Oil Seed and Pulse Processing

Level II

Based on October 2019, Occupational standards (OS) Version 2

Module Title: Operating Mixing and Blending process

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LG #35	LO#1- Prepare the mixing/blending equipment and process for operation

Instruction sheet

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

- Confirming raw materials
- Confirming different ingredients and service
- Identifying Cleaning and maintenance requirements
- Fitting and adjusting machine components and related attachments
- Entering operating parameters
- Checking and adjusting mixing and blending equipment
- Carrying out Pre-start checks
- Occupational Health and Safety (OHS) hazards
- Selecting personal protective clothing and equipment

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 raw materials and service
- Confirm different ingredients
- Identify Cleaning and maintenance requirements
- Fit and adjust machine components and related attachments
- Enter operating parameters
- Check and adjust mixing and blending equipment
- Carry out Pre-start checks
- Occupational Health and Safety (OHS) hazards
- Select personal protective clothing and equipment

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
4. Accomplish the Self-checks

Information Sheet 1 - Confirming raw materials

1.1 Introduction

This module aims to provide the trainees with the skills and knowledge required to combine ingredients and additives in the correct quantities and sequence to operate mixing and blending process to achieve the required mix characteristics. Mixing is the dispersing of components, one throughout the other. It occurs in innumerable instances in the food industry and is probably the most commonly encountered of all process operations. Unfortunately, it is also one of the least understood. There are, however, some aspects of mixing which can be measured and which can be of help in the planning and designing of mixing operations.

1.2 Confirming raw materials

Raw materials which are used in oil processing includes:

- Grounded oil seed(sesame and ground nut)

1.2.1Sesame seed

Sesame seed and its oil have been used for about 6000 years. The plant, Sesamum indicum, L. is believed to originate in the Savannas of Central Africa. From there, it spread to Egypt, India and China. The antioxidant activity of sesame seed and sesame seed oil and the various healthful properties are attributed to the presence of lignans such as sesamin, sesamolin, sesaminol, sesangolin, 2-episalatin and others.

It is one of the most stable edible oil despite its high degree of unsaturation. The presence of lignan type of natural antioxidants accounts for both the superior stability of sesame oil and the beneficial physiological effects of sesame. In Asia, sesame oil is obtained by pressing the roasted oilseeds and consumed as a naturally flavored oil without refining. In the western world, sesame oil is extracted by a multiple-step mechanical expeller and either the virgin oil or the refined oil is used for salad dressing. After pressing out oil, the remaining sesame meal contains high-quality protein suitable for human consumption as well as animal feed. It is also a good source of water-soluble antioxidants. Sesame contains substantial amounts of unique components

called lignans (sesamin and sesamolin), which play an important role in promoting health. Sesamin and sesamolin have been reported to have many bioactive properties, e.g. antioxidant activity, antiproliferative activity, lowering cholesterol levels, and showing antihypertensive effects and neuro protective effects against hypoxia or brain damage (Rang kadilok et al., 2010).

- **Sesame Oil Content**

Sesame seed has higher oil content (around 50%) than most of the known oil-seeds although its production is far less than the major oilseeds such as soybean or rapeseed due to labor-intensive harvesting of the seeds. Sesame oil is generally regarded as a high-priced and high-quality oil. Sesame seed is a rich source of edible oil. It contains more oil than the major oil-seeds, such as soybean, rapeseed-canola, sunflower seed, and cotton seed. The oil content of sesame seed varies with the variety of sesame; it may range from 28% to 59% (20 – 22). The wild seeds contain less oil (around 30%) than the cultivated seeds because the oil content is an important criterion for seed selection in agriculture practice. In general, the cultivated seed has around 50% oil, whereas the color of the seed coat exhibits slight influence on the oil content.

- **Chemical and Physical Characteristics of Sesame Oil**

Table 1. Chemical and Physical Characteristics of Sesame Oil

Properties	**Range**
Relative density (20C/water at 20C)	0.915–0.924
Refractive index (ND 40C)	1.465–1.469
Saponification value (mg KOH/g oil)	186 –195
Iodine value	104 –120
Unsaponifiable matter (g/kg)	$\leq$ 20

- **Fatty Acid Composition**

Sesame oil belongs to the oleic-linoleic acid group. It has less than 20% saturated fatty acid, mainly palmitic (7.9 ~ 12%) and stearic (4.8 ~ 6.1%) acids. Oleic acid and linoleic

acid constitute more than 80% of the total fatty acids in sesame oil. Unlike other vegetable oils in this group, the percentages of oleic acid (35.9 ~ 42.3%) and linoleic acid (41.5 ~ 47.9%) in the total fatty acids of sesame oil are close

- **Protein**

The protein content of sesame seed is approximately 25% with a range of 17 ~ 31% depending on the source of the seed. Sesame protein is low in lysine (3.1% protein), but it is rich in sulfur-containing amino acids methionine and cysteine (6.1%), which are often the limiting amino acids in legumes. Comparing with the standard values recommended by FAO and WHO for children, sesame protein is border line deficient in other essential amino acids such as valine, threonine, and isoleucine. Sesame seed protein, however, contains an adequate amount of tryptophanm, which is limiting in many oilseed proteins. Because of its characteristic amino acid composition, sesame seed protein is regarded as an excellent protein source for supplementing many vegetable proteins such as soybean and peanut to increase their nutritional value.

Sesame Processing

Sesame oil has a long history of human consumption. The processing of sesame seed to yield sesame oil varies from region to region.

Refined sesame oil is the salad oil grade of sesame oil. It is the most common type of sesame oil consumed worldwide except in the Orient. Sesame seeds are cleaned and cooked before oil extraction with expeller. Crude sesame oil is refined by alkali-refining, bleaching, and deodorization to obtain the refined sesame oil. Sesame cake from oil extraction with expeller may still contain18 ~ 22% of residual oil. It is often extracted with solvent or pressed again to obtain more oil. The desolventized sesame cake can then be processed into food grade sesame flour if the de-hulled sesame seed is used. If the seed coats are not removed, the sesame cake can only be used as feedstuff because it contains undesirable constituents. The dehulling process will be discussed later. Roasted sesame oil has a strong characteristic flavor of roasted sesame seed. It is the most popular sesame oil consumed in China, Japan, and Korea.

Sesame seeds are roasted at 140 – 200 ^{0}C prior to oil extraction. The conditions of the roasting process is of prime importance to the quality of the roasted sesame oil. The effect of roasting on sesame seed and oil will be discussed later. After roasting, sesame seeds are ground, cooked, and pressed to obtain the crude roasted sesame oil. The crude oil is simply filtered without further purification to produce roasted sesame oil. The color of roasted sesame oil ranges from light yellow to dark brown depending on the roasting conditions. It has a light roasted sesame flavor and is light brownish in color. Shiang -you is often used as seasoning oil for cold dishes; it is seldom used for cooking purpose. Roasted sesame oil, however, is mainly used as cooking oil. The processing scheme of small mill sesame oil is shown in Figure 1. Sesame seeds are cleaned and soaked in water for about an hour in order for the sesame seed to reach a water content of 35%, which can facilitate protein denaturation, assure even heating, and avoid burning during the subsequent roasting process. Roasting process is recommended to conduct at 200^{0}C for 30 min. The roasted sesame seeds are cooled to 140 - 150^{0}C by spraying water.

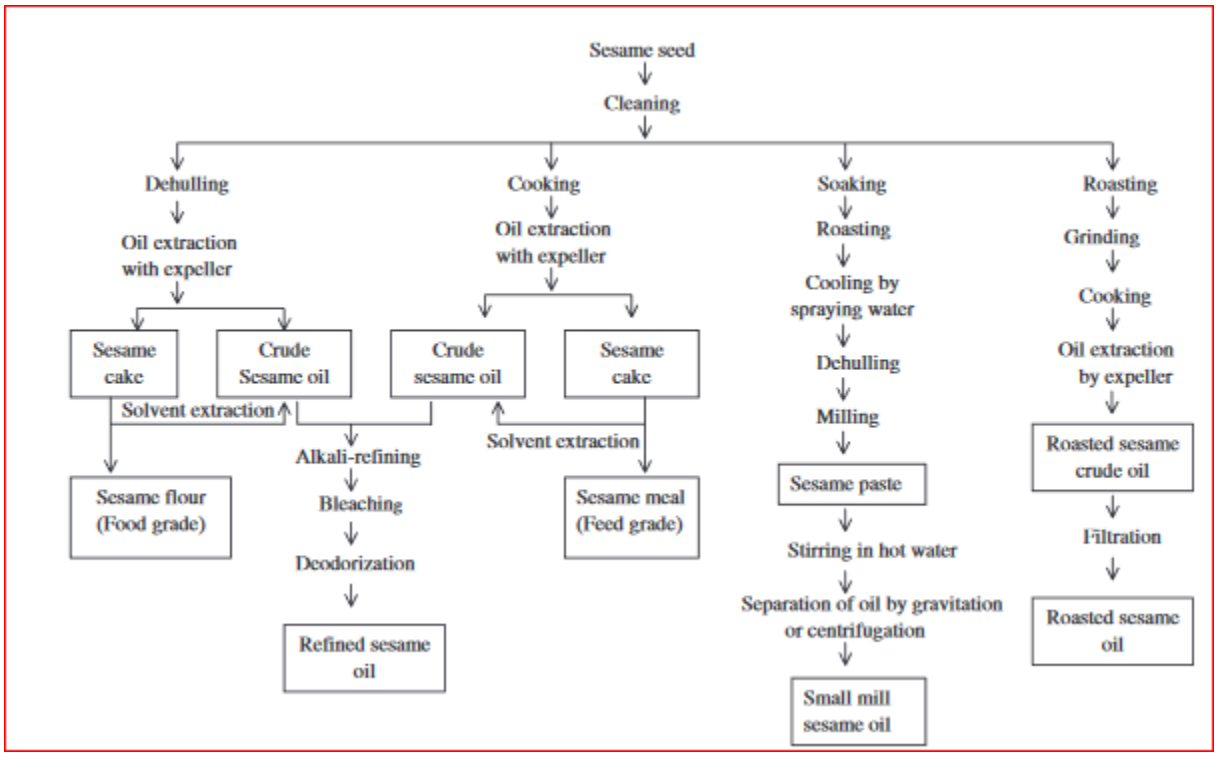

Figure 1. Flow diagram showing the processing of different sesame oils



Figure 2. Sesame oil

1.2.2 Ground nuts

Groundnut or peanut is an important legume nut known for its multifarious uses including oil production, direct human consumption as food and also animal consumption in the form of hay, silage and cake. Being a grain legume, peanut has an

important nutritional value for human beings, and its nutritional value has been exploited for combating malnutrition in children.

The groundnut or peanut is one of the important legume crops of tropical and semiarid tropical countries, where it provides a major source of edible oil and vegetable protein. Groundnut kernels contain 47-53% oil and 25-36% protein. The crop is cultivated between 40ºN to 40ºS of the equator. Groundnut is a self-pollinated crop whereby flowers are produced above ground and, after fertilization, pegs move towards the soil, and seed-containing pods are formed and developed underneath the soil.

Ground nuts are a good source of possessing 30 essential nutrients and phyto nutrients like niacin, fiber, folate, Mg, Mn and P and vitamin E 25% protein antioxidant polyphenols called pcoumaric acid-roasting can increase peanuts pcoumaric acid levels, boosting their overall antioxidant content by as much as 22%. They are significant source of resvertrol and co-enzyme. Resvertrol antioxidant is a chemical studied for potential antiaging effects and also associated with reduced cardiovascular disease and reduce cancer.

