Spice and Herbs Processing Level-II

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Module Title: - Operating Primary Processing of Spice and Herbs

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LG #32	LO #1- Prepare Primary Processing equipment for operation

Instruction sheet

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

- Confirming available spice and herbs materials for threshing, de-stemming, de-corning and de-hulling.
- Confirming the availability of equipment for threshing, de-steaming, de-corning and de-hulling
- Confirming type and quality of materials for pre-processing
- Identifying and confirming cleaning and maintenance requirements
- Fitting and adjusting machine components and related attachments
- Entering processing/operating parameters
- Checking and adjusting equipment performance
- Carrying out pre-start checks

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

- Confirm available spice and herbs materials for threshing, de-steaming, de-corning and de-hulling.
- Confirm the availability of equipment for threshing, de-steaming, de-corning and de-hulling
- Confirm type and quality of materials for pre-processing
- Identify and confirm cleaning and maintenance requirements
- Fit and adjust machine components and related attachments
- Enter processing/operating parameters
- Check and adjust equipment performance
- Carry out pre-start checks Carry out pre-start checks

Learning Instructions:

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

Information Sheet 1- Confirming available spice and herbs materials for threshing, de-stemming, de-corning and de-hulling

1.1. Introduction

Primary processing: This type of processing includes the simplest of processes such as washing, peeling, chopping, threshing, hulling of spice and herbs.

Secondary processing: This type of processing involves the conversion of primary processed products into more complex spice and herbs products and includes procedures such as mixing, depositing, layering, extruding, drying, fortifying, fermentation, pasteurization, clarification, heating, etc.

A spice and herbs are a dried seed, fruit, root, bark or vegetative substance used in nutritionally insignificant quantities as a food additive for the purpose of flavoring, and sometimes as a preservative by killing or preventing the growth of harmful bacteria. Used for other purposes, such as

- Medicine,
- Religious rituals,
- Cosmetics,
- Perfumery
- Or eating as vegetables.

For example, turmeric is also used as a preservative; garlic as a vegetable and medicine, nutmeg as a recreational drug. Spices are a group of plants represented in every corner of the world by numerous species and used in a variety of ways. Spices are available mainly in dried and ground form and the most sold ones are: black pepper, bay leaf, allspice, cumin, garlic, paprika, marjoram, fennel, parsley, nutmeg and cinnamon. Recently, mixtures of spices for specific meals such as pizza, fish, chicken, barbecued dishes and sauces, are also eagerly bought. The following list represents the most common spices and herbs raw materials: All spice, anise seed, basil, bay, leaf, black pepper, caraway, cardamom, celery seed, cilantro, cinnamon, cove, coriander, cumin, dill seed, dill weed, fennel, ginger, green pepper, mace, magoram, mustard, nutmeg, parsery, pink pepper, rosemary, saffron, sage ,thyme, turmeric, white pepper.

- **Classes of spices and herbs**

Hot spices; Capsicum (chillies), cayenne pepper, black and white peppers, ginger, mustard

Mild spices; Paprika, coriander

Aromatic spices; All spice (pimento), cardamom, cassia, cinnamon, clove, cumin, dill, fennel, fenugreek, mace and nutmeg

Herbs; Basil, bay, dill leaves, marjoram, tarragon, thyme

Aromatic vegetables; Onion, garlic, shallot, celery

Table: 1.1. Spice and herbs type and their part use as raw materials for processing

Plant organs use as raw material	Spice and herbs
Aril	Mace of nutmeg
Barks	Cassia, cinnamon
Berries	All spice, black pepper, chilies
Buds	Clove
Bulbs	Onion, garlic, leek
Pistil	(female part of flower) Saffron
Kernel	Nutmeg
Leaf	Basil, bay leaf, mint, marjoram, sage, curry leaf
Rhizome	Ginger, turmeric
Latex from rhizome	Asafoetida
Roots	Angelica, horse-radish
Seeds	Ajowan, aniseed, caraway, celery, coriander, dill, fennel, fenugreek mustard, poppy seed

Figure: 1.1. Different spice seeds/fruits

Figure: 1.2. Spice raw materials

1.2. Spice and herbs raw materials

Leaves and stems

The aromatic herbs such as basil, bay leaves, mints, oregano, parsley, rosemary, sage, tarragon and thyme are often used fresh to garnish food, as dry seasonings or for extracted essential oils. The aroma, a function of their essential oil composition, is dependent on chemo type and specific chemotypes can be chosen for an end-use. The essential oil composition and yield will also change during the seasons, and crop harvest should be directed to maximize both the essential oil content and quality parameters. As a general rule, the leaf and stem should be cut when the growth has matured to an elongated flower stem but without full flower or significant senescence of the lower leaves. The essential oil can be distilled from fresh or dry plant material. Harvesting the plant material should be avoided when it is wet and if it is to be dried the plant material should be evenly spread onto the drying racks or drier to ensure there is no sweating, fermentation and microbial invasion.

Flowers, buds and seed

When flowers and buds are the source of a spice or essential oil, the harvest time can be throughout the year in the tropics or during a limited flowering season in temperate regions. As an example in the tropics, clove clusters do not ripen evenly and each tree is harvested five to eight times in the fruiting season. Clove clusters are picked when the unopened flower buds are full-sized, the calyx base has developed the characteristic pink flush, but no buds have opened or petals fallen to expose the stamens. The harvested clove clusters are taken to the storage centre and the stems, which are about 25% of the total dry weight, are removed and separated. Cloves are harvested by hand but modern orchards will have tractor-mounted platform pickers. Similarly the ylang ylang tree flowers throughout the year. The flowers, a source of essential oil, are gathered principally after the rainy season and during the dry season. At this time the flowers are drier, contain more oil and the oil is of higher quality. Flowers are harvested early in the day. Only fully developed yellow flowers are picked as green flowers produce poor

quality oil. In order to avoid fermentation, the flowers should not be held in a mass and distillation should be undertaken as soon as possible.

In temperate environments flowering is seasonal and the stigma from theautumn flowering saffron crocus is an example of a flower-derived spice which has a specific harvesting time. , is the spice used to colour and flavour food There can be up to 12 flowers per corm which should be hand-picked daily, after the flower has opened but has not withered. The stigma is hand-separated or airflow-separated from the flower parts at the drying and processing facility.

Roots and rhizomes

The common spices which are derived from roots, bulbs and rhizomes are turmeric, ginger, onion, garlic, horseradish and wasabi. Turmeric**,** a perennial herb grown as an annual crop**,** is ready for digging when the lower leaves turn yellow. The length of time to harvest maturity is dependent on cultivar. Hand digging is the most common form of harvesting the rhizomes although diggers and lifters can be used. The leaves must be cut prior to mechanical lifting or after hand digging. Care is necessary to avoid damage to the rhizome (splitting or bruising) as injuries can result in fungal infection and rejection. Rhizomes are lifted whole, washed, sun dried and the rhizome fingers (which are kept as seed material) are separated from the mother rhizome. The harvesting of ginger**,** a perennial herb but often grown as an annual, depends on the cultivar and varies from 7-9 months for annual crops while perennial crops are harvested at the growers' discretion. The time to harvest is also dependent on the projected end-use with fresh ginger with low fibre content harvested at about 190 days after planting. The harvesting method must ensure there is no rhizome damage and both manual and mechanical methods of rhizome digging are used. Some production areas use both methods by mechanically loosening the rhizomes to assist the hand lifting. Following lifting the rhizomes are washed, the roots removed and then killed by immersion in boiling water for about 10 minutes, dried and then stored.

Bark, wood and resins

Many plants which are harvested for wood or bark products are managed under coppice plantation systems. Cinnamon and cassia production is an example of such a practice.

Harvesting of the shoots is undertaken during the rainy season two years after coppicing. The selected shoots must have a uniform brown color of bark and have at least two years growth. The rough outer bark of the selected shoots is first scraped off and the young tender inner bark is peeled off carefully from the stem. The inner bark curls naturally into the well-known quills. The best pieces of the peeled bark are packed with small pieces and tightly rolled to preserve the flavour and dried. The coppiced shoots are left for fermentation for 24 hours, dried in the shade for one day and in the sun for four days. The smaller quills are inserted into larger ones to form compound quills. The products are graded as quills, quillings, featherings, scraped chips and powders. The finest quality bark is obtained from shoots (<1.25 m by 1.25 cm diameter) with uniform brown thin bark harvested at six-month intervals.

