programmes;
  - ✓ Management systems;
  - ✓ Operational methods and personnel practices;
  - ✓ Maintenance for food safety;
  - ✓ Cleaning practices
- A food safety program is a written document indicating how a food business will control the food safety hazards associated with the food handling activities of the business. Food safety programs consider the following points based on HACCP (Hazard Analysis and Critical Control Point) guidelines:
  - ✓ identify potential hazards that may occur in all food handling operations carried out in the business
  - ✓ identify where these hazards can be controlled
  - ✓ monitor these control methods
  - ✓ provide corrective actions when a hazard is found to be not under control
  - ✓ establish, document and verify detailed pre-requisite programs
  - ✓ be regularly reviewed for adequacy

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: Short Answer Questions (15 point)

1. What are good manufacturing practices?
2. Write the basic cause of accidents during performing spice and herb cleaning operation.
3. Write some considerations in food safety program based on HACCP guidelines.

Note: Satisfactory rating-≥7.5 points Unsatisfactory-<7.5 points

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

Information Sheet 8- Maintaining workplace records

Records are important to the financial health of processing industry. Good records do not ensure your industry will be successful; however, success is unlikely without them. Industry records can help to evaluate the strengths and weaknesses of processing operation. Records in industry are essential for preparing income tax reports. Records are important in establishing eligibility for participation in government programs, determining the proper level of insurance coverage, and negotiating lease arrangements. Accurate records are essential for evaluating your industry processing performance. Accurate analysis requires accurate data.

Operational/ workplace/ records about products and practices can be helpful to firms. First, such records help ensure consistency of production/cleaning/, packing, and processing operations and end-product quality and safety. They are more reliable than human memory and serve as a useful tool to identify areas where inconsistencies occur in operations and corrective actions or employee training may be needed. Furthermore, maintaining adequate documentation and records could assist in identifying or ruling out potential contributing factors of contamination. Every workplace is different and requires different types of information to keep it running smoothly, efficiently and profitably. Different processing industries collect and use different types of information. Common workplace records maintained in operating cleaning of spices and herbs include:

- Quantity of raw material received to be cleaned
- Quality of raw material received
- Types of cleaning equipments to be used
- Cleaning methods
- Variety of spice cleaned and production per hour, day, week, month and year
- Quality of cleaned spice (contaminants, dusts, stones, etc. after cleaning)
- Date and time
- Employee training records

- Equipment monitoring and maintenance records
- Sanitation records
- Corrective action taken
- Inspection records (e.g., incoming product, facility, production area)
- Microbiological contamination records
- Name of person(s) who completed the record etc.

Self-Check – 8	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 (6 points)

1. Write some workplace records in cleaning operation of spices and herbs.
2. Why maintain work place records.

Test II: Choose the best answer (4 points)

1. Maintaining work place records helps:
    a. To take corrective actions
    b. To identifying potential contamination
    c. To ensure consistency of production
    d. All
2. Which is unnecessary data in spice and herb cleaning operation
    a. Name of spices and herbs
    b. Cleaning methods
    c. Cleaning equipments
    d. All
    e. None

Note: Satisfactory rating-≥5 points Unsatisfactory-<3 points

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

Information Sheet 9- Following workplace information requirements and procedures

A workplace is a location where someone works for his or her employer, a place of employment. A work place procedure explains a specific action plan for carrying out a policy. Procedures tells employees how to deal with a situation and when. Using policies and procedures together gives employees a well-rounded view of their workplace. They know the type of culture that the organization/workplace is striving for, what behavior is expected of them and how to achieve both of these. Information is passed from employee to employee, customer to employee, supervisor to team member, supplier to customer, and so on. Information needs to be sorted into related groups so that it can be stored easily and found when needed. An organization's success depends largely on how well it manages its information. Workplace information requirements include:

- Standard Operating Procedures (SOPs)
- specifications
- production schedules and instructions
- manufacturers' advice
- standard forms and reports

- The workplace instructions shall include Safety Data Sheets and relevant information on workplace such as:
  - ✓ first aid measures
  - ✓ fire fighting, including information about precautions in case of fire
  - ✓ precautions regarding accident, including information on safety directions
  - ✓ exposure controls/personal protection, including information about measures to be taken
  - ✓ disposal considerations, including information about precautions to be taken on disposal

A standard operating procedure (SOP) is a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations. SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing

miscommunication and failure to comply with industry regulations. A specification often refers to a set of documented requirements to be satisfied by a product or service. It is often a type of technical standard. Scheduling is the process of arranging, controlling and optimizing work and workloads in a production process or manufacturing process. It is used to allocate plant and machinery resources, plan human resources, plan production processes.