Figure 3. Ground nut seed

Figure 4.Ground nut oil

Self-Check 1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the below:

1. List some ingredients which are added in oil processing (5pts)

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

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

Information Sheet 2- Confirming different ingredients and Services

2.1 Confirming different ingredients

In oil seed processing there are different ingredients added to in oil which provides different functions to the oils. During addition of these ingredients you have to confirm that all the ingredients meet the specified condition, quality, and availability. Different ingredients that used in oil processing include:

- Water
- Salt
- white sugar
- Aerated sugar
- Emulsifier
- Flavors /citric acid

2.1.1 Emulsifier

An emulsifier acts in the following ways

- It adsorbs at the interface between two immiscible liquids such as oil and water.
- It reduces the interfacial tension between two liquids, enabling one liquid to spread more easily around the other.
- It forms a stable, coherent, viscoelastic interfacial film, which prevents or delays coalescence of the dispersed emulsion droplets.

Molecules that can act as emulsifiers contain both a polar, hydrophilic (water loving) section, which is attracted to water, and a hydrophobic (or water-hating) section, which is attracted to hydrophobic solvents such as oil. Good emulsifiers are able to interact at the interface to form a coherent film that does not break easily. The best emulsifiers are proteins, such as egg yolk (lipoproteins) or milk proteins, because they are able to interact at the interface to form stable films, and hence to form stable emulsions. However, many other types of molecules are used as emulsifiers. In some cases, finely divided powders such as dry mustard or spices are used to act as emulsifiers in oil-in-

water mixture. The mustard and spices adsorb at the interface and reduce interfacial tension. A temporary emulsion separates upon standing. The emulsion is not permanent because the hydrophobic oil and hydrophilic water components separate upon standing. A permanent emulsion is formed when two ordinarily non miscible phases, such as water and oil, are combined with an emulsifier. Thus, the time of separation of oil and water is dependent upon the effectiveness of an emulsifier and the degree of agitation.

Factors Affecting Emulsion Stability

- Type of emulsifier
- Concentration of emulsifier
- Droplet size
- Changing pH or ionic strength
- Viscosity
- Addition of stabilizers
- Heating, cooling, freezing, and/or shaking

2.1.2 Citric acid

Citric or lemon juice may be used to increase foam stability. Addition of acid reduces the pH, which reduces the charge on the protein molecules and usually brings them closer to their isoelectric point. This generally results in a stronger, more stable interfacial film

Foams make a vital contribution to the volume and texture of many common food products. They give volume and a distinctive mouth feel to products such as whipped cream and ice cream and they give a light, airy texture to baked goods.

2.1.3 Sugar and salts

Sugar and salts acts as preservative which improve shelf life of an oils.

2.1.4 Water

Water facilities the extraction of oil from oil seeds. It makes some fatty compounds soluble.

2.2 service Confirming different services

All services or utilities that could impact on product quality and process (e.g. steam, gases, compressed air, and heating, ventilation and air conditioning) should be qualified and appropriately monitored and action should be taken when limits are exceeded. Different services which are needed in oil seed processing may include but not limited to:

- Power
- Steam
- Compressed and instrumentation air

✓ **Electric power**

Electric power is the most important in any processing industry. Without electric power it is impossible to operate or produce any product using machine. It provides energy to operating equipments and machines which helps to process the feed raw materials in to new products. If power shortage happen during processing, it may cause many damages to raw materials, product and machine.

✓ **Steam**

Steam is water in the gas phase. It is commonly formed by boiling or evaporating water. Steam that is saturated or superheated is invisible; however, "steam" often refers to wet steam, the visible mist or aerosol of water droplets formed as water vapour condenses.

It is useful in:

- Clealing ,heat, and cook process of oil seeds
- Clealing of oil processing equipment
- Internal combustion engines and part
- Cleaning floors

✓ **compressed and instrumentation air**

Compressed air is air kept under a pressure that is greater than atmospheric pressure. Compressed air is an important medium for transfer of energy in industrial processes, and is used for power tools such as air hammers, mill, presser and to transfer materials through pipes.

Self-Check 2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the below:

1. List some ingredients which are added in oil processing (5pts)
2. Write the services that could have impact on process and product quality (5pts).
3. Write the uses of steam in an industry. (5 point)

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

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

Information Sheet 3- Identifying Cleaning and maintenance requirements

3.1 Cleaning

Cleaning is the complete removal of food soil using appropriate detergent chemicals under recommended conditions. It is important that personnel involved have a working understanding of the nature of the different types of food soil and the chemistry of its removal.

3.2 Cleaning methods

There are a number of methods which can be used to apply detergents and disinfectants.

3.2.1 Manual cleaning

Manual cleaning using cloths, mops, brushes, pads, etc. It is normally used in small areas, equipment that is non-water proof or requires dismantling or areas which are difficult to clean by other methods. It is a labor intensive method and may limit the use of certain chemicals for safety reasons. To ensure cleaning is effective the method must be clearly defined and staff trained to an appropriate level.

3.2.2 Foam cleaning

This is the common method for cleaning most food operations. A foam blanket, created using a wide range of available equipment is projected from a nozzle and allowed time to act on the soil. It is then rinsed off with the released deposits. Large areas such as floors, walls, conveyors, tables and well-designed production equipment are ideal for foam cleaning. Foam is a carrier for the detergent. The foam should be applied in an even layer. Coverage rates are quick and chemical usage is economical.

Figure 5. Foam cleaning

3.2.3 Spray

Spray cleaning uses a lance on a pressure washer with chemical induction by venture. This method can be wasteful of chemical and can be slow to produce foam. It should be used where foaming properties are not essential for the cleaning action.

3.2.4 Fogging

Aerial fogging uses compressed air or other equipment to generate a fine mist of disinfectant solution which hangs in the air long enough to disinfect airborne organisms. It will also settle on surfaces to produce a bactericidal effect. The system can come in a small portable device or built in automatic central systems. Fogging should never be used as a primary sanitizing method. It should be used in conjunction with other methods. It is also important to ensure that coverage and saturation is sufficient and the mist is fine to allow proper action.

3.2.5 Machine washing

This is normally an automatic or semi-automatic washing process conducted within a purpose built machine. There are many machine designs depending on the application. But failure to maintain them correctly can lead to a contamination risk to the product. Chemicals used in these machines should be low foaming. An effective system for controlling the dose of chemical should be employed and temperature control systems should be used where critical.

3.2.6 Cleaning in place (CIP)

Cleaning-in-place (CIP) is an automatically performed method of cleaning, applied to remove residues from complete items of plant equipment and pipeline circuits without dismantling or opening the equipment. It is a system of cleaning engineered to provide fast, productive, consistent and reproducible high quality cleaning of all product contact surfaces to a predetermined level of cleanliness, by circulating chemical (detergent and disinfectant) solutions and rinsing water through tanks and piping of a food processing plant that remains assembled in its production configuration, and by jetting or spraying of the product contact surfaces under conditions of increased turbulence and flow velocity.

3.3 Cleaning procedure

Cleaning is a complex process. To ensure it is conducted correctly a defined and systematic approach is required that takes into account a number of factors previously covered. This approach takes the form of a Procedure and this is usually a legal requirement in addition to a fundamental requirement of global food standards. A collection of these cleaning procedures forms a Cleaning Plan or Program which is plant specific.

The correct sequence of a general cleaning procedure for surfaces in a food plant is:

- Gross Clean/Preparation
- Pre-rinse
- Detergent application
- Post-rinsing
- Disinfection
- Terminal rinsing

3.3.1 Legal cleaning requirements

Compliance regarding cleaning of food premises

Make sure that:

- Processing rooms are designed and laid out so as to permit good food hygiene practices
- The lay out, design, construction, sitting and size of food premises, including facilities for cleaning and storing working utensils and equipment and refuse stores, allow for adequate cleaning.
- In rooms of processing the design and laid out are to permit good food hygiene practices, including protection against contamination between and during operations.
- In particular floor surfaces, wall surfaces, doors are to be easy to clean and where necessary, disinfect. Windows and other openings fitted with insect proof screens which can be easily removed for cleaning.

3.3.2 Maintenance requirements

Maintenance is a general upkeep and repair of equipment, buildings and grounds, heating and air-conditioning; removing toxic wastes; parking; and perhaps security.

Food premises and equipment that are not kept in good repair and condition are a potential source of microbiological and physical contamination of food. Poorly maintained premises and equipment cannot be cleaned effectively. Poor maintenance may allow the entry of other sources of physical, microbiological and chemical contaminants such as water, pests and dust. Poor maintenance can have health and safety implications for workers. Maintenance may include:

- Hand sharpening
- Cleaning
- lubricating
- Tightening
- Simple tool repairs and adjustments

3.3.3 Types of maintenance

Basically there are two types of maintenance:-

1. **Preventive or proactive maintenance:** is carried out to keep something functional. This type of activity is usually planned and scheduled.
2. **Corrective or reactive maintenance:** is repairing something to get it working again. This is an unscheduled, unplanned task, usually associated with greater hazards and higher risk levels.

Routine maintenance tasks refer to on-going, scheduled tasks that are performed in order to keep hand tools and basic equipment functioning properly.

3.4 Perform maintenance safely

Do maintenance safely:

- Always disconnect powered tools before servicing, adjusting, oiling, cleaning or repairing them, sharpening or changing accessories such as blades.
- Follow the manufacturer's instructions in user's manual for maintenance and servicing (e.g. lubrication, cleaning) and changing parts and accessories.
- Use appropriate tools and equipment while carrying out maintenance
- When maintenance is complete workers have to check if the maintenance has left the portable tools in a safe and functioning condition:
- Replace all guards and safety devices
- Record your inspection and actions, sign out and pass the tool to the worker or store it safely

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 cleaning? (5 points)
2. Write cleaning methods? (5 points)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**
You can ask you teacher for the copy of the correct answers.

Information Sheet 4 - Fitting and adjusting machine components and related attachments.

4.1 Introduction

Nowadays the market fluctuation and the fashion ask for more and more new and different patterns, the batch size decreases, it is necessary to design and manufacture with reducing delays best quality products at the lower cost. So the concept of concurrent engineering must be used, it is now well known in industry as well as in academic area. The design of the parts, the process planning, even the production system must be made quite simultaneously**.**

4.2 Fitting and adjusting machine components and related attachments

4.2.1 Adjustment of machine components

There are four types of machine component adjustment.

4.2.1.1 Functional requirement

Regarding the definition of adjustment, optimal adjustment needs a direct expression of functional requirement. Usually, assembly and positioning are two functional studied requirements having a geometrical expression. The concept of boundary translates cleverly the assembly condition. A part of a mechanism fits all the other parts if none of its manufactured points violates the interchangeability boundary. ISO standard allows to use the Virtual Condition with the Maximum Material Requirement. This condition describes near perfectly the concept of boundary and so the functional requirement of assembly. A manufactured part fits for use if it is entirely on the good side of the interchangeability boundary. A part is all the better since its matter is near the boundary without violating it. Therefore, the deviation, and more exactly, the smallest deviation between the part and the boundary evaluates numerically the respect of the function.