Figure: 1.3. Fresh herbs use as raw materials

1.3. Raw materials for de-stemming/threshing

Threshing is the process of removing and separating the fruit or seed from the unwanted flower stems or plant stalks as well as removing damaged or immature material. This process can be undertaken by hand, assisted by sieves and screens, by use of winnowing or by mechanical shakers and sorters. The aromatic herbs raw materials such

as basil, bay leaves, mints, oregano, parsley, rosemary, sage, tarragon and thyme should have clean and ready for further processing operation to garnish food, as dry seasonings or for extracted essential oils. The aroma, a function of their essential oil composition, is dependent on chemo-type and specific chemo-types can be chosen for an end-use.

- As a general rule, the leaf and stem should be cut when the growth has matured to an elongated flower stem but without full flower or significant senescence of the lower leaves.
- The essential oil can be distilled from fresh or dry plant material.
- The plant material should be avoided when it is wet and if it is to be dried the plant material should be evenly spread on to the drying racks or drier to ensure there is no sweating, fermentation and microbial invasion.

Aromatic herbs plants and spices are used throughout the world for flavoring food and beverages, as well as for food supplements, novel foods and as a source of essential oils and aromatic extracts. The non-availability or inadequacy of standards for checking and assuring the quality of aromatic plants and spices is one of the main problems that arise for industry when using such raw materials. As many aromatic plants are harvested from the wild, standardization to assure their quality is important for their safe and effective utilization in food and beverage industries. On the other hand, there are numerous parameters that influence the chemical composition of plants, which play an important role in the final quality of the product and possibly in any risk arising to the consumer. Also, from a safety point of view, aromatic plants and spices should be free of undeclared contaminants and adulterants, such as toxic botanicals, pathogenic microorganisms and excessive levels of microbial toxins, pesticides or fumigation agents. We focus on these aspects and examine ways to assure their appropriate utilization from the quality and safety standpoint. The regulatory situation of aromatic plants (APs) is very complicated; several differences in standards and regulations between countries can be found, a situation that can result in more health risks arising for consumers.

1.4. Raw materials for de-corning and de-hulling

De-corning and de-hulling is the process of removing of spice seed from husk or hull. De-hulling is a very important unit operation in primary spice processing. De-hulling is the removal of the outer pericarp and testa (hull) during processing of spice seed or spice grain. Besides nutritional and aesthetic enhancement, de-hulling reduces the bulk density of the plant material, thereby facilitating better temperature management and control of other rate transfer processes in downstream processing. The raw materials for de-corning and de-hulling can be derived from many parts of a plant, for example, the seeds (fennel), seed pods (cardamom) and fruit or berry (allspice).

1.5. Raw material for peeling

Make ready raw material bulbs (garlic and onion) and rhizome (ginger and turmeric) and others for primary processing of spice for secondary processing. Care should be taken not to injure the bulbs and rhizome which has a delicate skin and is easily wounded during harvest and handling. Early harvested ginger and turmeric will still have an actively growing green stem attached to the rhizome which needs to be snapped or cut off slightly above the point of attachment. Excess soil and roots should be removed by hand before placing the rhizomes in the field container. Cotton gloves are typically worn to facilitate field cleaning. Ginger and turmeric should be pre-graded in the field and any unmarketable, damaged, or diseased bulb should be discarded. The harvested ginger and turmeric should be placed directly into strong, well- ventilated wooden or plastic field crates for removal from the field.

The roots need to be trimmed from the rhizomes using a sharp knife or floral shears. Care must be taken when trimming roots and stems from rhizomes so as not to cut nearby fingers of ginger or one's own fingers. The harvested rhizomes should be washed to remove the soil sticking to them. This helps in getting uniform color for the dried product. If rhizomes are kept in masses for long, they are liable to ferment. Use a power nozzle on the end of a hose to wash soil/media from between the rhizomes. Rhizomes have no skin, so they can scratch and blemished relatively easily. Care must be taken in order not to break hands apart if there is a necessity to leave them as a whole. Foliages need to be trimmed off about a half inch above where it meets the rhizome. Longer

stems can be left on, and the more stem length left on, rhizomes will dry out faster. After trimming and washing, the rhizomes are allowed to stay for an hour or two, depending upon how long it takes for them to dry, out of direct sunlight before packing for market or storage.

Examples of spices and herbs

Allspice - This individual spice is commonly confused as a spice mixture. It has flavors of cloves, nutmeg, cinnamon and a little pepper, but it is in fact a single spice.

Figure: 1.4. Allspice fruit

Cardamom - Cardamom aka the queen of spices in India (with pepper as her King) is used to intensify both sweet and savory flavors. Cardamom itself has a light lemony flavor, with an aroma that is rugged, but gentle, biting and fruity. Cardamom can be used in its whole pod form or the seeds can be extracted and ground into a powder depending on the type of dish being prepared.

Figure: 1.5. Cardamom fruit

Celery Seed - Celery products is cultivated in India. Celery seeds and ground celery seeds have more “earthy” taste that is still fresh and light.

Figure: 1.6 Celery seed

Chiles

Chiles vary in size and application, but generally add a small level of heat to a dish. We offer a variety of whole dehydrated chiles, as well as chiles powders and flakes.

Figure: 1.7. Chile fruit

Cinnamon - Cinnamon is the oldest known spice, being referenced in written text in the 5th century. There are 4 distinct types. It actually comes from pieces of tree bark that have been sun dried. After drying, the bark is cut into strips or ground into a powder. There are a variety of cinnamon types, and each has a slightly different flavor as well as a different volatile oil content that determines its intensity. Cinnamon is used in baking and can also be found in an assortment of savory dishes.

Figure: 1.8. Cinnamon barks

Cloves - Cloves are probably the only spice that can be used by stabbing it into the food you're cooking and just letting it sit. This popular way to flavor a holiday pork roast or

ham is truly unique and also provides an aesthetic appeal. They can also be used whole when cooking liquids, such as cider, but they should be removed before serving.

Figure: 1.9. Clove

Coriander - The plant that produces coriander seed is one of three plants that produce both an herb and spice. The herb produced by this plant is cilantro. Coriander is popular in Indian and Mexican dishes and provides a warm earthiness to dishes along with citrusy undertones. It is a popular ingredient with beer brewers.

Figure: 1.10. Coriander seed

Cumin- Cumin has long been an essential ingredient in cuisines around the world and has only relatively recently become main stream as a spice in the US. Cumin has a very distinct earthy, nutty and spicy flavor with a warm aroma with hints of lemon. It is an ingredient in many spice blends and is used in bean, couscous, curry, rice and vegetable dishes.

Figure: 1.11. Cumin

Fennel - Fennel seed, called “the fish herb” in Italy and France, has two types, sweet and bitter. Bitter fennel is the type that is typically referred to when the word ‘fennel’ is used in the United States. It has a warm, licorice type aroma with a flavor that is slightly sweet with camporous undertones. It is used in beet, lentil, potato and meat dishes and adds flavor to Sauerkraut.

Figure: 1.12. Fennel seed

Fenugreek- Fenugreek seeds look more like small, caramel colored pebbles than seeds. They are extremely popular in Indian and Middle Eastern cooking and are used in a

variety of curry powders. The flavor is nutty and bittersweet with a pungent, spicy aroma that has undertones of butterscotch and sweet nuts. The plant that fenugreek Seeds come from also provide us with the herb Fenugreek Leaves.

Figure: 1.12. Fenugreek seeds

Long pepper- Long pepper is now considered an exotic spice, but it was used just as often as black pepper before the discovery of the “new world.” During this time long pepper was used wherever some extra heat was called for. After the discovery of the “new world” and the commercial transportation of chile peppers, it decreased in popularity, as cooks had access to ingredients that better fit the heat component called for in a variety of dishes.

Figure: 1.13. Long pepper

Mace- mace is the little known, lacy covering of nutmeg. Mace is removed from the outside of nutmeg in strips known as mace blades and can be ground after drying for easy culinary use. The flavor is warm with hints of lemony sweetness. It is often described as similar to but more delicate than nutmeg. Mace is considered a savory spice and works well as a replacement for nutmeg in lighter colored dishes where the dark specks of nutmeg are unwanted.

Figure: 1.14. Mace

Mustard - Mustard seeds come in a variety of colors including yellow (also called white), brown and black. The darker the mustard seed, the more intense the flavor is when ground. Ground mustard is used to make mustard sauces and whole mustard seeds are used for pickling applications.