Self-Check-9	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 (12 points)

1. Mention workplace instructions when performing cleaning of spices and herbs.
2. What will be the negative consequences if the employees do not follow workplace information and instructions?
3. Why follow work place information.
4. What the information requirements that shall be included in workplace?

Note: Satisfactory rating-≥6 points Unsatisfactory-<6 points

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

LG #29	LO #3- Shut down the spices and herbs cleaning process

Instruction sheet

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

- Identifying the appropriate shut down 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**:

- Identify the appropriate shut down procedure.
- Shut down the process
- Identify and report maintenance 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 the appropriate shut down procedure

The standard operating procedures for each type of equipment must be adhered to when shutting a processing down. Shut down must be conducted using the standard procedures established for the machine or equipment. Refer to your standard operating procedures for the correct way to operate each type of processing unit in your workplace. So the appropriate shut down procedures depends on the type of shut down. The types of shutdowns used in a processing industry are: scheduled shutdown, maintenance shutdown and emergency shutdown.

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 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 cleaning and other mechanical operations
- Removing or flushing waste materials from the cleaning process workplace

1.2. Maintenance shutdown

When maintenance to the cleaning 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 and electric tested on a continuous basis prior to and during entry

- A planned process shutdown will prevent:
  - ✓ plugging of lines or equipment
  - ✓ possible damage to equipment
  - ✓ Possible injury to be occurred

1.3. Emergency shutdown

An emergency shutdown is initiated in the event of a fire, instrument failure, power failure, unexpected hazard etc. 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. If the machine or equipment is operating, shut it down by the normal stopping procedure or with manufacturer's or industry specifications.

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: Choose the best answer (4 points)

1. _____is initiated in the event of a fire, instrument failure, power failure, unexpected hazard or loss of the processes.
   a. Scheduled shutdown,
   b. Maintenance shutdown
   c. Emergency shutdown
   d. None of the above
2. _____ is initiated by the operator during normal operation of the unit when, maintenance is required.
   a. Scheduled shutdown,
   b. Maintenance shutdown
   c. Emergency shutdown
   d. None of the above

Test II: Short answer question (6 points)

1. Differentiate the types of shut down.
2. What are the importance of a planned process shutdown

Note: Satisfactory rating-≥5 points Unsatisfactory-<5 points

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

Information Sheet 2- Shutting down the process

A shutdown is temporary in nature, which means that it has a specific start and finish. There will be a preferred sequence of implementation for the shutdown tasks. The shutdown is a unique, one-time undertaking; it will never again be done exactly the same way, by the same people, and within the same environment. During normal running of the plant, experienced people usually carry out familiar tasks using well-defined procedures, but during plant shutdown, one could come across hazardous procedures and unfamiliar events. In such situations, the probability of accidents increases.

Major shutdowns in process industries typically happen infrequently (every year or two) and take several days to complete. In general, these shutdowns should have two objectives:

- To repair problems identified during previous major shutdowns, and
- To inspect parts of the plant not accessible during operation in order to identify problems that will be repaired during future planned shutdowns.

Major shutdowns provide an opportunity for the people in the maintenance department to demonstrate how well they can perform under pressure. A well-planned and well-executed shutdown can be an exciting and satisfying experience. A strong operations/maintenance partnership will be a key. Finally, be sure to include all operations and maintenance activities in an integrated shutdown schedule, which should be under constant review and revision during the shutdown period.