4.2.1.2 Manufacturing deviations, adjustment parameters and measurement

Adjusting a machine tool demands to connect the active part of the tool with the machined surface. This work does not succeed at the first time because there are a lot of errors or uncertainties due to the adjustment operation and the machining process as well as the static or dynamic behavior of the machine tool, the tool or the work

piece. Those uncertainties are the causes of manufacturing deviations. To control the influence of some uncertainties as screw, displacement reversibility or slide way defects, machine-tool builder put some adjustment parameters into the numerical control unit or adjustable stops on conventional machine tool. The modification of these parameters allows to moving the uncertainty zone compared with its nominal position. The dimension of this displayed quantity (adjustment parameter) is the length, and diameter. In return, the dimension of machined quantity is more complicated, it assures the respect of the functional requirement. So in practice, for adjustment correction, these requirements must be translate into a dimension compatible with a length (dimension of displayed quantity). Therefore, the aim of the measurement task is to evaluate the respect of the function and to give a measured quantity compatible with the adjustment parameters. The difference between displayed quantity and measured quantity gives the value of the correction of the adjustment parameter.

4.2.1.3 Adjustment model for the determination of the correction

We define a model built on a geometrical representation of the interchangeability boundary. Variation of some dimensions, which correspond to adjustment parameters, allows to distort the model. They allow to fit at best adjustment model to the geometry given by the measurement of first (or a couple of) manufactured part on the coordinate measuring machine for example. After moving and distorting of the model, the variations of dimensions give directly the value of the corrections of the adjustment parameters. Therefore, after having introduced these corrections, the following manufactured part has more chances to fit at best the interchangeability boundary and consequently the functional requirement.

4.2.1.4 Geometric adjustment method

To explain the proposed method, we use an application that is quite representative of the industrial adjustment problem. Its first function is to respect an assembly condition: The mixer agitator have to fit with the part. There is no difference with a numerical machine tool; just we deal with numerical.

Self-Check 4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the below:

1. Write the four types of machine component adjustment (5pts).

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

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

Information Sheet 5- Entering operating parameters

4.1 Entering operating parameters

Operating procedures are followed to start and operate equipment to achieve required outcome. During operating oil mixers there are different operating parameters that must be adjusted on a mixers are:

- Rotational speed of agitator,
- Pressure,
- Feeding speed of crude oil and ingredients.

Provision of clear, concise and accurate operating procedures is the most effective measure to prevent, control and mitigate accidents.

This procedure aims to:

- Increase employee awareness on the safe use of equipment used in the workplace;
- Ensure that mixer is suitable for the purpose for which it is to be used or has been provided;
- Ensure that mixers is inspected at regular intervals;
- Ensure that mixer is maintained in good working order and kept in a good state repair;
- Ensure employees receive relevant information, instruction and training (where this is required and/or appropriate) in relation to using work equipment.

4.2 Standard Operating Procedures (SOP)

Comprehensive written operating procedures should be generated where applicable that address:

- Standard operating procedures and operating philosophy;
- Abnormal operating procedures;
- Temporary operating procedures;
- Plant trials;
- Emergency operating procedures;
- Commissioning;

- Plant Start-up;
- Plant Shut-down;
- Bulk loading and unloading;
- Process change;
- Plant change.

These procedures should cover the following:

- Material safety data control of substances hazardous to health (COSHH) states that general requirements on employers to protect employees and other persons from the hazards of substances used at work.);
- Plant operatives should have an awareness and understanding of material safety data for raw materials, intermediates, products and effluent / waste;

4.3 Material safety data sheet (MSDS)

Material safety data sheet (MSDS) is the document that list information relating to OHS for the use of various substances and products.

These include:

- Control measures and personal protective equipment;
- Location of plant where process to be undertaken;
- Roles and responsibilities of individuals involved in plant operations;
- Plant fit for purpose;
- The condition of main process plant and equipment (clean, empty etc. as appropriate) should be established as being fit for purpose;
- The condition of ancillary process plant and equipment (clean, empty etc. as appropriate);
- Plant correctly set-up for processing;
- Process monitoring and recording;
- Monitoring and recording of key process parameters (temperature, pressure etc.) in plant logs;
- Quality;
- Sampling of raw materials, intermediates, products and effluent/waste;
- Packaging of final product.

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. What is the aim of operational procedure during operating the machine or equipment**? (5pts)**
2. Comprehensive written operating procedures was generated to address? **(5pts)**

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**
You can ask you teacher for the copy of the correct answers.

Information Sheet 6 - Checking and adjusting mixing and blending equipment

6.1 Introduction

There are a very large variety of mixers available, due to the large number of mixing applications and the empirical nature of mixer design and development.

6.2 Checking and adjusting mixing and blending equipment

Mixing and blending equipment which is used in oil seed processing includes:

- Blender
- Mixers
- Dosing equipment
- Pumps
- Measuring and weighing equipment, such as scales, load cells
- Bin
- In-line homogenizers
- Conveyors

6.2.1 Blender

- **Dry Blending**

The Ribbon Blender is well proven equipment popularly used in the food and beverage industries. A ribbon blender consists of a U-shaped horizontal trough and an agitator made up of inner and outer helical ribbons that are pitched to move material axially in opposite directions, as well as radially. The ribbons rotate up to tip speeds of approximately 300 ft/min. This blender design is very efficient and cost-effective for mixing dry applications such as cake and muffin mixes, flour, bread improvers, cereals, trail mixes, snack bars, spices & herbs, tea (leaves or iced tea powders), coffee (whole or ground beans), and other beverage blends including whey protein shakes, Chocolate drinks, powdered juices, energy drinks, etc.

When dry blending food products, relatively small amounts of liquid may be added to the solids in order to coat or absorb coloring, flavoring, oils or other additive solutions. Liquid ingredients can be added through a charge port on the cover but for critical applications, liquid addition is best accomplished through the use of spray nozzles installed in a spray bar located just above the ribbon agitator. Liquid flow rate, as well as blender speed, are fine-tuned during liquid addition to avoid flooding or formation of wet clumps of powder.

Figure 6. Ribbon blender

6.2.2 Mixers

- **Horizontal ribbon mixer**

The horizontal ribbon mixer has been installed world-wide in a variety of applications including animal feed, pet food, powdered drink mix, polyester resin, vitamin premixes, and mineral premixes.

- ✓ Decreased mixing time;
- ✓ Higher levels of liquids and/or molasses (paddle);
- ✓ Good clean-out.

Figure 7. Horizontal ribbon mixer

- **Double Screw Vertical Mixer**

✓ Low initial investment;

✓ Low maintenance cost;

✓ Small footprint;

✓ Can be installed on a scale

✓ Increased mixing time (>10 min);

✓ Low inclusion of liquids;

✓ Poor clean out

Figure 8. Double Screw Vertical Mixer

6.2.3 Conveyor

- **Screw conveyors**

Screw conveyors, sometimes known as spiral, worm, or auger conveyors use helical elements to move materials. They consist of a helical screw element or steel auger that rotates around a central shaft, driving the work material according to the screw design and rotational direction. The helical screw functions within a casing, trough or compartment to take full advantage of the rotational force. Manufacturers use screw conveyors to transport materials such as flakes, grains, powders, seeds, and granules.

Figure 9. Screw conveyor

6.2.4 Pumps

Pumps mix ingredients by creating turbulent flow both in the pump itself and in the pipe work. There are a large variety of pumps available for handling different fluids and suspensions.

- **Two basic types of pumps**
  - ✓ Centrifugal and Positive Displacement

Centrifugal Pumps

- Develop pressure by increasing the velocity of the liquid
- Liquid is literally flung out of the cutwater

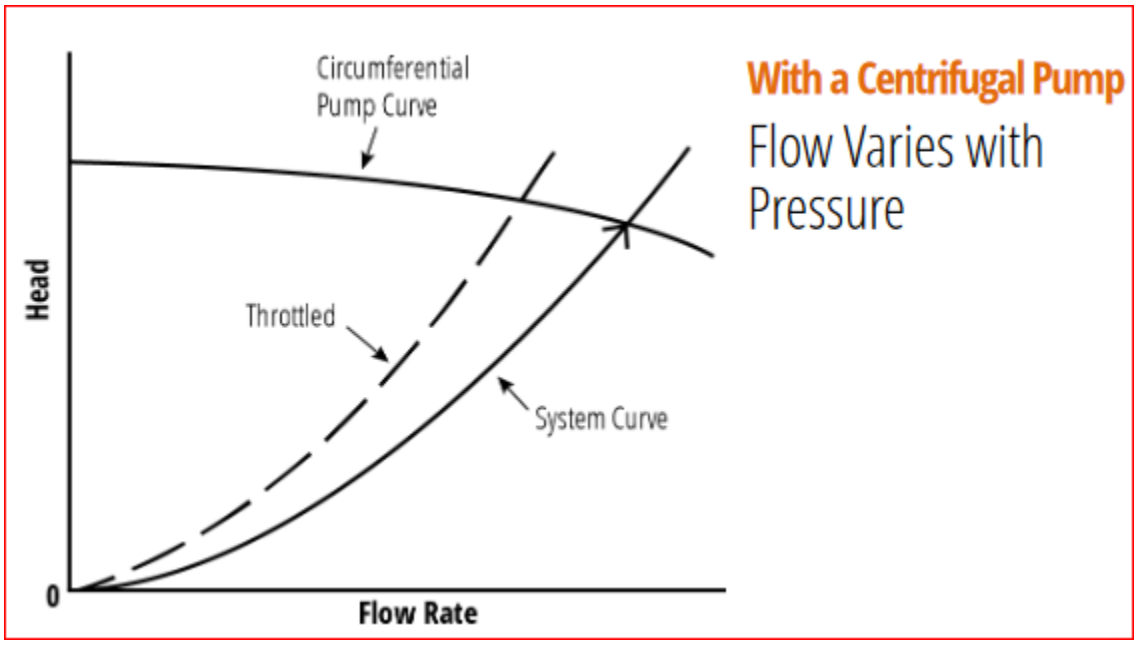

Figure 10. Pressure Vs Flow rate diagram of Centrifugal Pumps

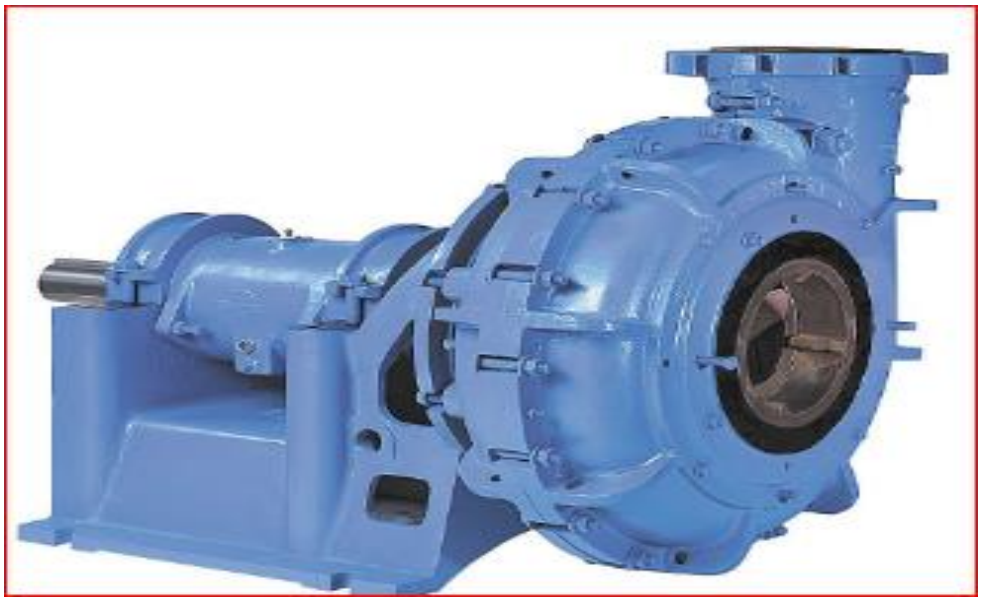

Figure 11. Centrifugal Pumps

Positive Displacement

- Allow liquid to flow into an open cavity
- Trap the liquid in the pump

- Transport liquid from the suction to discharge port
- Mechanically force liquid out of the pump