Figure: 1.15. Mustard seeds

Nutmeg- nutmeg is the seed of a yellow brownish edible fruit that grows on an evergreen tree. When picked, the nutmeg seed is covered in mace which is scraped off and sold as a separate spice. Nutmeg is typically solid all the way through and is most commonly used in its ground form. Nutmeg works well with hearty dishes such as lamb and mutton recipes, tomato sauces and vegetable stews. Nutmeg is always a popular flavor in baking and cold weather beverages.

Figure: 1.16. Nutmeg

Saffron- saffron is the most expensive and most counterfeited spice in the world. The production of saffron is extremely labor intensive, as saffron is the pistil of a flower that must be picked by hand, with an average of only three to five pistils being produced per plant. Saffron is used in a variety of applications including being a seasoning, fragrance, dye and medicine.

Figure: 1.17. Saffron

Sesame seed- Sesame seeds come in a variety of colors including white, yellow, black and red. They are popular in chinese stir fry and Middle Eastern spice blends. Sesame Seeds can also be used on baked goods such as breads, hamburger buns and pastries.

Figure: 1.18. Sesame

Basil - Basil has a better flavor when dried, as opposed to fresh. Dried basil has anise, pepper and minty undertones and it somehow sweet yet savory at the same time.

Figure: 1.19. Basil

Bay leaves- bay leaves are the whole dried leaves of a tree in the laurel family. Bay leaves have a much more pleasant flavor when dried, with has higher volatile oil content. Bay leaves are used in their whole form in soups and stews and are removed before serving. Ground bay leaves are added to seasoning blends and dishes to give an earthy flavor with undertones of nutmeg and clove.

Figure: 1.20. Bay leaves

Oregano - Oregano is commonly associated with Italy and pizza, but there are two main types of oregano, Mediterranean oregano and Mexican oregano. Mediterranean oregano is the type used in Americanized Italian dishes and Mexican oregano is more like marjoram and has citrusy, lime-like undertones.

Figure: 1.21. Oregano leaves

Parsley- parsley is a popular garnish because of its bright green color, but it can be eaten too! Parsley has a vegetable aroma and flavor that is prominent in Middle Eastern recipes for hummus, baba ganoush and tabbouleh. Parsley also works well in grain-based dishes, with fish and in pastas and soups.

Figure: 1.22. Parsley

Rosemary- rosemary has a very distinct, strong flavor that is minty, cooling and somewhat balsamic. The aroma is just as strong and has hints of eucalyptus. Rosemary works well with meats of all kinds, especially lamb, pork, veal and wild game. It also works well with dairy based foods such as cream cheese, butters and cream sauces.

Figure: 1.23. Rosemary

Thyme- thyme, the subject of many a spice pun, is popular in a plethora of European cuisines for its strong, fresh, lemony flavor. It is used to give flavor to sauces, vinegars, soups and stews. In the United States thyme is most recognized for its use in Creole cooking to add flavor to blackened meats and fish. It is used in turkey stuffing, sausages and New England clam chowder.

Figure: 1.24. Thyme

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. List some of aromatic spices?(2pts)

2. List some of herbs?(2pts)

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

1. Primary processing includes the simplest of processes such as washing, peeling, chopping, ageing, the milling of spice and herbs. (2pts)

2. Secondary processing involves the conversion of primary processed products into more complex spice and herbs products?(2pts)

Note: **Satisfactory rating - 8 points** **Unsatisfactory - below 8 points**

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

Answer Sheet

Score = _____

Name: _____ Date: _____ Rating: _____

Test I

1._____

2._____

Test II

1._____

2._____

Information Sheet 2- Confirming the availability of equipment for threshing, de-stemming, de-corning and de-hulling

2.1. Preparing personal protective equipment

Preparing personal protective equipment is necessary to protecting the person as related to the job performed. Select boot, hats, lotions, goggles, mask and gloves. In similar manner you need to identify the likely risks that might occur on your body or sense organs from specific activities, then once you identify the risks it is necessary to select the necessary personal protective equipment that fit the body or the sense organ involved.

Figure: 2.1. Personal protective equipment

2.2. Thresher

A threshing machine or a thresher is a piece of equipment that threshes grain or seed of spice, that is, it removes the seeds from the stalks and husks. Manually threshing does by beating the plant which contains seed or grain to make the seeds fall out. Separate reaper-binders and threshers have largely been replaced by machines that combine all of their function that is combine harvesters or combines. However, the simpler machines remain important as appropriate technology in low-capital farming contexts, both in developing countries and in developed countries that strive for especially high levels of self-sufficiency.

Figure: 2.2. Spice seed thrasher machine

Figure: 2.3. Spice and herbs threshing machine

Figure: 2.4. Combined harvester

Seed /grain of spice also threshing **manually by beating seed/grain manually by stick/ metal or by using livestock foot** on well prepared floor or on plastic.

Figure: 2.5. Manual threshing

2.3. De-corner and De-huller

De-corning and de-hulling is the process of removing of spice seed from husk or hull. The machine /equipment use implementing de-corning and de-hulling called de-corner and de-huller respectively. The purpose of hulling/corning machine is to remove husk spice from any seeds with minimum damage to the bran layer and as far as possible not to break the seed. Due to surface characteristics of different types of seeds it is

necessary to apply friction to the seed to remove the husk. Therefore, during hulling, certain percentage of broken cannot be avoided. In this respect the construction of machine, its precision adjustment and the operation govern the optimum performance and the efficiency of the machine and best quality of spice seed production.

De-hullers; de-huller is a machine used in removing outermost thin-layer covering of a seed. De-hulling is a very important unit operation in spice and herbs processing. De-hulling is the removal of the outer pericarp and testa (hull) during processing of spice seeds. Besides nutritional and aesthetic enhancement, de-hulling reduces the bulk density of the plant material, thereby facilitating better temperature management and control of other rate transfer processes in downstream processing. This unit operation is necessary in order to have products with desirable qualities. Most de-hullers use frictional force in removing the outer thin layer of seed. This could be done using a serrated surface cylinder or grinding discs with a concave screen. The serrated cylinder rubs against the crop to remove its outer cover after which it is reduced to powdery form and passes through the screen to be removed while the de-hulled seed is discharged through the chute. The components of a de-huller are:

a. Hopper- to hold the raw materials

b. Serrated cylinder or grinding disc- to de-hull the seeds

c. Concave/screen: for separation of grain from hulls.

d. Chute: to discharge

2.3.1. Selection of a huller

Factors to be considered in the selection of a huller are

- Capacity
- Energy requirement
- Efficiency of husk removal
- Extent of physical damage to seed
- Separation of loose husk
- Durability
- Ease of maintenance

2.3.2. Need for de-hulling technology

Most producers and consumers of spice which has seed or grain face a daily task of de-hulling and pulverizing the grains manually before being able to prepare the daily meal. To remove the outer layers, which contain primarily fiber, the presence of which affects cooking quality and taste and texture of the product, and adds bulk to the daily meal and to remove sources of bitter taste (polyphenols or tannins) that are often found in the outer hull or in the testa layer immediately under it. The average rural homemaker and her children will save substantial energy and time if they have access to machinery that can provide a convenient and inexpensive de-hulling and grinding service.

2.3.3. Equipment for de-hulling

Husk separator

This machine is required to blow away husk from the mixture of shelled seed, husk and unshelled seed obtained from huller. In the first stage the husk, broken, germ and bran must be separated which is accomplished by the husk separator. It is a simple machine having a fan and an arrangement to distribute the product of Sheller uniformly on an oscillating sieve with fine perforation. This is done to ensure that air flow across uniformly and blow away the husk; the broken, germs and bran are separated through perforation while the immature grains are also blown away by fan.

Figure: 2.6. Husk separator machine

2.4. Tools use for hulling activities

Some spice seed and fruit can separate from its husk using mortal and pistil manually by beating to-hulling and pulverizing the grains from its husk.

Figure: 2.7. Mortal and pistil use to separate husk

2.5. Ginger and turmeric peeling machine

Ginger, turmeric and other type of rhizome and root type of spice which adopts emery grinding principle advanced technology at home and industry. It can peel, wash, and then can deeply process it into slice, powder, juice and other products.

Figure: 2.8. Ginger and turmeric washing and peeling machine

We can also use hand tools (different knives) for primary processing (peeling and bulb breaking) of spice and herbs.

Figure: 2.9. Knives for peeling and bulb breaking

2.6. Garlic bulb breaker

This machine is used to separate garlic bulbs into cloves. The working principle is using standard rubber rollers for food product to break the garlic bulb into clove. Easy operation makes the clove without damage and high separating rate, even a single person is able to operate this machine.