The documentation for a major shutdown can be extensive. It may include the list of shutdown work, critical-path schedules, the process inventory plan, permits and other safety documentation, the shutdown budget, all isolation and vessel-entry procedures (complete with detailed schedules and resource plans), as well as a list of the people responsible for all aspects of the shutdown (including their work schedules.

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: Choose the best answer (4 point)

1. What is/are the objectives of shut down the spice cleaning process:

Note: Satisfactory rating-≥2 points Unsatisfactory-<2 points

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

Information Sheet 3- Identifying and reporting maintenance requirements

The term ‘maintenance’ covers many activities, including inspection, testing, measurement, replacement and adjustment, and is carried out in workplaces. It has a vital role to play in reducing the risk associated with some workplace hazards and providing safer and healthier working conditions. Insufficient/inadequate maintenance can cause serious (and potentially deadly) accidents or health problems. 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.

A risk assessment should be carried out before any maintenance work begins and work should be planned. It is best practice to keep a maintenance log which is regularly updated. Workers should be involved in the risk assessment process as those carrying out a maintenance task are often in the best position to identify hazards and the most efficient ways of dealing with them. The work area should be made safe and the people performing the maintenance work should be equipped with the proper tools and equipment to do the work safely (including personal protective equipment). The work should be monitored and safe working procedures need to be followed at all times. The process needs to end with checks to ensure that the job has been completed satisfactorily.

The frequency and nature of maintenance should be determined through risk assessment, taking full account of:

- the manufacturer's recommendations
- the intensity of use
- operating environment)
- user knowledge and experience
- the risk to health and safety from any foreseeable failure or malfunction

Equipment failure can result in the following consequences:

- Loss in production and resources

- Possibility of project subcontracting
- Rescheduling of entire projects
- Material wastage from unused resources
- Overtime labor due to unexpected downtime
- Early disposal of machinery and equipment

General requirements for equipment maintenance include:

- Obtaining a copy of the maintenance schedule recommended by the manufacturer.
- Ensuring that maintenance is performed as required.
- Ensuring that the person(s) performing the maintenance are competent (e.g. licensed mechanic).
- Retaining records of maintenance/service conducted.
- Specifying who is responsible for overseeing equipment maintenance and where the records are kept.
- Setting up a system for removal and tagging of damaged or defective tools and equipment.

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 (6 point)

1. Mention the General requirements for equipment maintenance.
2. How the frequency and nature of maintenance should be determined.
3. What are the problems that arise from Insufficient/inadequate maintenance

Note: Satisfactory rating-≥3 points Unsatisfactory-<3 points

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

LG #30	LO #4- Prepare the grading process for operation

Instruction sheet

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

- Confirming and available washed and chilled spices and herbs
- Ordering/arranging clean spice and herbs.

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 washed and chilled spices and herbs
- Order/arrange clean spice and herbs.

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 washed and chilled spices and herbs

Washing most commonly takes place when fresh herbs are delivered to the processing unit. Spices are rarely washed, but notable exceptions are nutmegs which are dipped in water to remove unsound nuts or "floaters", and cardamom which may receive a sodium bicarbonate dip to preserve its green color. In the case of herbs it is most important to wash them as soon as they arrive in order to remove 'field heat' and thus slow down the growth of micro-organisms. Common herbs and spices that needs washing and chilling and confirm for further processing includes: parsley, coriander leaves, dill, oregano, basil, cilantro, chervil, chives and etc.

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 (6 point)

1. Write some spices and herbs that requires washing before processing.
2. Why herbs are washed as soon as arrive at the processing industry?

Note: Satisfactory rating-≥3 points Unsatisfactory-<3 points

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

Information Sheet 2- Ordering/arranging clean spice and herbs

Cleaned spices can be ordered based on their color, size, weight, thickness and their cleanliness extent before sending to further processing. Spices and herbs having similar color arrange together and also it is true for size, weight and thickness. Sizing produce is usually a part of grading, and you must meet the standards for any produce packed for sale through traditional wholesale markets. Sizing produce is optional for direct marketers, but may be worthwhile if certain size grades receive a higher price than others. Sizing can be done subjectively (visually). The arrangement of clean spice also consider the expired date that is spices having short shelf life give priories to pass the next step after cleaning.