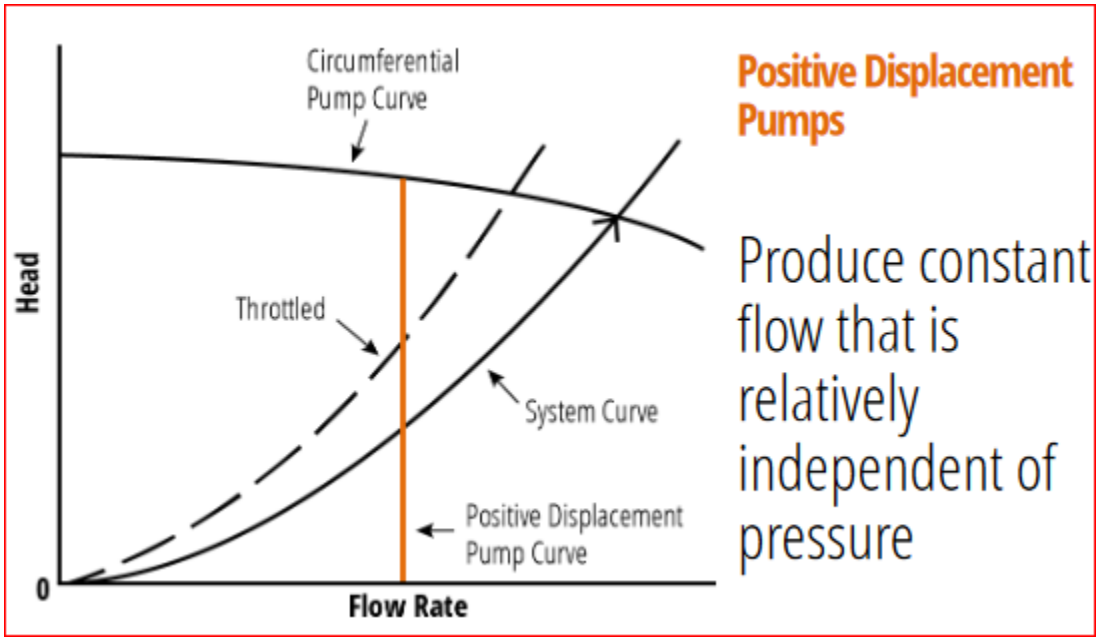

Figure 12. Pressure Vs Flow rate diagram of Positive displacement Pumps

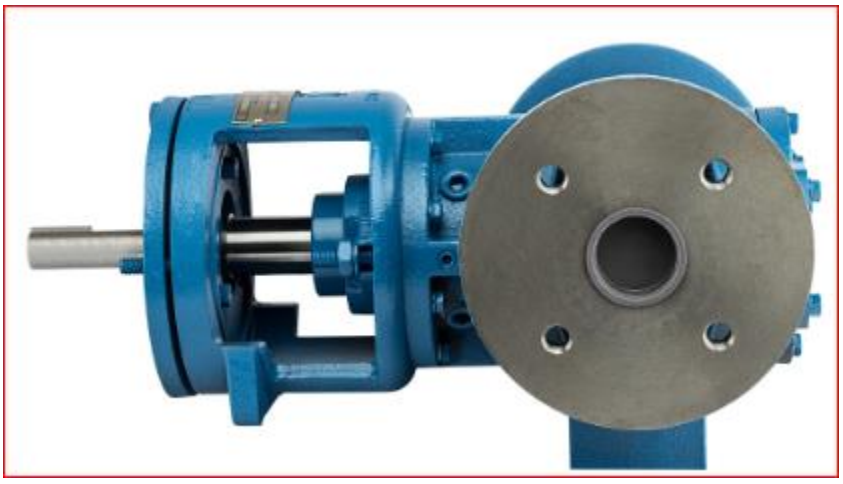

Figure 13. Positive displacement pump

6.2.5 Measuring and weighing equipment (scales, load cells)

Load cells

Load cells are typically used as part of the weighing system and to prevent overloading. In addition to standard load cells, our selection covers customer-specifically tailored special load cells that are designed and manufactured to precisely meet each customer's needs

Figure 14. Scales

Self-Check #6	Written test

Name…… ID…… Date…….

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

Test I: Short Answer Questions

1. Define blender (5pts)
2. What are the two basic types of pumps (5pts)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**
You can ask you teacher for the copy of the correct answers.

Information Sheet 7- Carrying out Pre-start checks

7.1 Introduction

In an industry, there are many types of works to be operated using different machine and equipment. So before we are going to operate machine/lab equipment we have to inspect /check whether it was in a good operating condition or not. Before allowing someone to start using any machine you need to think about what risks there are and how these can be managed. So, you should:

- Check that it is complete, with all safeguards fitted, and free from defects. The term 'safeguard' includes guards, interlocks, two-hand controls, light guards, pressure-sensitive mats etc. By law, the supplier must provide the right safeguards and inform buyers of any risks ('residual risks') that users need to be aware of and manage because they could not be designed out.
- Produce a safe system of work for using and maintaining the machine. Maintenance may require the inspection of critical features where deterioration would cause a risk. Also look at the residual risks identified by the manufacturer in the information/instructions provided with the machine and make sure they are included in the safe system of work.
- Ensure every static machine has been installed properly and is stable (usually fixed down) and is not in a location where other workers, customers or visitors may be exposed to risk.
- Choose the right machine for the job.
- safe for any work that has to be done when setting up, during normal use, when clearing blockages, when carrying out repairs for breakdowns, and during planned maintenance;
- Properly switched off, isolated or locked-off before taking any action to remove blockages, clean or adjust the machine.

7.2 Conduct pre-start checks

The pre-start checks that must be conducted before starting operating a machine or equipments are:

- Inspecting equipment condition (signs of wear)
- Ensure that the oil mixers agitator are tightened well.
- Ensure that the mixers agitator speed controller are in a good condition.
- Selecting appropriate settings and/or related parameters
- Cancelling isolation or lock outs as required
- Positioning sensors and controls correctly
- Ensuring any scheduled maintenance has been carried out
- Confirming that all safety guards are in place and operational

7.3 Pre-operational checks of equipment

Pre-operational checks of equipment include:

- Pre-start and safety checks including the service and maintenance system.
- Checking size of sieve, type machine with respective oil seed type, fuel, and lubricants needed, fan belts, lines, connections and transmission.
- Inspection of safety guards
- Checking and confirming equipment calibration settings and operating methods
- Observing and monitoring noise levels for correct operation.
- Preparation of independently powered tools may include cleaning, priming, tightening, basic repairs and adjustments.
- Identify and segregate unsafe or faulty equipment for repair or replacement.

Self-Check 7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the pre-operational checks of equipment (5pts)
2. What we have to do during conduct pre-start checks on an equipments? (5pts)

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

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

Information Sheet 8- Occupational Health and Safety (OHS) hazards

8.1 Introduction

Occupational health and safety is one of the oldest and most advanced social policy areas of the work. OHS is an integral part of everyday work. It is every Public service employee's responsibility to cooperate in practicing sound OHS principles in all work activities established minimum occupational safety and health requirements and stated that "particularly sensitive risk groups must be protected against the dangers which specifically affect them". It includes Information about key health and safety policies, standards of conduct, and associated issues.

8.2 Occupational Health and Safety (OHS) hazards

Hazard is a source or situation with the potential for harm in terms of human injury or ill-health, damage to property, the environment, or a combination of these.

Common workplace hazards are; such as:

- Stress
- Fatigue
- Chemicals
- Electrical safety
- Bodily fluids
- Sharps
- Noise
- Work postures
- Manual handling
- Under foot hazards and moving parts of machinery

8.3 Hazards control measures

Measures for controlling, eliminate or minimize hazards in accordance with the hierarchy of control includes:

- Elimination (e.g. controlling the hazard at the source)
- Substitution (e.g. replacing one substance or activity at the source)
- Engineering control (e.g. installing guards on machinery)
- Administration control (e.g. policies and procedures for safe work practices)
- Personal protective equipment (e.g. respirators and ear plugs)

8.4 2.5. Safety signs and symbols

Putting Safety signs and symbols in an appropriate area or place also can helps to minimize or reduce hazards that can happen in work areas. Safety signs and symbols include:

- Regulatory signs (e.g. prohibition, mandatory and limitation or restriction)

- Hazard signs (danger and warning)

- Emergency information signs (e.g. exits, equipment, first aid)

- Fire signs (e.g. location of fire alarms and firefighting equipment)

- safety tags and lockout (e.g. danger tags, out of service tags)

- caution signs

Self-Check 8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the common workplace hazards (6pts)
2. Write the measures for controlling , eliminate and minimize hazards (5pts)

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

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

Information Sheet 9 - Select personal protective clothing and equipment

9.1 Personal protective equipment

Equipment worn by a person to provide protection from hazards, by providing a physical barrier between the person and the hazard include:

- Head protection

- Face and eye protection

- Respiratory protection

- Hearing protection

- Hand protection

- Clothing and footwear

Self-Check 9	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the personal protective equipments that helps to protect a person from hazards (6pts)

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

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

Operation Sheet - 1: Procedures of pre-start checks on mixers

Sequence of pre-start checks on mixers

1. Wear personal protective equipment's
2. Unplug mixers from power source
3. Inspect the mixers components (agitator speed)
4. Identify faulty and un fit parts of the a mixer
5. Adjust identified part mixers
6. Test the mixers before starting operation
7. Record performed maintenances

LAP TEST #1	Performance Test

Name……ID……..Date……

Time started: _____ Time finished: _____

I 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- 1: Conduct pre-start checks on mixer

LG #36	LO #2 Operate and monitor the mixing and blending process

Instruction sheet

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

- Delivering ingredients and additives
- Basic operating principles of mixing and blending equipment
- Operating mixing and blending process
- Monitoring equipment to identify variation
- Identifying variation in equipment operation
- Report workplace information
- Monitor mixing process
- Identifying out-of-specification product
- Maintaining the work area
- Conducting workplace environmental guidelines
- 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:

- Deliver ingredients and additives
- Understand operating principles of mixing and blending equipment
- Operate mixing and blending process
- Monitor equipment to identify variation
- Identify variation in equipment operation
- Report workplace information
- Monitor mixing process
- Identify out-of-specification product

- Maintain the work area
- Conduct workplace environmental guidelines
- Maintain workplace records

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below. Read the information written in the information Sheets
3. Accomplish the Self-checks
4. Perform Operation Sheets
5. Do the “LAP test”

Information Sheet 1 - Delivering ingredients and additives

1.1 Introduction

Food ingredients have been used for many years to preserve, flavor, blend, thicken and color foods, and have played an important role in reducing serious nutritional deficiencies among consumers. These ingredients also help ensure the availability of flavorful, nutritious, safe, convenient, colorful and affordable foods that meet consumer expectations year-round. Substances which are of little or no nutritive value, but are used in the processing or storage of foods or animal feed, especially in the developed countries; includes antioxidants; food preservatives; food coloring agents; flavoring agents; anti-infective agents; vehicles; excipients and other similarly used substances.