Figure: 2.10. Garlic bulb breaker machine

2.7. Herbs thresher/cutter

Equipment specially designed and built for cutting herbs and fresh and dried herbs, and other raw materials in general designed with a simple structure and small size, is characterized by the cutting system, which emulates the traditional combined movement which occurs when the manufacturer operates manually, so that the descent of the guillotine blade is accompanied by a vigorous push that keeps the product compact.

You get a clean cut that minimizes the loss of juices and oxidation, recovering, but the experience of innovating herbal tradition. The system of knife self-sharpening knives and counter-drive double and composed of tilted blades made of special steel and highly resistant.

Figure: 2.11. Herbs thresher machine

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

1. What is thresher?(2pts)

2. List the factors to be considered during the selection of huller?(2pts)

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

1. Thresher is a piece of equipment that threshes grain or seed of spice, that is, it removes the seeds from the stalks and husks. (2pts)

2. The machine /equipment use implementing de-corning and de-hulling called de-corner and de-huller respectively. (2pts)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

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

Score = _____

Rating: _____

Answer sheet

Test I

1._____

2._____

Test II

1._____

2._____

Information Sheet 3- Confirming type and quality of materials for pre-Processing

3.1. Quality control of raw materials

The central, interlinking issue in the spice and aromatic plant industry has to be quality. The quality of the product on the shelf is dependent on the quality of the raw material and the quality of the extraction, formulation and manufacturing processes. The safety and benefits of a product are directly related to its quality, just as the quality of the raw material is dependent on practices in the agricultural supply line. Spice and aromatic plants have been used for centuries as spices and condiments to confer aroma and flavor to food and beverages.

Additionally, due to the antioxidant and antimicrobial activities of their constituents, medicinal and aromatic plants can act as stabilizer agents, playing an important role in the shelf-life of foods and beverages. In this context, they are important raw materials for the food industry, being used as a source of essential oils and aromatic extracts for foods, food supplements (functional ingredients derived from botanicals, used for their health-promoting properties, e.g. carotenoids), novel foods, beverages, etc. Since the use of botanicals is possible under both medicinal law and food law, it is important to determine first which legal framework would be applicable to an individual product. This is not always easy. Considering that the main purpose of spice and aromatic plants (MAPs) is human consumption, quality assurance of raw materials is extremely important to guarantee safety of intake. The demand for high-quality, safe, effective and clean natural plant products and their formulations with various substances have been growing significantly in the industrialized world and international trends projected to the twenty first century indicate that agricultural products having medical, health protection, nutraceutical or other positive effects on life will increase in value, in both absolute and relative terms.

Quality is the basic requirement that food and beverages must comply with to guarantee the safe consumption of a product. Quality control of herbal raw materials intends to ensure the identity, purity and the content of desired compounds, using a combination of

both physical and chemical tests. Quality standards that raw materials must fulfill are described and established in national or other international monographs. All tests described in the monographs should be per-formed with validated methodologies on representative samples as necessary, to ensure raw material quality, and all information must be confirmed and documented. In the following pages, these and other items are discussed in detail.

Most dried foods are comparatively low risk products in terms of causing food poisoning as they rely upon drying to a sufficiently low moisture content to prevent the multiplication of micro-organisms. However, herbs and in particular spices, are an exception and commonly contain very high levels of micro-organisms including those that cause food poisoning. In addition, they are commonly subject to contamination with foreign matter. There are two main reasons for these high contamination levels. First considerable contamination occurs during harvesting, washing and sun drying which takes place 'on farm', often under primitive conditions. Secondly, subsequent processing of herbs and spices is restricted to low temperature drying, grading, cleaning and grinding. They are not heat treated because this would result in loss of flavor and micro-organisms may thus survive processing. Fortunately for the producer, public health risks to the consumer are greatly reduced as herbs and spices are used as minor flavouring ingredients and well cooked in the home.

3.2. Quality assurance in raw material supply

Processors thus face a complex range of problems even before the product enters the processing unit and at first sight these appear to be beyond their control. For this reason the greatest gains in finished product quality may be made by carrying out a HACCP (Hazard Analysis Critical Control Point) analysis that focuses on these pre-purchase areas. The first step is to understand the supply chain from grower to purchaser and then identify all potential hazards and their severity. The next step is to consider what can be done to eliminate or minimize these risks. In this context, the most important aspect is the relationship between the growers and the buyer. Each must have confidence in the other. The processor should consider ways in which the grower may be assisted and this will also give greater confidence over the raw material quality. Ways of helping are many

and varied but the following examples may guide the reader to develop the correct tactics and systems.

Many smallholders are forced to sell through agents as they are also a source of credit during periods of hardship or when material inputs are required. The entrepreneur may assist in a similar way by offering contracts with phased payments against an agreed quality standard. This may be particularly useful for buying inputs such as herbicides and pesticides. The entrepreneur may purchase these in larger quantities at lower prices and distribute them to growers in the correct amount, depending on the area of the crop to be treated. In this way the buyer has considerable control over both the type and level of chemicals used. In other cases the distribution of selected seed may provide the farmer with higher yields and give the buyer more uniform raw materials.

Here smallholder members of a co-operative were attempting to supply herbs, which after drying were to be sold to a major multi-national food company which applies very high quality standards. Despite rigorous washing and sanitizing, it proved impossible to meet the company's microbiological standards.

A local institution carried out some tests which showed heavy contamination not only on the outer surface of the plants but also internally. It was clear that simple washing would never solve the problem, but the final solution proved to be very simple. First the use of raw manure as a fertilizer was stopped as this was the major source of contamination. Secondly harvesting methods were changed and the cut herbs were placed in clean baskets off the soil instead of being laid on the ground. It had been shown that when a plant is cut, its stem attempts to seal itself by sucking up moisture, which in this case contained microorganisms from the soil. The farmers were trained in the proper management of manure and hygienic harvesting. The problem disappeared and a contract was won.

Dried spices that are stored on the farm often become rapidly infested with beetles and moths. Growers usually put dried products in dirty gunny sacks which are laid on the floor in a corner of the house. Training in correct storage methods may dramatically reduce infestation levels and buyers may also directly assist the growers by providing

heavy-gauge plastic bags or large tins with lids for on-farm storage. The technique of "sunning" is used to prevent infestation of grains by heating them in the sun and this is also applicable to spices. In many cases growers wash herbs and spices using heavily contaminated water. To summarize, it is possible for an entrepreneur to improve the quality of incoming herbs and spices by finding ways to have more control over their production, including for example:

- Forming good relationships with a group of trusted suppliers.
- Having one person responsible for receiving /purchasing.
- Assisting and controlling farm inputs.
- Providing phased payment contracts with mutually agreed terms.
- Arranging training and funding occasional investigations.
- Carrying out regular visits to growers to make sure bad practices are not occurring.
- Arranging collection of harvested material. The shorter the time between harvest and processing the better the product quality.
- Where possible, discouraging on-farm washing and drying. If the produce can be moved quickly from the farm to the processing unit it is better to carry out these steps in a controlled way 'in-house'.
- When buying from larger producers or agents, samples should be taken and tested prior to purchase. Also inspection of suppliers' stores may indicate if they are clean and have any signs of insect or rodent infestation.

3.2.1. Quality assurance and control in the processing of raw materials

It has been repeatedly stressed in this topic high quality finished products can never be made from poor quality raw materials. Although all stages in a process are important, errors in early stages build up, becoming larger problems later, which cannot usually be corrected. Careful attention to the initial stages of a process is therefore very beneficial in maintaining quality.

3.2.2. Appearance and presence of contaminants

A sample of the incoming raw material should be spread on a sheet of clean paper and carefully examined for signs of infestation, moulds, foreign matter, rodent hairs, broken

seeds etc. In some cases, placing a small sample in water may reveal spices which have been internally attacked by insects as they will tend to float. In other materials the size of pieces may be important and a simple test procedure can be developed to check the range of sizes, by either sieving or weighing a known number of seeds can be used to identify insect parts.

3.2.3. Odour and flavor

Small and medium scale producers are not able to chemically analysis the flavor-bearing essential oils in the product. With experience however, abnormalities may be detected by tasting. In the case of a unit processing dried herbs and spices, a similar examination system to that used for fresh crops is required, together with a determination of moisture content.

3.2.4. Moisture content

The moisture content of dried herbs and spices is very important and if it is too high moulds and yeasts will be able to grow. The grower is always anxious to sell the maximum amount of water! The moisture content may be checked using scales and an oven.