- Ordering/arranging clean spice and herbs can have some benefits:
  - ✓ Reduce cleaning complexity
  - ✓ Helps to increase degree of cleanliness
  - ✓ Reduce time of cleaning
  - ✓ Is a best way to adjust and increase efficiency of cleaning equipment

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: Choose the best answer (6 point)

1. What are the parameters that are used to arrange clean spices and herbs?
2. Mention the benefits of ordering/arranging clean spices and herbs?

Note: Satisfactory rating-≥3 points Unsatisfactory-<3 points

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

LG #31	LO #5- Inspect and grade of cleaned spices and herbs

Instruction sheet

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

- Inspecting and grading spices and herbs
- Identifying, rectifying and/or reporting product out-of-specification.
- Maintaining work area
- Maintaining workplace records
- Organizing spices and herbs product and wastes properly

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**:

- Inspect and grade spices and herbs
- Identify, rectify and/or report product out-of-specification.
- Maintain work area
- Conduct the work
- Maintain workplace records
- Organize spices and herbs product and wastes properly

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- Inspecting and grading spices and herbs

Spice and herb grading involves the inspection, assessment and sorting of various spice and herbs regarding quality, freshness, legal conformity and market value. The International Organization for Standardization (ISO) standard defines inspection as activity of measuring, examining, testing one or more characteristics of the product and comparing the results with specified requirements in order to establish whether conformity is achieved for each characteristic. To decrease the quality risk, the spices and herbs should be inspected in any processing flow especially in cleaning operation. The spices and herbs in processing industry need inspection and making grade.

The first inspection should be an overall inspection of the product as the doors of the container are opened or the load is made accessible at cleaning site. This necessarily basic first inspection is made to look for large-scale infestation, mould growth, unacceptable packaging, rodent infestation or an unsuitable container, e.g. one previously used for chemicals, which have contaminated the spice or herb. The inspection also examines the amount of dust, the amount of stalks, stem, extraneous matter, etc. and most importantly the color, flavor and general appearance of the product after cleaning. When testing a given lot for cleanliness the samples taken from individual bags representing the square root of the total number of bags in the lot up to a maximum of 10 samples per lot. This is a good rule of thumb to follow when sampling any gin lot of spice for any parameter. If these 10 samples are composited, the end result says nothing about the variation within lots, but does give a good idea of the overall lot average.

Grading is the process of classifying produce into groups according to set criteria of quality and size recognized or accepted by governments and the industry. The criteria used in grading vary with the commodity, some common properties that are used include:

- Appearance: the external condition of the produce that includes uniformity of variety, cleanliness, wholeness (no missing parts), color and shape.

- Texture: a characteristic related to finger-feel and mouth-feel like firmness, smoothness, turgidity, solidity, and toughness.
- Presence of damage or defect: refers to any imperfection, lack of completeness or other conditions that differ from what is described as acceptable. Defects sprouting and discoloration such as yellowing and browning.
- Safety and wholesomeness: the condition of being clean and free from harmful contaminants such as heavy metals, pesticide residues, additives, food spoilage microorganisms and physical contaminants such as hairs, wood splinters and broken glass.

Grading and standardization play an important role in marketing of agricultural product.' including spices. It is a well known fact that spices exhibit wide variations in quality due to a number of factors such as the varietal differences, varying agro-climatic conditions of growth, different methods of processing and preparation for market, etc. Further, spices being perishable/semi-perishable by nature, changes in quality do occur during storage, also the quality requirements for different end uses of the same commodity also differ considerably.

Grading helps the spice producer in realizing prices commensurate with the quality of the produce. Grading and standardization no doubt make a major contribution to the improvement of marketing system of spices by establishing common international language. Under an efficiently managed grading and standardization programme, transactions can take place on the basis of recognized grade standards rather than on samples which often lead to disputes. The time consuming and waste full practice of physical inspection of the consignment at different sales points can be avoided and efficiency of marketing considerably improved when scientific grading of spices is adopted. When the transactions are the basis of well known grades, the collection and dissemination of market prices become more accurate and meaningful.