The worldwide trend to replace synthetic food additives with natural compounds has led to an increasing interest in replacing synthetic antioxidants with natural ones.

1.2 Ingredients

Why are food and color ingredients added to food?

Additives perform a variety of useful functions in foods that consumers often take for granted. Some additives could be eliminated if we were willing to grow our own food, harvest and grind it, spend many hours cooking and canning, or accept increased risks of food spoilage. But most consumers today rely on the many technological, aesthetic and convenient benefits that additives provide.

Following are some reasons why ingredients are added to foods:

- **To Maintain or Improve Safety and Freshness**

Preservatives slow product spoilage caused by mold, air, bacteria, fungi or yeast. In addition to maintaining the quality of the food, they help control contamination that can cause foodborne illness, including life-threatening botulism. One group of preservatives antioxidants prevents fats and oils and the foods containing them from becoming rancid or developing an off-flavor. They also prevent cut fresh fruits such as apples from turning brown when exposed to air.

- **To Improve or Maintain Nutritional Value**

Vitamins and minerals (and fiber) are added to many foods to make up for those lacking in a person's diet or lost in processing, or to enhance the nutritional quality of a food. Such fortification and enrichment has helped reduce malnutrition in the U.S. and worldwide. All products containing added nutrients must be appropriately labeled.

- **Improve Taste, Texture and Appearance**

Spices, natural and artificial flavors, and sweeteners are added to enhance the taste of food. Food colors maintain or improve appearance. Emulsifiers, stabilizers and thickeners give foods the texture and consistency consumers expect. Leavening agents allow baked goods to rise during baking. Some additives help control the acidity and alkalinity of foods, while other ingredients help maintain the taste and appeal of foods with reduced fat content.

1.3 Additives

In its broadest sense, a food additive is any substance added to food. Legally, the term refers to "any substance the intended use of which results or may reasonably be expected to result directly or indirectly in its becoming a component or otherwise affecting the characteristics of any food." This definition includes any substance used in the production, processing, treatment, packaging, transportation or storage of food. The purpose of the legal definition, however, is to impose a premarket approval requirement. Therefore, this definition excludes ingredients whose use is generally recognized as safe (where government approval is not needed), those ingredients approved for use by FDA or the U.S. Department of Agriculture prior to the food additives provisions of law, and color additives and pesticides where other legal premarket approval requirements apply.

Direct food additives are those that are added to a food for a specific purpose in that food. For example, xanthan gum used in salad dressings, chocolate milk, bakery fillings, puddings and other foods to add texture is a direct additive. Most direct additives are identified on the ingredient label of foods.

Indirect food additives are those that become part of the food in trace amounts due to its packaging, storage or other handling. For instance, minute amounts of packaging substances may find their way into foods during storage. Food packaging manufacturers must prove to the U.S. Food and Drug Administration (FDA) that all materials coming in contact with food are safe before they are permitted for use in such a manner.

1.3.1 Benefits of additives

There are obviously many recognized benefits to be derived from additives. Some of the major benefits area safer and more nutritious food supply, a greater choice of food products, and a lower priced food supply.

- **Safer and more nutritious foods**

There is no question that the preservative and nutritional additives used in foods increase the safety and overall value of many food products. The use of several antimicrobials is known to prevent food poisoning from various bacteria and molds .Antioxidants, used to prevent the development of off flavors, also prevent the formation of potentially toxic autoxidation products and maintain the nutritional value of vitamins and lipids.

- **Greater choice of food**

Most major super markets today carry more than 20,000 food items, providing the consumer a wide choice of food products. The availability of additives has allowed the production of numerous out of season foods and a variety of new food products. Additives have increased the development of convenience foods, snack foods, low-calorie and health promoting (functional) foods, exotic foods, and a variety of food substitutes. Additives allow these foods to be pre-prepared and still maintain acceptable flavor, texture, and nutritional value. Although many of these foods can have added convenience through the use of new packaging approaches or other processing methods, most depend on preservatives and texturizing agents. It is estimated that the shelf life of cereal products can be increased over 200% by the use of antioxidants (Branen, 975).

- **Lower-Priced Foods**

Although there have been few recent studies to indicate that additives reduce the overall price of foods, a study reported in 1973 (Angeline and Leonardos,1973) indicated that, at least for some processed foods, total removal of additives would result in higher prices. This study was based on the premise that the consumer would still desire the same type of foods in the absence of additives. The researchers reported that if, for example, additives were removed from margarine, consumers would have no alternative but to purchase a higher-priced spread such as butter, which usually contains few or no additives. They also reported that if additives were removed from bread, franks, wieners, and processed cheese, new processing procedures, increased refrigeration, and improved packaging would be required, at a higher cost, to keep the same type of products available.

Self-Check # 1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the benefits of food additives (5pts)
2. Write the reasons why ingredients are added into foods(10pts)
3. Define food additives(5pts)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

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

Information Sheet 2 - Basic operating principles of mixing and blending equipment

2.1 Introduction

Mixing (or blending) is a unit operation in which a uniform mixture is obtained from two or more components, by dispersing one within the other(s). Mixing has no preservative effect and is intended solely as a processing aid or to alter the eating quality of foods.

- It has very wide applications in many food industries where it is used to combine ingredients to achieve different functional properties or sensory characteristics.

Examples include:-

- ✓ Texture development in dough's and ice cream
- ✓ Control of sugar crystallization
- ✓ And aeration of batters and some chocolate products.

In some foods, adequate mixing is necessary to ensure that the proportion of each component complies with legislative standards (for example mixed vegetables, mixed nuts, sausages and other meat products).

When food products are mixed there are a number of aspects that are different to other industrial mixing applications:

- Mixing is often used primarily to develop desirable product characteristics, rather than simply ensure homogeneity.
- It is often multi-component, involving ingredients of different physical properties and quantities.
- It may often involve high viscosity or non-Newtonian liquids
- Some components may be fragile and damaged by over-mixing.
- There may be complex relationships between mixing patterns and product characteristics.

The criteria for successful mixing have been described as first achieving an acceptable product quality in terms of

- sensory properties
- functionality
- homogeneity
- Particulate integrity, etc.

Followed by adequate safety, hygienic design, legality (compositional standards for some foods), process and energy efficiency, and flexibility to changes in processing.

2.2 Theory of Mixing

2.2.1 Theory of solids mixing

In contrast with liquids and viscous pastes it is not possible to achieve a completely uniform mixture of dry powders or particulate solids. The degree of mixing that is achieved depends on:

- The relative particle size, shape and density of each component
- The moisture content, surface characteristics and flow characteristics of each component.
- The tendency of the materials to aggregate
- The efficiency of a particular mixer for those components.

In general, materials that are similar in size, shape and density are able to form a more uniform mixture than are dissimilar materials.

During a mixing operation, differences in these properties also cause un-mixing (or separation) of the component parts.

In some mixtures, uniformity is achieved after a given period and then un-mixing begins.

It is therefore important in such cases to time the mixing operation accurately.

The uniformity of the final product depends on:-

- The equilibrium achieved between the mechanisms of mixing and unmixing
- Which in turn is related to the type of mixer
- The operating conditions and the component foods.

2.2.2 Theory of liquids mixing

The component velocities induced in **low viscosity liquids** by a mixer are as follows.

- Longitudinal velocity (parallel to the mixer shaft)
- Rotational velocity (tangential to the mixer shaft)
- Radial velocity which acts in a direction perpendicular to the mixer shaft.

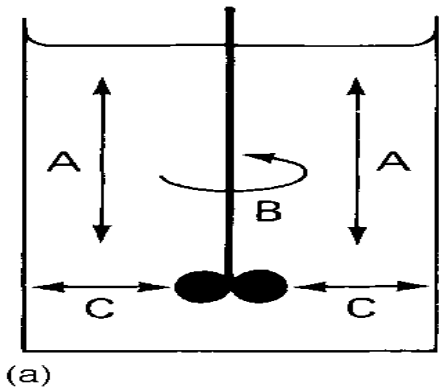

Figure 15. (a) Component velocities in fluid mixing: (A, longitudinal; B, rotational; C, radial)

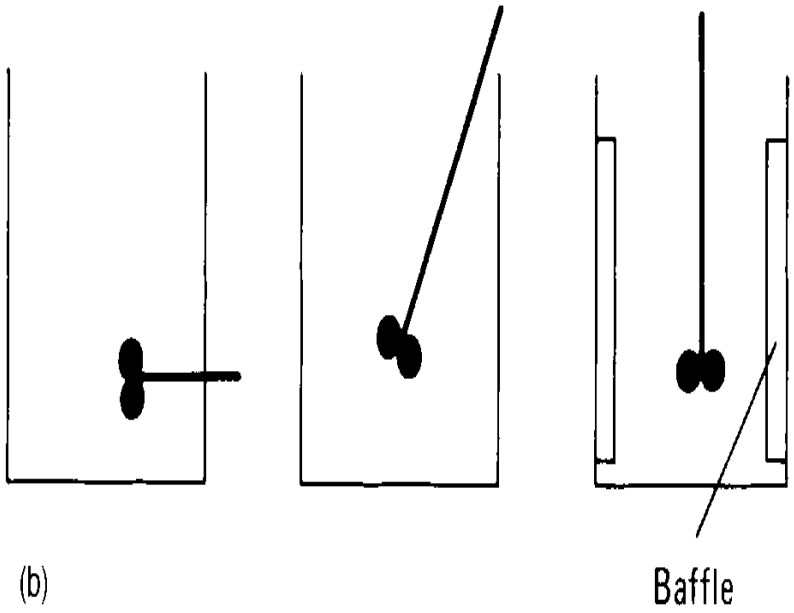

Figure 16. (b) Position of agitators for effective mixing of liquids**.**

To achieve successful mixing, the radial and longitudinal velocities imparted to the liquid are maximized by baffles, off-center or angled mixer shafts, or angled blades.

To mix low-viscosity liquids adequately, turbulence must be induced throughout the bulk of the liquid to entrain slow-moving parts within faster moving parts. A vortex should be avoided because adjoining layers of circulating liquid travel at a similar speed and mixing does not take place. The liquids simply rotate around the mixer.

2.3 Basic operating principles of mixing and blending equipment

2.3.1 Classification of Mixers

Mixers are classified into types that are suitable for:

i. Dry powders or particulate solids
ii. low- or medium-viscosity liquids
iii. high-viscosity liquids and pastes
iv. Dispersion of powders in liquids

i. Mixers for dry powders and particulate solids

These mixers have two basic designs:

- The tumbling action of rotating vessels and
- The positive movement of materials in screw types.

They are used for blending grains; flours and the preparation of powdered mixes (for example cake mixes and dried soups).

- **Tumbling mixers**

Tumbling mixers include

✓ Drum
✓ double-cone
✓ Y-cone and V-cone mixers.

They are filled approximately half full and rotate at speeds of 20–100 rev min-1.

Optimum mixing for a particular blend of ingredients depends on the shape and speed of the vessel. The efficiency of mixing is improved by internal baffles or counter-rotating arms.