Self-Check – 3	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

1. Define quality control of raw materials?(3pts)

2. How to improve the quality of incoming herbs and spices raw materials?(1pts)

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

1. Dried spices that are stored on the farm often become rapidly infested with beetles and moths. (2pts)

2. The moisture content of dried herbs and spices is very important and if it is too high moulds and yeasts will be able to grow.(2pts)

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

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

Score = _____

Rating: _____

Answer sheet

Test I

1._____

2._____

Test II

1._____

2._____

Information Sheet 4- Identifying and confirming cleaning and maintenance Requirements

4.1. Cleaning and maintenance of tools, equipment and machinery

Cleaning and maintenance of tools, equipment and machinery is essential:-

- To preserve the life of the tools, equipment and machinery and
- To protect the raw material from contamination.

4.1.1. Cleaning

Tools, equipment and machinery should be cleaned and sterilized according to the manufacturer's specifications, enterprise procedures and regulations.This is used to increases life span of tools and equipment and avoids scarcity of tools and equipment at critical periods. Always before storing of tools and equipment cleaning is a must. Plant sap and organic debris builds up on parts of tools and equipment that are in regular contact with produce. This plant sap and organic debris will cause corrosion of metal parts, reducing the life of the tools, equipment and the sharpness of the cutting blades of different machineries. Unnecessary damage to produce occurs and the risk of injury to the operator increases when blunt tools are used. Produce may also be contaminated by the residues leaf on tools and equipment from previous use.

4.1.2. Maintenance

Maintenance of all tools, equipment and machinery should be carried out in accordance with the manufacturer's recommendations.

When carrying out maintenance activities remember:

- Turn the machine OFF and DISCONNECT from the electricity before starting work
- Do not put your head and hands into moving machinery
- Replace the safety guards are cleaning
- Only work on tasks and machinery that you are authorized to work on
- Account for all tools, equipment and machinery parts on completion of the job.

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 I: Short Answer Questions

1. List the importance of cleaning and maintenance of tools, equipment and machinery?(3pts)

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

1. Maintenance of all tools, equipment and machinery should be carried out in accordance with the manufacturer's recommendations. (2pts)

2. Plant sap and organic debris builds up on parts of tools and equipment that are in regular contact with produce.(2pts)

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

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

Score = _____

Rating: _____

Answer sheet

Test I

1._____

Test II

1._____

2._____

5.1. Methods of machine safeguarding

There are many ways to safeguard machines. The type of operation, the size or shape of stock, the method of handling, and the physical layout of the work area, the type of material, and production requirements or limitations will help to determine the appropriate safeguarding method for the individual machine. As a general rule, power transmission apparatus is best protected by fixed guards that enclose the danger areas. For hazards at the point of operation, where moving parts actually perform work on stock, several kinds of safeguarding may be possible. One must always choose the most effective and practical means available.

5.2. Adjusting machine component

The openings of these barriers are determined by the movement of the stock. As the operator moves the stock into the danger area, the guard is pushed away, providing an opening which is only large enough to admit the stock. After the stock is removed, the guard returns to the rest position. This guard protects the operator by placing a barrier between the danger area and the operator. The guards may be constructed of plastic, metal, or other substantial material. Self-adjusting guards offer different degrees of protection.

The point consider when fitting and adjusting machine component and related attachment

- Become familiar with the machine before the first operation. Read the manual that came with the machine
- Never leave the machine unattended while the engine is running. Keep children away from the machine. Keep hands and feet away from moving parts
- Do not fill the tank while the engine is running
- Keep all flammable materials (including dry straw) away from the engine
- Do not oil, grease, or adjust the machine during operation. Wait until all moving parts have stopped before servicing
- Do not wear loose fitting clothing that may be picked up by moving parts

- While operating, keep all shields and guards in place
- Never extend hands or feet into the feed opening of the machine
- Never operate your machine in a closed shed or garage. Exhaust fumes are dangerous to your health
- Do not operate machine with loose peg teeth, bolts and nuts. Loose peg teeth may be ejected at high speeds, causing injury to operators and damage to the thresher
- Keep a first-aid kit at hand
- Tie up long hair to prevent entangling
- Do not wear neckties or other garments that may be wrapped into moving parts of the machine

5.3. Fittings machine component and releted attachment

Fitting are threaded or snap-lock attachments allowing connections between different machine components and related attachments. Made of stainless steel, fittings have various pressure ratings that are usually higher than the components being connected. This allows for fail-safe operation at a possible weak point in the circuit. The only repair on a fitting is replacing any failed seals. Otherwise, a failed fitting must be replaced. As fittings are attached with swage pressure (connecting fittings with compression), the components attached to the fitting (hose or tube) are distorted. Replacing a fitting usually means also replacing the connected piece.

Self-Check – 5	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

1. List the importance of fitting and adjusting, equipment and machinery?(3pts)

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

1. Do not wear neckties or other garments that may be wrapped into moving parts of the machine. (2pts)

2. Never leave the machine unattended while the engine is running.(2pts)

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

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

Score = _____

Rating: _____

Answer sheet

Test I

1._____

Test II

1._____

2._____

Information Sheet 6- Entering processing/operating parameters

6.1. Entering processing/operating

A spice and herbs processing trainee/technician must have the ability to plan, organize, prioritize, calculate and handle pressure. The individual must possess reading, writing and communication skills. In addition, the individual must have personal and professional hygiene.

During operate primary processing 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.

In a large processing area the owner of manager will meet with the buyers and the processer manager will be informed of the standards to be used for produce processing. These requirements will then be explained to all supervisors and quality assurance staff involved and this team will be responsible to explain to workers and ensure that the required standards are achieved.

Self-Check – 6	Written test

Name……ID…… Date…….

Directions:

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

Short Answer Questions

1. What guideline follow while performing various processing operations / tasks?(3)

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

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

Score = _____

Rating: _____

Answer sheet

1._____

_____

Information Sheet 7- Checking and adjusting equipment performance

7.1. Checking tools, equipment and machinery

A very good safety habit to adopt is to conduct daily pre-operational checks of tools, equipment and machinery each day before you use them. Pre-operation checks are not only a good safety practice, they can also save you a lot of money in maintenance and downtime costs. If you find any problems during your pre-operational check, make sure you correct the problem before using the machine.

For example before operating a machine it is important to;

- Walk around and look at all fluid levels such as engine oil, fuel, and hydraulic fluid.
- Look underneath the tractor; do you see any big leaks or puddles of fluid that have accumulated under the tractor.
- Look closely at the tires.
- Check the batteries to make sure they are securely held down, the connections are clean and the electrolyte level is good.
- As you are walking around, look for any obvious damage like cracked or broken parts, leaking or damaged hoses.
- Make sure that the steps are clean of any grease or mud that could cause you to slip.
- Check to see that the operator's platform or cab is free of any objects that could interfere with the operation of the tractor. If you have a cab tractor, keep the windows clean for good visibility.
- Properly adjust the seat for a comfortable position. Check the seatbelt to see if it is functioning.

7.2. Adjusting tools, equipment and machinery performance

Adjustments; various adjustments are required before starting machine operation. The machine is to be installed on clean level ground and is to be set according to task conditions. Any piece of equipment (including tools and furniture) identified as unsafe, either in normal day-to-day activities or during a safety inspection, must be promptly tagged using a tag out. Then further action must be taken for repair or disposal.

Equipment identified as faulty should be disconnected and tagged, and appropriate service people contacted to arrange repair or replacement to improve the performance.

Think, plan and check

- Lockout procedure must be employed whenever a piece of equipment is being repaired and there is the possibility of that equipment being switched on without the knowledge of the repairer.
- Identify all parts of any equipment or system that needs to be shut down.
- Find the switches, valves or other devices that need to be switched off.
- Follow the correct procedure for the shutdown of equipment so you don't endanger anyone.

Self-Check – 7	Written test

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

Test I: Short Answer Questions

1. List the some pre-operational before operating a machine? (3pts)

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

1. Follow the correct procedure for the shutdown of equipment so you don't endanger anyone. (2pts)
2. Very good safety habit to adopt is to conduct daily pre-operational checks of tools. (2pts)

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

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

Score = _____

Rating: _____

Answer sheet

Test I

1._____

Test II

1._____

2._____

Information Sheet 8- Carrying out pre-start checks

8.1. Pre-start checks of equipment and machine

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

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

Check all the tools and equipment before use.