Figure 1.1: Sorting and grading ginger

Figure 1.2: Clean ginger

Figure 1.3: Decayed and culled ginger

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 (12 point)

1. Define and differentiate the word inspection and grading?
2. What are the criteria used in grading clean spices and herbs?
3. Write the benefits of grading spices.

Note: Satisfactory rating ≥6 points Unsatisfactory <6 points

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

Operation sheet 1- Inspecting and grading clean spices by taking samples

Steps / Procedures to inspect and grading cleaned spices

Step 1. Take representative sample from cleaned spice as required

Step 2. Prepare composite sample

Step 3. Separate the remaining impurities (foreign matter, damaged leaves ...)

Step 4. Weigh the clean spice and impurities separately

Step 5. Record the results

Step 6. Compare the value of impurity to cleanliness specification

Step 7. Make decision (accept, reject or re clean)

Step 8. If the result matches with the specification (accepted), make grading based on their colour, degree of purity etc.

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 2 hours. The project is expected from each student to do it.

Task-1 Inspect spices by taking representative samples and make grading

Information Sheet 2- Identifying, rectifying and/or reporting product out-of-specification

It is nearly impossible to perform a cleaning operation at reasonable production rates that results in a pile of foreign material completely free of spice and a pile of spice completely free of foreign material. To be sure that most of the foreign material is being removed; some spice must also be removed. The opposite of this is also true. At reasonable production rates, it is impossible to guarantee the absence of any foreign material in a lot of cleaned spice. A specification needs to be written for how much foreign matter is allowed in the cleaned spice.

Out of specification implies test results which fall outside specifications or acceptance criteria established by the product manufacturer or the laboratory. It is the test result does not comply with the predetermined acceptance criteria. Out of specification such as off flavor, contaminated (live or dead insects, insect fragments), decayed, foreign matter>2%, extraneous matter (Herbs >2%, Spices >1%), over wetting when cleaning, discolored products should be report to responsible person. Inspecting fresh produce throughout the processing stream for contaminants that may not have been noticed during the incoming produce inspection is a crucial task. Removing from the processing stream damaged or decomposed produce, extraneous matter, and produce that appears to be contaminated by animal feces, fuel, machine grease or oil. Out of specification results can result from either of two situations.

- Laboratory testing error (during sampling)
- Product manufacturing errors (e.g. cleaning equipments)

- So while doing the sample testing in the laboratory the following points must be confirmed:
  - ✓ Tests were performed under prescribed environmental conditions
  - ✓ Tests were conducted by a validated analyst
  - ✓ Validated test methods were adopted and SOP is followed without deviations
  - ✓ Equipment used were calibrated
  - ✓ Reagents used were within their validity
  - ✓ All results were recorded honestly and simultaneously to the analysis

All out-of-specification products must be clearly identified, labeled, and quarantined to prevent unauthorized release. Cleanliness specifications exist for all major herbs and spices, in terms of permitted amounts of extraneous matter or filth, mould (visible), insects, excreta and insect damaged material. The amount of contamination is measured by microscopic analysis (x 30) of aliquots of the material. American spice trade association recommends that all of its members, and their suppliers, adhere to the following guidelines for control of non-conforming product.

- ✓ Specific individuals should be responsible for decisions pertinent to nonconformance, release, rework, or destruction of product.
- ✓ Products that are reported as non-conforming as a result of quality control activities, production, customer complaints, or external audits should be designated as “on-hold” and documented.
- ✓ Clearly label and isolate “on hold” products so that they are not accidentally released.
- ✓ Products should only be released after necessary controls are made and specification limits are achieved.
- ✓ Inform brand owner if applicable.
- ✓ Initiate corrective action in response to customer complaints.
- ✓ If non-conformance does not affect the use or safety of the product, then corrective action completes the response.
- ✓ If non-conformance affects the safety of the product, recall is initiated with management approval.
- ✓ Until the recall is completed, products from the same lot cannot be shipped and must be quarantined.
- ✓ Determine the corrective action required to eliminate non-conformance of future product, i.e., through re-work or other means. Upon completion, re-check the quality of the product to ensure the elimination of the non-conformance and seek approval for shipment.
- ✓ Document any destruction/disposal of non-conforming product.
- ✓ Where customer-branded products not meeting specifications are sold to staff or passed on to charities, this shall be with the prior consent of the brand owner, and shall be fit for consumption, meeting the legal requirements.