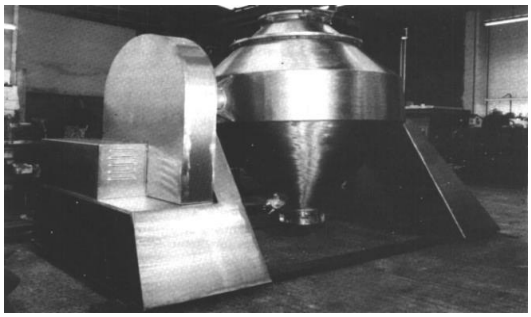

Figure 17. Tumbling mixers

- **Ribbon mixers**

Have two or more thin narrow metal blades formed into helices which counter-rotate in a closed hemispherical trough. The pitch of the ribbons is different so that one moves the material rapidly forwards through the trough, and the second moves the material slowly backwards, to produce a net forward movement of material. This type of mixer is used for dry ingredients and small-particulate foods.

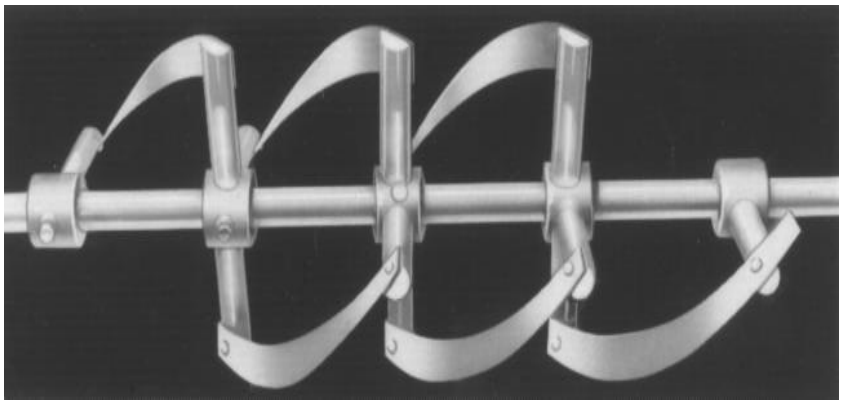

Figure 18. Ribbon mixes

- **Vertical-screw mixers**

Have a rotating vertical screw, contained within a conical vessel which orbits around a central axis to mix the contents. This type of equipment is particularly useful for the incorporation of small quantities of ingredients into a bulk of material

- ✓ Decreased mixing time;
- ✓ Higher levels of liquids and/or molasses (paddle);
- ✓ Good clean-out.

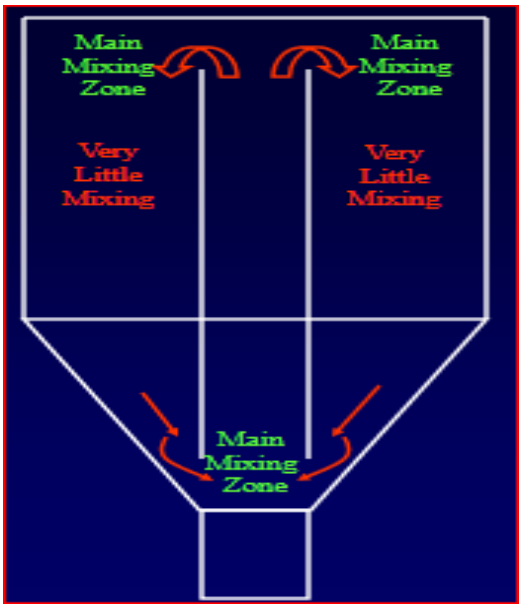

Figure 19: Mixing Flow in a Vertical Mixer

- **Horizontal ribbon mixer**

Working Principles of Horizontal ribbon mixer

Horizontal ribbon mixers consists of drive disk, double layer ribbon agitator, U- shape cylinder. Inside ribbons move materials towards the end of the ribbon blender whereas the outside ribbon move materials back towards the center of the ribbon blender, therefore materials get fully mixing. Materials flow direction are determined by ribbon angle, direction, twining, method. Material outlet are located in the middle of cylinder bottom. Outside ribbon driven by main shaft moves materials to discharge to ensure no discharging dead zone,

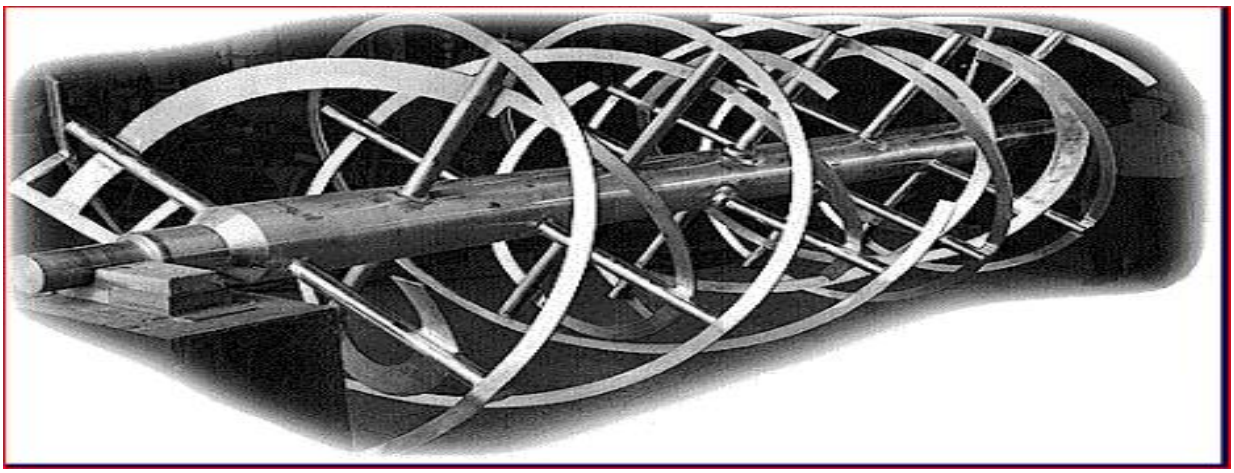

Figure 20. Horizontal ribbon mixer

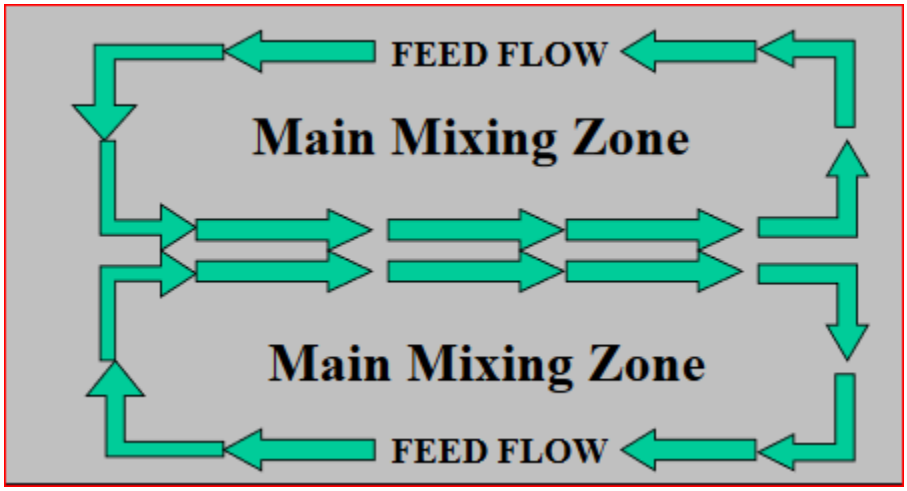

Figure 21. Feed flow in Horizontal ribbon mixer

ii. Mixers for low- or medium-viscosity liquids

A large number of designs of agitator are used to mix liquids in un-baffled or baffled vessels. The advantages and limitations of each vary according to the particular application. The simplest paddle agitators are wide flat blades which measure 50–75% of the vessel diameter and rotate at 20–150 rev min-1. The blades are often pitched to promote longitudinal flow in un- baffled tanks.

Impeller agitators consist of two or more blades attached to a rotating shaft.

- The blades may be flat, angled (pitched) or curved.
- Turbine agitators are impeller agitators which have more than four blades mounted together.
- The size is 30–50% of the diameter of the vessel and they operate at 30–500 rev min-1.
- The blades are flat, pitched or curved to increase radial and longitudinal flow. In addition blades may be mounted on a flat disc (the Vaned disc impeller, mounted vertically in baffled tanks.
- High shearing forces are developed at the edges of the impeller blades and they are therefore used for pre-mixing emulsions.
- Impellers which have short blades (less than a quarter of the diameter of the vessel) are known as propeller agitators.

In each type the agitator is located in one of the positions shown in to promote longitudinal and radial movement of the liquids and to prevent vortex formation. Alternatively, baffles are fitted to the vessel wall to increase shearing of the liquids and to interrupt rotational flow, but care is necessary in the design to ensure that the vessel may be adequately cleaned.

- ***Propeller agitators***

✓ Operate at 400–1500 rev min-1 and are used for blending miscible liquids, diluting concentrated solutions, preparing syrups or brines and dissolving other ingredients.

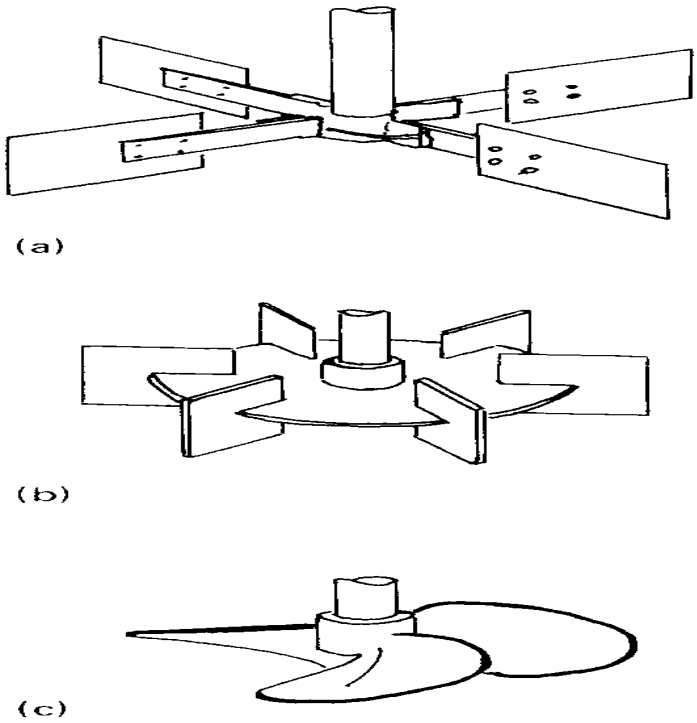

Figure 22. Agitators: (a) flat blade agitator; (b) Vanned disc impellor; (c) propeller agitator

Are short-residence-time mixers which are used to incorporate powders into liquids? They operate by mixing a uniform stream of powder into sprays of liquid and may also involve subsequent mixing by blades or rotors. Typical examples are shown in Fig. 5.7.

Powders may also be mixed with liquids by pumping them through pipes that are fitted internally with stationary mixing blades.

Food liquid mixtures

Food liquid mixtures could in theory be sampled and analyzed in the same way as solid mixtures but little investigational work has been published on this, or on the mixing performance of fluid mixers. Most of the information that is available concerns the power requirements for the most commonly used liquid mixer -some form of paddle or propeller stirrer. In these mixers, the fluids to be mixed are placed in containers and the stirrer is rotated. Measurements have been made in terms of dimensionless ratios involving all of the physical factors that influence power consumption

iii. Mixers for high-viscosity liquids and pastes

More viscous liquids are mixed using slow-speed vertical-shaft impellers such as

- ✓ Multiple-paddle (gate) agitators or,
- ✓ More commonly,
- ✓ Counter-rotating agitators to develop high shearing forces.