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

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

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

1. List the three stages pre-start check of machine before start a day work? (1pts)

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

1. Visual inspections of important features prior to starting the machine. (2pts)

2. Checking is important to know functional and sufficient equipment. (2pts)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points

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

Score = _____

Rating: _____

Answer sheet

Test I

1._____

Test II

1._____

2._____

Operation Sheet 1– Conducting pre-start checks of tools, equipment and machine

Objectives of conducting pre-start check of tools, equipment and machinery;

- To know all the tools, equipment and machine functional and sufficient enough
- To know tools, equipment and machine which needs maintenance

Procedures to ensure the job gets done safely and without delay

1. Select, fit and use personal protective clothing and/or equipment
2. Conduct pre-start checks
3. inspecting equipment condition to identify any signs of wear;
   a - Visual inspections of important features prior to starting the machine
   b - Visual & function tests while the machine is turned on but stationary
   c- Testing the machine's functions during a short drive
4. Follow isolation and lock out/tag out procedures as required to take process and related equipment off-line in preparation for cleaning and/or maintenance within level of responsibility.
5. Any scheduled maintenance has been carried out and that all safety guards are in place and operational.
6. Take corrective action in response to out-of-specification results
7. Maintain work area to meet housekeeping standards
8. Clean tools equipment and machinery
9. Turn tools equipment and machinery in to their storing area
10. Make record and report to your supervisors

Figure: 8.1. Conducting pre-start check of machine

Operation Sheet 2– Preparing raw materials for primary processing

Objectives to preparing quality raw materials for primary processing of spice and herbs

Procedures

1. Prepare PPE
2. Prepare tools, equipment and machineries
3. Prepare raw materials for primary process
4. Montoring/check the quality of raw materials by visual observation
5. Remove all the contaminated or undesirable raw materials
6. Load or transfer quality rwa materials to primary processing area
7. Threshing /hulling/peeling etc.)raw materials either manualy and or mechanicaly
8. Winnowing threshed/hulled/peeled/de-corned of raw materials
9. If necessary drying
10. Storing the grain/seed/bulb/bean/
11. Remove workplace waste
12. Clean tools equipment and machinery
13. Turn tools equipment and machinery in to their storage area
14. Make record and report to your supervisors

Figure: 8.2. Threshing of spice

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 **6** hour. The project is expected from each student to do it.

Task 1: Conduct pre-start check of tools, equipment and machinery

Task 2: Prepare spice and herb raw materials for threshing/hulling/peeling etc.)

LG #33	LO #2- Operate and monitor the pre-processing process

Instruction sheet

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

- Conforming clean raw spice and herbs for threshing, de-stemming, de-corning and de-hulling process
- Monitoring the variation of equipment and materials
- Identifying variation in equipment operation and reporting maintenance requirements
- Monitoring the process
- Identifying, rectifying and/or reporting out-of-specification product/process achieving housekeeping standards
- Maintaining workplace records

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

- Conform clean raw spice and herbs for threshing, de-stemming, de-corning and de-hulling process
- Monitor the variation of equipment and materials
- Identify variation in equipment operation and report maintenance requirements
- Monitor the process
- Identify, rectify and/or report out-of-specification product/process outcomes
- Achieve housekeeping standards
- Maintain workplace records

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 clean raw spice and herbs for threshing, de-stemming, de-corning and de-hulling process

1.1. Washing of raw materials

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. Large amounts of clean chlorinated water are required, using chlorine levels that are higher than those found in tap water. 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. 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.

At a larger scale continuous washers are more appropriate. Here a moving conveyor picks up the produce and carries it under powerful sprays of water. Recirculation through a filter is normal to reduce water consumption. Although spices are rarely washed in most processing units, rapid washing and re-drying offers the greatest potential to improve quality. Most contamination by micro-organisms and soils on spices such as black pepper, cardamoms and pimento is surface contamination. Washing or spraying for a minute or so with chlorinated water removes most soils and reduces microbial

levels. Quick washing only wets the surface and a short re-drying period is all that is required to reduce the moisture to the required level.

1.2. Other cleaning methods

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. 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).

1.2.1. Contamination by dust and dirt

There is obviously a high risk of contamination occurring if the raw materials are laid out in the sun. Solar and powered dryers protect against contamination and are thus strongly recommended. It should be noted that fan driven dryers may suck in fine dust particles in dusty areas. In very dusty areas, powered dryers may need a muslin filter over the air inlet.

1.2.2. Drying time and temperature

During the early stages of drying, conditions in the dryer (high humidity and moderate temperature) are ideal for the growth of micro-organisms. The quicker the drying time the better the final microbial quality of the product. Drying rates may be increased in two ways; by increasing the air flow and by increasing the air temperature. However temperatures should not be too high as they cause damage to the product. This is particularly true of herbs and spices as there is the risk of losing delicate flavors or colors. The processor therefore needs to experiment and find the best temperature for each product.

1.2.3. Cleaning raw materials during transport

The harvested raw plant material of the spice crop should be transported promptly in clean, dry conditions. The crop may be placed in clean baskets, dry sacks, trailers, hoppers or other well-aerated containers and carried to a central point for transport to the processing facility. All containers used at harvest should be kept clean and free from contamination by previously-harvested plant products and other foreign matter. If plastic containers are used, particular attention should be paid to any possible retention of moisture that could lead to the growth of mould. When containers are not in use, they should be kept in dry conditions, in an area that is protected from insects, rodents, birds and other pests, and inaccessible to livestock and domestic animals. Conveyances used for transporting bulk plant materials from the place of production to storage for processing should be cleaned between loads. Bulk transport, such as ship or rail cars, where appropriate, should be well ventilated to remove moisture from plant materials and to prevent condensation.

Figure: 1.1. Cleaning of 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 I: Short Answer Questions

1. List cleaning methods of spice and herbs raw materials? (3pts)

2. List the importance of cleaning spice and herbs raw materials? (2pts)

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

1. High humidity and moderate temperature are ideal for the growth of micro-organisms. (2pts)

2. The harvested raw plant material of the spice crop should be transported promptly in clean, dry conditions. (2pts)

Note: Satisfactory rating - 9 points Unsatisfactory - below 9 points

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

Score = _____

Rating: _____

Answer sheet

Test I

1._____

2. _____

Test II

1._____

2._____

Information Sheet 2- Monitoring the variation of equipment and materials

2.1. Monitoring variation of equipment

Manufacturing processes have many factors that influence their success, and in each, the possibility of variation is introduced. The specific types of variation depend on what is being manufactured -- for example, an adhesive is affected by factors unlike those that affect a machine. In general, however, the outcome-specific factors fit into five major areas.

2.1.1. Variation due to raw materials

All manufacturing processes begin with raw materials, whether it's ore from the ground or the end result of previous manufacturing processes. If the raw materials change, that change can create variations in the overall process. There might be a difference in quality from the same supplier, which may fall within the specified limits but is still enough to cause variation in the next process, or material from a different supplier may not be identical to the one from the first supplier.

2.1.2. Variation due to equipment

Whether a manufacturing process uses simple or complex equipment, changes in the equipment can cause variation. Variations occur with the use of more than one piece of equipment to complete the same task because even two pieces of equipment bought at the same time from the same company will not always behave exactly the same over time. Variations are also introduced in the performance of an individual piece of equipment, which can begin to break down or drift from the calibration point.

2.1.3. Variation due to human actions

Humans are by nature variable. Even with the best controls, an individual operator can have a bad day and introduce variations from one day to the next. Two different operators trained in the same way might have slightly different actions or criteria for decision making, which causes variation. Not all variation caused by human action can be considered human error, although that possibility also exists.

2.1.4. Variation due to environment

Changes in temperature and humidity affect various processes and some agro-food processes require a clean room environment and the introduction of particles from outside the clean room can cause variation. Changes in the environment have the ability to trigger changes in raw materials, equipment and human action, even if the environmental changes do not directly affect the manufacturing process.

2.1.5. Variation due to method

A manufacturing process is defined by a series of steps. Variation can be introduced if the time between the executions of the steps changes, the order of the steps changes, one is missed or a change is made in carrying out the step -- for example, if the step says to heat to a certain temperature but a different one is selected. Some variations in method can be tracked to variations in human action, but others may be approved alternatives.