- When a quality defect is found and documented, the technician assumes the third role of quality control, which is to report the defect. This function usually contains four parts:
    - ✓ Notification to others of the defect;
    - ✓ Follow-up to make sure the defect does not occur again;
    - ✓ Documenting how the problem was fixed; and
    - ✓ Changing the processing specification as needed

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: Choose the best answer (12 point)

1. Define out off specification in terms of spice and herbs?
2. How out off specification can appear?
3. Mention some out off specification products when cleaning spices and herbs.

Note: Satisfactory rating ≥6 points Unsatisfactory <6 points

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

Information Sheet 3- Maintaining work area

Under occupational safety and health administration law, it is required that employers create and maintain a safe work environment. Assessing the workplace and implementing safety measures are an excellent first step, but efforts must be maintained to keep workers safe and healthy. One of the best ways to maintain a safe facility and promote a safe culture is through visual communication. Having visual cues around the facility can be helpful reminders of the safe practices that must be followed. Some ways to do this is to post signs to let workers know when to done PPE, use labels to clearly communicate dangerous equipment, or hang posters reminding workers of safety procedures. Floor marking is another visual tool that can be used in a facility. Training is also an excellent strategy for maintaining safety in the workplace. Periodic training sessions should be held annually or throughout the year to keep workers up-to-date and refreshed on safety practices and procedures.

Another way to ensure your facility's safety is a priority is to establish a safety committee. Workers from different levels and different departments should be brought together to form a committee dedicated to safety. The committee can meet on a monthly-basis to review safety practices, evaluate safety procedures, assess issues, and to brainstorm safety solutions. If you hold monthly company meetings, have the safety committee prepare to share any safety related news and any employee feedback. This way, managers and supervisors can all be on the same page when it comes to workplace safety.

Importance of a clean workplace

The workplace environment influences employees' productivity, performance and well-being. No matter the industry, maintaining a clean workplace may help keep staff members safe, healthy and efficient. However, busy production schedules and increasing workloads may cause standards to dip. Maintaining a clean workplace is vital for employers to reduce their workers compensation claims and keep efficiency high.

Crucial to health-Flu season is rapidly approaching and workplaces may see an increase in the number of employees using sick days if they become ill. According to Kimberly-Clark Professional, germs can spread quickly through the workplace if supervisors and employees don't adequately sanitize their hands and their workspaces. Another common health hazard of unclean workplaces is the germination of mold.

Essential to safety-When employees work in a messy environment, they may not notice all hazards, which increase the risk of an accident. According to the Occupational Safety and Health Administration (OSHA), an occupational hazard is anything in the workplace that may cause harm. An occupational hazard is commonly caused by neglect on the part of the employer or a lack of awareness by workers.

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: Choose the best answer (4 point)

1. Importance of a clean workplace
   A. Crucial to health
   B. Essential to safety
   C. A & B
2. One of the best ways to maintain a safe facility and promote a safe culture is
   A. visual communication
   B. Training
   C. establish a safety committee
   D. all

Test II: Short Answer Questions (4 point)

1. List and explain the importance of clean workplace area.

Note: Satisfactory rating-≥4 points Unsatisfactory-<4 points

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

Information Sheet 4- Conducting the work

- OHS measures and procedures while conducting the work

Safety is the safe of being free from danger. Occupational health and safety (OHS) information is discussed and shared with colleagues. As always we should be aware of safety requirements and attempt to observe safety rules in order to eliminate serious injury to ourselves or others. Personnel working with machines must be aware of the risks involved and follow safe work practices. Basic cause of accidents is faulty attitude toward safety, failure to recognize danger and emotion. Machine operator should follow safety precautions required in terms of personal safety, work shop safety, and tools and equipment safety to avoid injuries. The work should be carrying out according to company policies and procedures, regulatory and licensing requirements, legislative requirements, and industrial awards and agreements.