The basic design in this group is the anchor and gate agitator.

It is often used with heated mixing vessels, when the anchor is fitted with scraper blades to prevent food from burning onto the hot surface. Some complex designs have arms on the gate which intermesh with stationary arms on the anchor to increase the shearing action, whereas others have inclined vertical blades to promote radial movement in the food.

- **Z-blade mixer**

The most common design of twin-shaft horizontal blade mixers is the Z-blade (or sigma-blade) mixer. This consists of two heavy-duty blades which are mounted horizontally in a metal trough. The blades intermesh and rotate towards each other at either similar or different speeds (14–60 rev min-1) to produce shearing forces between the two blades and between the blades and the specially designed trough base. These mixers use a substantial amount of power which dissipated in the product as heat.

Mixing efficiency should therefore be high to reduce the mixing time. If necessary the walls of the trough are jacketed for temperature control.

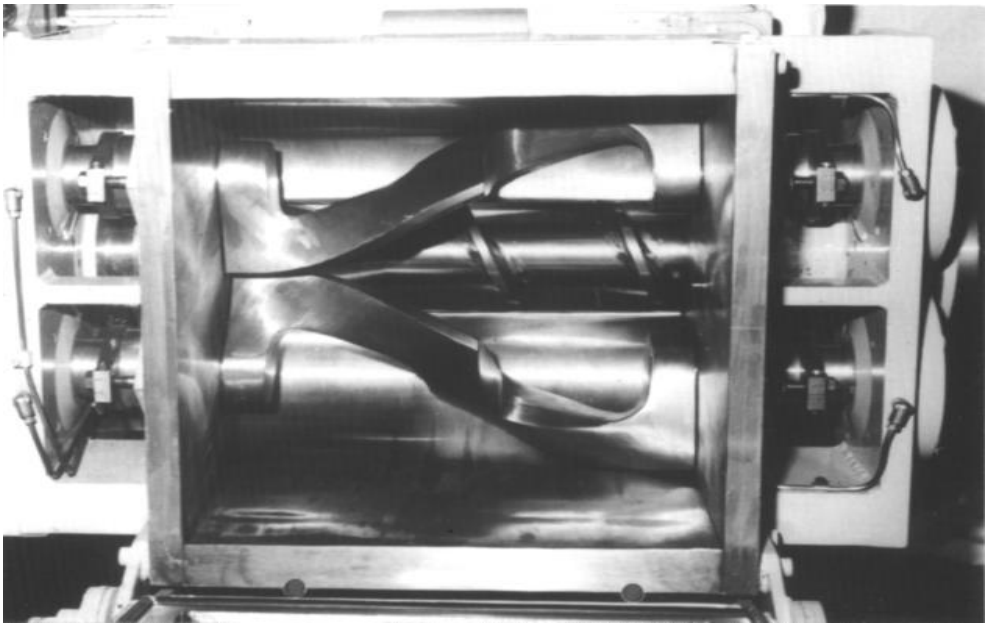

Figure 23. Z-blade mixer.

- **Planetary mixers**

Are commonly found in both industrial and domestic applications, and take their name from the path followed by rotating blades (at 40–370 rev min1), which include all parts of the vessel in the mixing action. An alternative design employs fixed rotating blades which are offset from the center of a co-currently or counter-currently revolving vessel. In both types there is a small clearance between the blades and the vessel wall.

Gate blades

Gate blades are used for

- mixing pastes
- blending ingredients and
- Preparation of spreads.

- **Screw conveyor mixers**

Are typical of the type known as continuous rotor-stator mixers.

A horizontal rotor fits closely into a slotted stationary casing (or 'barrel').

Single or twin screws are used to convey viscous foods and pastes through the barrel and to force it through perforated plates or grids. The small clearance between the screw and the barrel wall causes a shearing and kneading action. This is supplemented by shearing and mixing as the food emerges from the end plate or grid. The screw may be interposed with pins to increase the shearing action.

Recent developments include automatic microprocessor control with recipe storage for:-

- Rapid change of products
- process monitoring and
- Control and logging of process and product data.

These continuous mixers are used to produce dough's for crackers, biscuits, breads, crisp breads, rusks, cakes and confectionery products.

Roller mills and colloid mills are suitable for mixing high-viscosity materials in addition to their function as size reduction equipment.

Figure 24. Screw conveyor mixers

2.4 Effect of mixer on foods

The action of a mixer:

- Has no direct effect on either the nutritional quality or the shelf life of a food
- But may have an indirect effect by allowing components of the mixture to react together.

The nature and extent of the reaction depend on the components involved but may be accelerated if significant heat is generated in the mixer.

In general, mixing has a substantial effect on:-

- ✓ sensory qualities and
- ✓ Functional properties of foods.

For example, gluten development is promoted during dough making by the stretching and folding action which aligns, uncoils and extends protein molecules and develops the strength of the gluten structure to produce the desired texture in the bread. The main effects are to increase the uniformity of products by evenly distributing ingredients throughout the bulk.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Instruction 1: Choose the best Answer

1. The selection of a correct type and size of mixer depends on_____?
   A. The type of food being mixed
   B. The Amount of food being mixed.
   C. The speed of operation needed to achieve the required degree of mixing with minimum energy consumption
   D. All
2. Mixers are classified into types that are suitable for:
   A. Dry powders or particulate solids
   B. low- or medium-viscosity liquids
   C. high-viscosity liquids and pastes
   D. Dispersion of powders in liquids
   E. All

Instruction 2: Matching

Column A	Column B
1. Ribbon mixer	A) Mixers for high-viscosity liquids and pastes
2. Z-Blade Mixer	B) Mixers for Medium-viscosity liquids
3. Impeller mixer	C) Mixers for Low-viscosity liquids

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

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

Information Sheet 3 - Operating mixing and blending process

3.1 Introduction

Recent advances in mixer and blender designs have contributed to the growing success of food companies, meeting their requirement for consistency and developing new products while also lowering production costs. This white paper discusses both traditional and new specialty mixing technologies available to food manufacturers today. Phase and viscosity are used to classify different mixing categories. Sample applications are presented as well to illustrate certain processing challenges and the mixing technologies used to resolve them.

DPPH is a common abbreviation for the organic chemical compound 2, 2-diphenyl-1-picrylhydrazyl. It is a dark-colored crystalline powder composed of stable free-radical molecules. DPPH has two major applications, both in laboratory research: one is a monitor of chemical reactions involving radicals, most notably it is a common antioxidant assay, and another is a standard of the position and intensity of electron paramagnetic resonance signals.

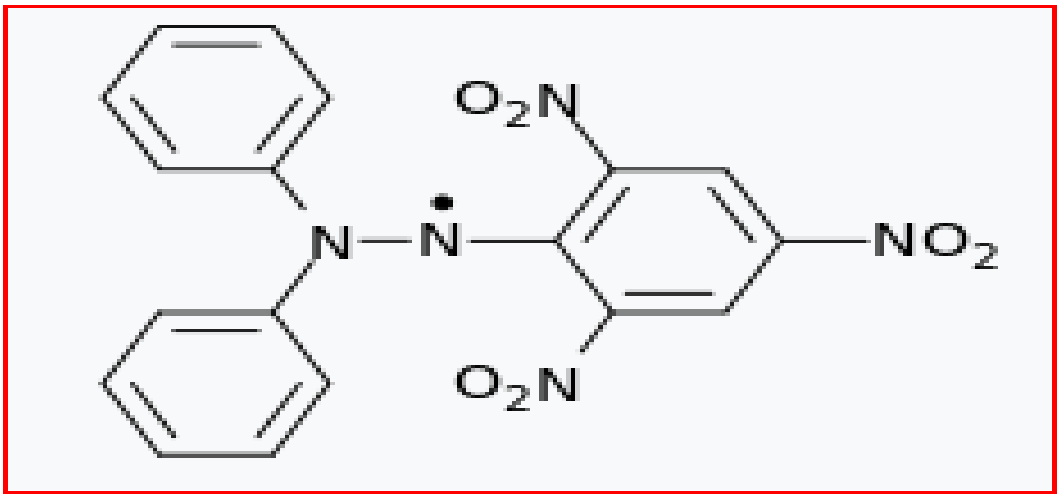

Figure 25. DPPH structure

Roasted Sesame seed oil extracted by cold pressing (RSSO) is very stable due to the presence of a number of natural antioxidants. Therefore, it has a long shelf-life and can be blended with less stable edible oils to improve their stability. In this work, blends of different ratios of RSSO (10, 20 and 40%) with soybean and/or sunflower oils were prepared and evaluated for their oxidative stability. The evaluation included the measurement of peroxide value, free fatty acid, iodine value, colour index, refractive index, Rancimat induction period and fatty acid composition. Protective factors as well as Cox value were calculated. In addition, total phenolic content of sesame oil blends and their antioxidant scavenging activity by DPPH free radical, were evaluated. The results showed that the addition of RSSO especially 20 and 40% to either soybean or sunflower oils improved the anti-oxidative property of the oil blends. Thus, the blends of these two refined edible oils with roasted sesame seed oil showed nutritional merits with improved stability for domestic cooking and heating purposes. Also, blending is the most economical process for fat modification.

3.2 Objective of mixing/blending

To obtain a uniform, random mixture of solid and liquid ingredients in the formula without nutrient destruction in a minimum amount of time. To improve the stability, shelf life, utility and nutritional value, fats and oils could be modified by blending. The Blending of two or more oil with different properties is an economic way to modify fatty acid profile and physicochemical properties of the final oil blend.

3.3 Need of blending of oil

Oil is an integral cooking medium of every food preparation. Apart from energy, oil also provide essential fatty acids linoleic acid (omega-6) and linolenic acid (omega -3), which cannot be synthesized in the human body and must be obtained from diet. The nutritional value of edible oils depends upon the fatty acid profile, degree of unsaturation, arrangement of fatty acid in triglyceride structure. In present scenario, cardiovascular diseases (CVDs) are the major cause of morbidity and mortality in the world and saturated fat intake is directly related to CVDs, due to which consumption of healthy oil is a topic of concern. According to World Health Organization (WHO, 2008), the healthy oil should have following three characteristics:

- The ratio of saturated, mono and polyunsaturated should be 1:1.5:1.
- The ratio of essential fatty acid, linoleic acid (omega-6): linolenic acid (omega -3) should be 5-10:1.
- Presence of antioxidants.

Blending of different vegetable oil can also improve the content of antioxidant and bioactive lipids and these antioxidants and bioactive components are also improving the stability of vegetable oils. On comparing the oxidative stability and radical scavenging activity of soybean oil with its blends (sea buckthorn oil, camellia oil, rice bran oil, sesame oil and peanut oil), it was found that soybean oil blends were more stable then soy bean oil. A mixture of rice bran oil and soybean oil improves oxidative stability of soybean oil and retard the rancidity in fried product during storage. Blending of seinat seed oil with peanut oil improved the stability and tocopherols content. The blend of palm olein and canola oil suffered minimum losses of antioxidant and polyunsaturated fatty acid (PUFA) during repeated frying. Coconut oil blends with sunflower and rice bran oil showed less peroxide formation and greater oxidative stability than the individual oils. A blend of canola and olive oil in the ratio 80: 20 with 20% palm olein is suitable for deep frying. Some recent researches on stable oil blends and their suitable ratio have summarized in Table 2.