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

1. List the five factor of variation of equipment? (3pts)
2. How environment create equipment variation? (2pts)

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

1. Whether a manufacturing process uses simple or complex equipment, changes in the equipment can cause variation. (2pts)

2. Changes in the environment have the ability to trigger changes in raw materials, equipment and human action. (2pts)

Note: Satisfactory rating - 9 points Unsatisfactory - below 9 points

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

Score = _____

Rating: _____

Answer sheet

Test I

1._____

2. _____

Test II

1._____

2._____

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

3.1. Identifying variation

Identifying equipment variation is one of the essential elements of a quality management system. Identifying equipment variation in the processing area is necessary to ensure accurate, reliable, and timely testing. The benefits of Identifying equipment variation program are many:

- Helps to maintain a high level of equipment performance;
- Reduces variation equipment, and improves the technologist's confidence in the accuracy of testing results;
- Lowers repair costs, as fewer repairs will be needed for a well-maintained instrument;
- Lengthens instrument life;
- Reduces interruption of services due to breakdowns and failures;
- Increases safety for workers;
- Produces greater customer satisfaction.

3. 2. Types of maintenance

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

- Corrective maintenance: The set of tasks is destined to correct the defects to be found in the different equipment and that are communicated to the maintenance department by users of the same equipment.
- Preventive maintenance: Its mission is to maintain a level of certain service on equipment, programming the interventions of their vulnerabilities in the most opportune time. It is used to be a systematic character, that is, the equipment is inspected even if it has not given any symptoms of having a problem.
- Predictive maintenance: It pursues constantly know and report the status and operational capacity of the installations by knowing the values of certain variables, which represent such state and operational ability. To apply this maintenance, it is necessary to identify physical variables (temperature, vibration, power consumption, etc.).

- Zero hours Maintenance (overhaul): The set of tasks whose goal is to review the equipment at scheduled intervals before appearing any failure, either when the reliability of the equipment has decreased considerably so it is risky to make forecasts of production capacity. This review is based on leaving the equipment to zero hours of operation, that is, as if the equipment were new. These reviews will replace or repair all items subject to wear. The aim is to ensure, with high probability, a good working time fixed in advance.
- Periodic maintenance (Time Based Maintenance TBM): the basic maintenance of equipment made by the users of it. It consists of a series of elementary tasks (data collections, visual inspections, cleaning, lubrication, retightening screws) for which no extensive training is necessary, but perhaps only a brief training. This type of maintenance is the based on TPM (Total Productive Maintenance).

3.3. Reporting maintenance requirement

Each piece of equipment which required maintenance should have reported to the concerned person/supervisor/ manufacturer.

Documenting and reporting all maintenance elements characteristics should include:

- Preventive maintenance activities and schedule;
- Recording of function checks and calibration;
- Any maintenance performed by the manufacturer;
- Full information on any problem that the instrument develops the subsequent troubleshooting activity, and follow-up information regarding resolution of the problem.

In recording problems, be sure to record:

- Date problem occurred and when equipment was removed from service;
- Reason for breakdown or failure;
- Corrective action taken; including a note about any service provided by the manufacturer; date returned to use;
- Any changes to procedure for maintenance or function checks as a result of the problem. Some of the tools that are helpful for keeping records on equipment management are: charts, logs, checklists, graphs, service reports.

Table 3.1. Maintenance report form:

Tenant Name_____

Contact _____

Property Address: _____

Email: _____

Please describe below the repair clearly and in detail - what room, when it started to occur etc.

_____

_____

_____

s/n	equipment /machine part to maintain	Status				
		Lost	leaks	broken	Other(specify)	Remark
1						
2						
3						
5						
6						
7						
8						

Tenant Sign …… **Dated**……/……/……

Thank you for your cooperation! We appreciate your help with everything!

Self-Check – 3	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

1. List the important of identifying variation? (3pts)

2. List the type of maintenance? (2pts)

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

1. Identifying equipment variation in the processing area is necessary to ensure accurate, reliable, and timely testing. (2pts)

2. This maintenance is the most technical, it requires advanced technical resources, and at times of strong mathematical, physical and / or technical knowledge (2pts)

Note: Satisfactory rating - 9 points Unsatisfactory - below 9 points

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

Score = _____

Rating: _____

Answer sheet

Test I

1._____

2. _____

Test II

1._____

2._____

Information Sheet 4- Monitoring the process

4.1. Monitoring work operation

Monitoring is a process of determining how well our plans are being implemented. You cannot monitor something if you do not have a plan or basic structure of how something should be done, or a defined goal or target. Work operations refer to the work itself and includes systems and procedures, staff performance, and levels of service in the workplace. Many primary processing operations require skilled operators and a multi-disciplinary team to complete all the necessary operations efficiently and on time.

- Moving raw materials in to processing area and loading transport needs operators who are fit and strong as heavy lifting is involved. The team must have sufficient literacy to read labels, complete records and update the stores raw materials inventory.
- Threshing, de-corning and de-hulling needs workers who handle produce gently, have a good eye for detail and can work quickly. Scale operators need good literacy to be able to keep records.
- Personnel allocated to quality control need a very good understanding of the quality and quality control of raw material to be processed.
- Personnel involved in primary processing operation of spice and herbs need to have received training in the safe and correct way.
- Supervisors need good organizational and people management skills to ensure that targets are met, and standards maintained.
- Equipment and machinery maintenance and electrical work is done by dedicated specialists.

Many of these people will learn the necessary skills in processing area so the management and supervisory team need to actively engage in organizing and providing training. In addition to allocating tasks to suitably skilled and experienced workers, achievement of targets and maintaining the timeliness of operations to primary processing requires that the correct number of workers is allocated to each task.

Figure:4.1. Work process

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 I: Short Answer Questions

1. List the important of monitoring processing operation? (3pts)

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

1. Monitoring is a process of determining how well our plans are being implemented. (1pts)

2. Personnel allocated to quality control need a very good understanding of the quality and quality control of raw material to be processed. (1pts)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points

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

Score = _____

Rating: _____

Answer sheet

Test I

1._____

Test II

1._____

2._____

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

All out-of-specification products must be clearly identified, rectified, and reported to prevent unauthorized release. Identifying, rectifying and reporting of out-of-specification 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 (undesirable particle size; present of on products mould, spoilage, micro-organim, over and under matured, un-recommended moisture conetent and etc.)
- 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.
- 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.

Spices and aromatic herbs that have undergone a microbial reduction treatment should be processed and stored separately from untreated spices and aromatic herbs. Equipment should not be used for both treated and untreated products without adequate cleaning and disinfection before use with treated products. Persons handling raw materials or semi-processed products capable of contaminating the end-product should not come into contact with any end-product unless and until they discard all protective clothing worn during the handling of the material at earlier stages of the processing and have changed into clean protective clothing.

Hands should be washed and disinfected thoroughly before handling products at different stages of processing. Out of specification such off flavor, contaminated, discolored products should be report to responsible person. Inspecting fresh produce throughout the processing stream for field contaminants, this may not have been noticed during the incoming produce. 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.

Self-Check – 5	Written test

Name…… ID…… Date…….

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

Write true if the statement is correct and false if the statement is incorrect

1. All out-of-specification products must be clearly identified, rectified, and reported to prevent unauthorized release.(2pts)

2. Determine the corrective action required to eliminate non-conformance of future product, i.e., through re-work or other means. (2pts)

3. Hands should be washed and disinfected thoroughly before handling products at different stages of processing. (2pts)

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

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____
2. _____
3. _____

Information Sheet 6- Achieving housekeeping standards

6.1. Housekeeping

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

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

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

Self-Check – 6	Written test

Name…… ID…… Date…….

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

Short Answer Questions

1. List the 10 good housekeeping rules?(10pts)

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

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____
   _____

Information Sheet 7- Maintaining workplace records

7.1. Maintaining workplace record

Accurate records are essential for evaluating your primary 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/threshing, hulling, peeling, slicing and chopping 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 if product implicated in an outbreak is traced to a particular farm or facility. Every workplace is different and requires different types of information to keep it running smoothly, efficiently and profitably. Different primary processing operation of spice and herbs and by using different types quality raw materials should be recorded for future use as reference. Workplace records in operating threshing, hulling, peeling, slicing and chopping of spices and herbs include:

- Quantity of raw material
- Quantity control of raw material
- Threshing, de-hulling, peeling, slicing and chopping equipment
- Threshing, de-hulling, peeling, slicing and chopping methods
- Primary processing condition
- Employee training records
- Equipment monitoring and maintenance records
- Calibration records
- Sanitation records
- Product processing batch records
- Corrective action records
- Pest control records
- Distribution records
- Inspection records (e.g., incoming product, facility, production area)
- Microbiological contamination records (e.g., food contact surfaces, equipment)

Self-Check – 7	Written test

Name…… ID…… Date…….