- Good manufacturing practices are systems put in place to ensure that food prepared in a plant is sound and free of contamination. GMPs include:
  - ✓ Food safety programmes;
  - ✓ Management systems;
  - ✓ Operational methods and personnel practices;
  - ✓ Maintenance for food safety;
  - ✓ Cleaning practices
- A food safety program is a written document indicating how a food business will control the food safety hazards associated with the food handling activities of the business. Food safety programs consider the following points based on HACCP (Hazard Analysis and Critical Control Point) guidelines:
  - ✓ identify potential hazards that may occur in all food handling operations carried out in the business
  - ✓ identify where these hazards can be controlled
  - ✓ monitor these control methods
  - ✓ provide corrective actions when a hazard is found to be not under control
  - ✓ establish, document and verify detailed pre-requisite programs
  - ✓ be regularly reviewed for adequacy

- Principles of food safety plans should be implemented during drying operation which includes the following:
    - ✓ Conduct a hazard analysis
    - ✓ Determine critical control points
    - ✓ Establish critical limits
    - ✓ Establish monitoring procedures
    - ✓ Establish corrective actions
    - ✓ Establish verification procedures
    - ✓ Establish record-keeping and documentation procedures

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 II: chose the best answer (2 point)

1. Off the following one is not include in good manufacturing practices.
    a. Food safety program
    b. Management systems
    c. Maintenance for food safety
    d. All
    e. None

Test I: Short answer questions (6 points)

1. Write some considerations in food safety program based on HACCP guidelines.
2. Mention and explain the principles of food safety plans.

Note: Satisfactory rating-≥4 points Unsatisfactory-<4 points

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

Information Sheet 5- Maintaining workplace records

Records are important to the financial health of processing industry. Good records do not ensure your industry will be successful; however, success is unlikely without them. Industry records are like report cards students receive in school. With a farm report card, you can tell how well you are managing your operation compared with other producers in your "classes. You also can see the strengths and weaknesses of your processing operation.

Besides use as a management tool, records in industry are essential for preparing income tax reports. Also, most banks require extensive records from industry owners to formulate credit ratings. Finally, records are important in establishing eligibility for participation in government programs, determining the proper level of insurance coverage, and negotiating lease arrangements. Accurate records are essential for evaluating your industry processing performance. Accurate analysis requires accurate data.

Workplace records about products and practices can be helpful to firms. First, such records help ensure consistency of production/cleaning, inspection and grading/, packing, and processing operations and end-product quality and safety. They are more reliable than human memory and serve as a useful tool to identify areas where inconsistencies occur in operations and corrective actions or employee training may be needed. Every workplace is different and requires different types of information to keep it running smoothly, efficiently and profitably. Different businesses collect and use different types of information. Workplace records in operating drying of spices and herbs include:

- ✓ Quantity of cleaned spices confirmed for inspection and grading
- ✓ Inspections to be done
- ✓ Grading parameters
- ✓ Variety of spice inspected & Labeling
- ✓ Employee training records
- ✓ Monitoring & maintenance to be conducted
- ✓ Calibration records
- ✓ Sanitation records
- ✓ Corrective action records & name of person(s) who completed the record

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 (10 points)

1. Write some workplace records in inspection and grading of clean spices and herbs.
2. Why maintain a work place record is necessary.

Note: Satisfactory rating ≥5 points Unsatisfactory <5 points

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

Information Sheet 6- Organizing spices and herbs product and wastes properly

Spice and herb products types can be fresh, dried whole or ground, oleoresins and steam distilled oils. Fresh cut herbs are popular at the upper end of the retail and catering markets in many developing countries. Fresh herbs require less post-harvest processing and can be washed by customers to reduce microbial contamination. Exporting of fresh herbs demands a high standard of cold-chain management. Popular fresh herbs include basil, chives, cilantro/coriander, dill, mint, parsley, rosemary, and lemongrass. Fresh herbs and spices are also processed into paste/pesto-basil, coriander, garlic and ginger, for example-where less flavor and aroma is lost than during drying, and the product should be commercially sterile. Spice oils and oleoresins are the major products obtained from spices. Steam distilled essential oils from aromatic herbaceous and spice crops are used in a multitude of products in foods, healthcare, personal hygiene, household fragrances and perfumes.