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

Short Answer Questions

1. Why maintain work place records?(2)

2. Write some workplace records during primary processing spices and herbs?(3)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____
2. _____

LG #34	LO #3- Shut down the pre-processing process

Instruction sheet

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

- Identifying the appropriate shutdown procedure
- Shutting down the process according to workplace procedures
- 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 shutdown procedure
- Shut down the process according to workplace procedures
- Identify and reporting 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 shutdown procedure

1.1. Shutdown of equipment/machine

Shout is the act of closing equipment/ machine or stopping of equipment/a machine. Refer to your standard operating procedures for the correct way to operate each type of processing unit in your workplace. The standard operating procedures for each type of equipment must be adhered to when shutting a processing down.

The types of shutdowns used in a plant unit are:

- Scheduled shutdown
- Maintenance shutdown
- Emergency shutdown

1.1.1. Scheduled shutdown

A scheduled shutdown is initiated by the operator during normal operation of the unit when, maintenance is required. The shutdown procedure will depend on the type of equipment and the process to be done. Some steps taken in a unit/process shutdown may include:

- Shutting off the feeds to stop processes and heat generation particularly if processes are produce heat
- Shutting off heating or cooling to the unit/ processing operation
- Shutting off chopping, threshing, peeling, hulling and other mechanical operations
- Removing or flushing waste materials from the processing workplace

1.1.2. Maintenance shutdown

When maintenance to the threshing, de-hulling and de-corning equipment is required, the equipment may need to be entered so that work can take place. The shutdown should be a scheduled or planned shut down as per standard operating procedures where equipment is:

- Isolated (process, mechanical and electrical)
- Cooled and depressurized
- Cleaned
- Electric tested on a continuous basis prior to and during entry.

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

1.1.3. Emergency shutdown

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

Self-Check – 1	Written test

Name…… ID……. Date…….

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

Test I short answer

1. List the three type of shutdowns used in equipment or machine?(3)

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

1. The shutdown procedure will depend on the type of equipment and the process to be done.(2pts)
2. Shout is the act of closing equipment/ machine. (2pts)
3. An emergency shutdown is initiated in the event of a fire, instrument failure, power failure, unexpected hazard or total loss of the processes. (2pts)

Note: Satisfactory rating - 9 points Unsatisfactory - below 9 points

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

1. _____
   _____

Test II

1. _____
2. _____
3. _____

Information Sheet 2- Shut down the process according to workplace procedures

2.1. Shut down the process

The threshing, de-steaming, de-corning and de-hulling operation in spice and herb raw material processing machine should be shut down after completion of work every day according to the standards and procedures of the industry. Cleaning and sanitizing steps are listed below:

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

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

Successful shut down process

At some point, most machines will have a scheduled outage. The time, money and effort devoted to planned shutdowns can be extreme. Scheduled outages may be plant wide, occur through different sections or be cold or running. Job plans for each asset is a prerequisite. They also decrease costs versus emergency repairs by three to seven times.

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

1. List the importance of successful outage procedure of equipment or machine?(2)

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

1. The threshing, de-steaming, de-corning and de-hulling operation in spice and herb raw material processing machine should be shut down after completion.(2pts)
2. Scheduled outages may be plant wide, occur through different sections or be cold or running. (2pts)
3. A checklist with every piece of equipment involved in the outage should be available for review. (2pts)

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

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

1. _____
   _____

Test II

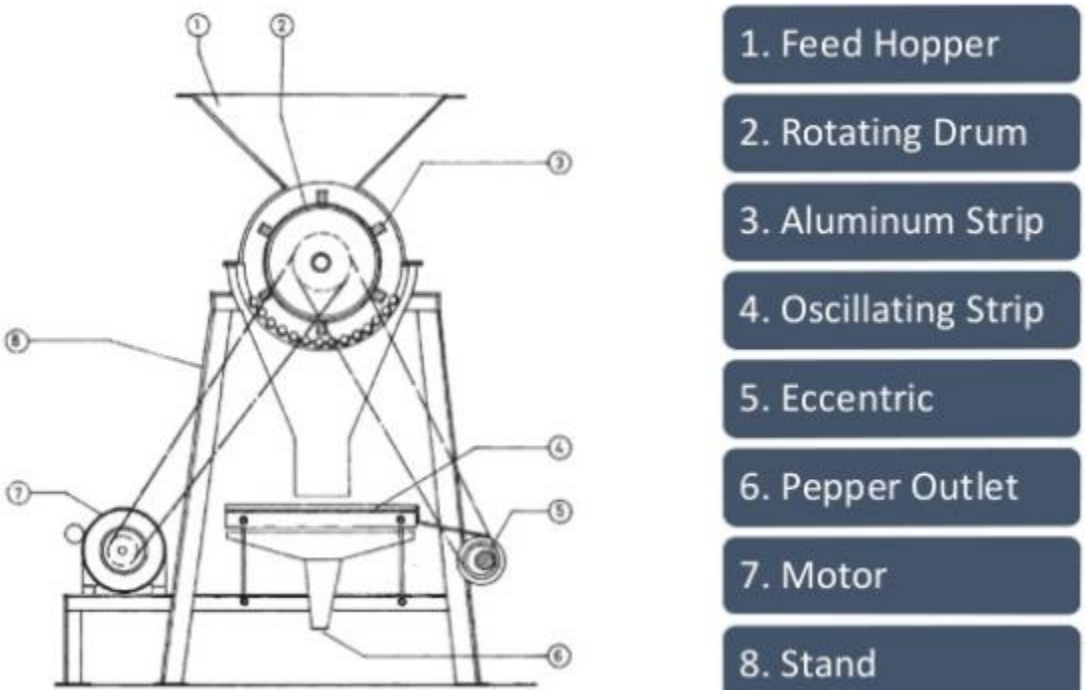
1. _____
2. _____
3. _____

Information Sheet 3- Identifying and reporting maintenance requirements

3.1. Identifying and reporting maintenance requirement

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

- Scheduled maintenance is work based on known information, such as number of operations, hours run, etc., and can therefore be carried out at a predetermined time interval.
- Corrective maintenance is work carried out following the failure of the plant and equipment, and is so designed to return the component to its normal operating condition.
- Emergency maintenance is that work which is required to be performed without delay due to a failure of a component which, if not implemented, would lead to further failures or even permanent damage, resulting in the total loss of the plant and equipment. Plant and equipment in such a condition may also be dangerous to personnel.



3.1. Pepper threshing machine parts

Self-Check – 3	Written test

Name…… ID……. Date…….

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

Write true if the statement is correct and false if the statement is incorrect

1. Any activities which require maintenance should be identified properly and reported immediately as soon as possible. (2pts)

2. Corrective maintenance is work carried out following the failure of the plant and equipment.(2pts)

3. Emergency maintenance is that work which is required to be performed without delay due to a failure of a component which. (2pts)

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

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

1. _____
2. _____
3. _____

Operation Sheet 1– shutting down primary processing equipment/machine

Objectives; to know successful shut down procedure of spice and herbs primary processing equipment / machine.

The procedure to successful shut down equipment/machine

Following the steps outlined below will help ensure that equipment / machine next outage will be successful

Step 1: Checklist with every piece of equipment involved in the outage should be available for review.

Step 2: Machine/equipment operational function is determined and understood.

Step 3: Shut-down sequence is undertaken safely and to standard operating procedures.

Step 4: Machine/equipment is depressurized/emptied/de-energized/bled to standard operating procedures.

Step 5: Safe shut-down of machine/equipment is verified.

Step 6: Safety/security lock-off devices and signage are installed to standard operating procedures.

Step 7: Machine/equipment is left in clean and safe state.

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 **1** hour. The project is expected from each student to do it.

Task

Preform successful shut down activities of the available equipment or machinery

Reference Materials

Book:

1. Aremu AK, Adeniyi AO, Fadele OK (2015) Development and performance of a jatropha seed shelling machine based on seed moisture content. Journal of Biosystems Engineering. 40(2): 137-144.
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5. Pinson GS, Melville DJ, Cox DRS (1991) Decortication of tropical oilseeds and edible nuts (NRI Bulletin No. 42).

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2. https://detail.en.china.cn/provide/p141281914.html
3. https://www.alibaba.com/product-detail/herb-medicine-slicing-machine-tea-leaf_62073355456.html?spm=a2700.7724857.normallist.24.638e11aevxec59
4. https://www.plantengineering.com/articles/seven-steps-for-a-successful-shutdown/
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