In spice oil and oleoresin industry, 80%–90% of the bulk spice is left over as residues which do not find any commercial use or application at present and create disposal problem. Materials removed in dry cleaning operations can readily be handled dry. When the quantity of material removed is relatively small, containers, such as bins or portable hoppers, can be used to accumulate the solid waste. If the material quantity is large, equipment should be provided to continuously remove the waste from the operation and to convey it to an appropriate on-site storage area; belt, screw, and drag chain convey ors, as well as pneumatic systems are quite suitable for most types of wastes removed. Peels from spices produce finely divided particles of solid waste which are difficult to separate from water. The peel slurry can be collected in waste bin and transported to waste disposal area.

The initial washing of raw spices and herb is primarily to remove dust and dirt adhering to the produce. These become mixed in the water as settle able or suspended solids and can be transported from the operation only in water. However, other extraneous materials, such as leaves and vines, often accumulate as floating debris in wash tanks and flumes. These waste materials should be skimmed from the

water, either manually or by mesh belt or other skimming devices, and deposited into large containers. Preventing these materials from entering the gutter system will minimize the volume of water required to transport wastes generated at this operation. Intermediate and final washing of prepared product are normally provided to remove fragments and unwanted components (such as peel and seeds) from the primary product flow.

Most spices and herbs are classified into various size ranges; the size grading operation does not generate a large quantity of residuals from most products. However, some leaves, stems, crushed and undersized product and similar materials are normally separated from the usable product. These materials should be collected in large containers or transported by mechanical or pneumatic conveyors, thereby eliminating the need for water and preventing the generation of an organic load due to leaching of soluble matter. Solid residuals from sorting and trimming operation will contribute significantly to the organic load if placed in water. Therefore, these materials should be handled dry. So each undesirable fragments/wastes of the product is normally separated from the desired material/spices and herbs, especially during cleaning and inspection.

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 (12 points)

1. Mention some of the products obtained from spice and herbs.
2. List the wastes that come from spice cleaning, sorting and grading operations.
3. How wastes organize and dispose properly?

Note: Satisfactory rating ≥6 points Unsatisfactory <6 points

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

Reference Materials

Book:

1. Pruthi, J. S. (1992). Post-harvest technology of spices: pre-treatments, ouring, cleaning, grading and packing. *Journal of Spices and Aromatic Crops*, *1*(1), 01-29.
2. Food Industry Guide to implement GMP/GHP requirements(2018). Spice processing. Online available at www.fssai.gov.in
3. Regulatory procedures for the grant of spice house certification to the spice processing establishments (2012). Spices Board India Doc No: SB/SHC/01/2012 Vol-I
4. Kitinoja, Lisa, and James R. Gorny. "Postharvest technology for small-scale produce marketers: economic opportunities, quality and food safety." *Postharvest technology for small-scale produce marketers: economic opportunities, quality and food safety.* 21 (1999).
5. Peter, K. V. (Ed.). (2012). *Handbook of herbs and spices*. Elsevier.
6. Tainter, D. R., & Grenis, A. T. (2001). *Spices and seasonings: a food technology handbook*. John Wiley & Sons.

WEB ADDRESSES

1. http://www.fao.org/3/V5380E/V5380E09.htm#2.4%20Herb%20and%20spice%20products
2. **http://grain-cleaning.com/PRODUCTS/Destoner-Machine/Pepper-Seeds-Cleaner.html**
3. **https://www.nexeed.ca/wp content/uploads/2016/09/GravitySeparator_GB_web.pdf**
4. **https://fitforwork.org/blog/maintenance-of-equipment-in-the-workplace/**

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