Table 2. Recent studies on stable oil blends and their ratios

Oil blend	Ratio	Reference
Rice bran oil : Olive oil	(70:30)	5
Virgin olive oil : Soybean oil or sunflower	(20:80)	6
Palm olein : Canola oil	(50:50)	77
Palm olein : Sesame oil	(50:50)	8
Rice bran oil : Palm olein	(80:20 and 70:30)	9
Palm oil : Extra virgin olive oil	(80:20)	10
Palm oil : Canola oil	(50:50)	11
Sunflower oil : Palm oil	(65:35)	
Sunflower oil :Black cumin oil	(80:20)	

Tiger nut oil : Sunflower oil	(20:80 to 50:50)	
Moringa oleifera oil: Soya bean oil	(80:20)	
Camellia oil: Soya bean oil	(60:40 and 50:50)	
Extra virgin olive oil : Sesame oil	(80:20)	
Canola oil : palm oil	(30:70)	

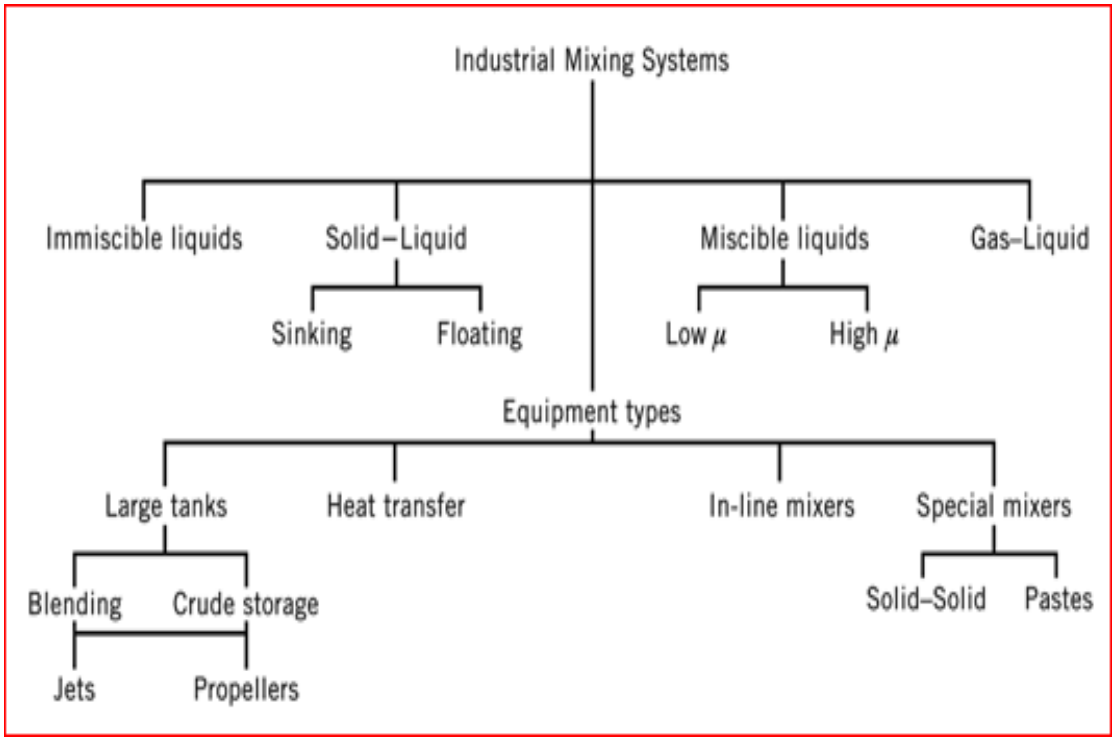

Figure 26. General industrial mixing system

Self-Check # 3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the objective of mixing/blending (6pts)
2. Why we the need to blending oil (8)

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

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

Information Sheet 4 – Identify and monitoring variation in equipment operation

4.1 Identify and monitoring variation in equipment operation

There are different variables in a processing industry that must be monitored and controlled. Variables to be monitored to minimize variations in equipment operations includes:

- Production capacity
- Equipment durability
- Equipment performance (e.g. Speed, output, variations)
- Equipment component performance
- Sequences and timing of operation
- Materials changes (desired and not desired)

For example: During oil extracting using mechanical screw preser, if the rotation speed of screw high the time to obtain the crude oil increase. But due to the temperature developed between the screw barrel the protein component of the cake may be damaged.

4.2 Types of Variation:

- Around Process Average
- Between Process Average and Target

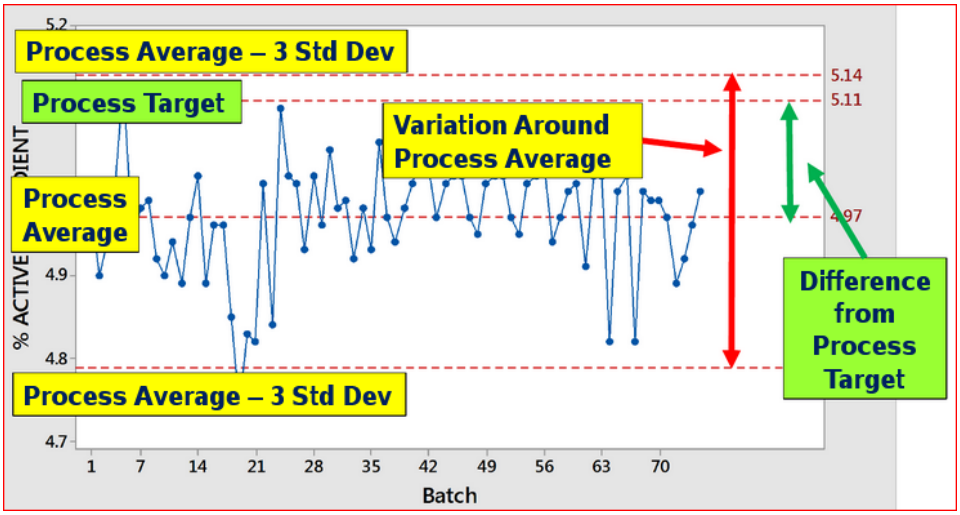

Figure 27. Process variation

4.3 Process variation reduction methods

Variation transmission is a very complicated issue in a multi-operational machining process (MMP). The complicatedness is primarily due to two reasons: firstly, each operation has three major variation sources, i.e., machine tools, fixtures and workpiece, which affect part quality through different ways; secondly, the operation sequence could make significant difference in final product variations. This second fact can be explained by the datum effect, i.e., if previous machined features are used as datum in the current operation, datum imperfection often affects the accuracy of currently machined features. Consequently, the issue of variation transmission in a MMP needs to be addressed at both the operation level and the process level.

Statistical Process Control (SPC) is a systematic tool to reduce process variations. However, for multistage manufacturing processes, like MMPs, control charts need to be developed for every single stage so as to determine faulty stage(s). Furthermore, SPC does not focus on variation transmission analysis and root cause diagnosis. The first step in constructing the chart is to establish the relationship between incoming workpiece and outgoing quality characteristics. Then the proposed chart is constructed based on the values of outgoing quality characteristics that have been adjusted for the values of incoming workpiece.

How Do We Reducing Variation?

Approach for Reducing Variation	**Useful Tool**
Understanding Critical Process Variables	Design of Experiments
Better Control of Processes	Control Charts
Improve Process Capability	Process Capability Indices Process Variation Components
Improving Measurement Systems	Gage Repeatability and Reproducibility Studies
Process and Measurement Robustness	Design of Experiments

Self-Check # 4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the approach for reducing process variation(6pts)
2. Write the variables that must be monitored to minimize variations in equipment operations(8)

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

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

Information Sheet 5 - Report workplace information

5.1 Report workplace information

Reporting workplace information in processing industry is very important activities that must be performed which helps to produce consistent products. Workplace information which is reported includes:

- Standard Operating Procedures (sops)
- Specifications
- Production schedules and instructions
- Manufacturers' advice
- Consignment notes
- Verification procedures
- Standard forms and reports

5.2 Standard Operating Procedures (SOP)

SOP is a process document that describes in detail the way that an operator should perform a given operation. SOPs involve the purpose of the operation, the equipment and materials required, how to perform the set-up and operations required for the process, how to perform the maintenance and shut down operations carried out by the worker, a description of safety issues, trouble-shooting,a list of spare parts and where to find them, illustrations, and checklists. In addition, SOPs are frequently used as checklists by inspectors when auditing procedures. Ultimately, the benefits of a valid SOP are reduced work effort, along with improved comparability, credibility, and legal defensibility.

5.3 Specification

A specification is exact statement of the particular need to be satisfied, or essential characteristics that customer requires (in a good, material, methods, process, service, or work).

5.4 Production schedules and instructions

In production scheduling the products to be manufactured and their quantities are determined initially. The sequence of manufacturing processes required for the production of these items are also established. The manufacturing resources are then allocated to perform production processes to realize various items. This is spread over a predetermined time. This function is known as production scheduling. The objectives of scheduling also include maximization of the resource utilization, minimization of the work-in-process inventory, reduction of manufacturing lead time, etc.

Self-Check # 5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List at list four workplace information that must be reported to the supervisor or production manager the (6pts)
2. Define specification mean(4)

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

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

Information Sheet 6 - Monitor mixing process

6.1 Introduction

Mixing is the dispersing of components, one throughout the other. It occurs in innumerable instances in the food industry and is probably the most commonly encountered of all process operations. Unfortunately, it is also one of the least understood. There are, however, some aspects of mixing which can be measured and which can be of help in the planning and designing of mixing operations. Most machine and process characteristics which affect quality, availability, capacity, safety, risk and cost can be continually evaluated throughout an asset's lifetime. This is essential in identifying impending failure and will be applied to critical areas identified in the reliability plan. The current state-of-health of process plant is important information related to current information, diagnosis and prognosis of various defects, and predicted useful life in the optimizations of safety, quality and high production rates.

6.2 Parts of mixer

Parts of mixers include:

- Agitator
- Baffle
- Cooling jackets
- Motor

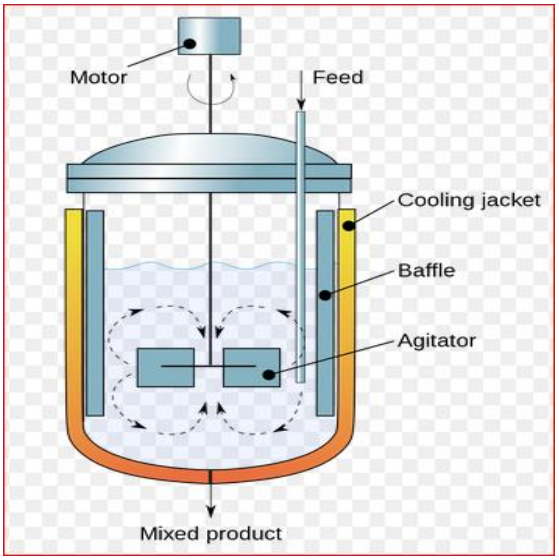

Figure 28. Parts of mixers

6.3 Monitor mixing process

The System Monitor interface provides remote monitoring, a features that helps you to access multiple clients through a single console for remote device management. The mixers monitoring immediately recognizes equipment and provides real-time equipment maintenance, which improve system stability and reliability. Remote monitoring monitors the system status of remote devices. The monitoring parameters during edible oil mixing include temperature, pressure applied by agitator, speed of mixer agitator, and system voltages. Remote Monitoring also provides support for function logs so that managers can regularly check the status of mixers easily. The System Monitor can display messages when thresholds are exceeded

Self-Check # 6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1 Write the parameters which will be monitored during edible oil mixing (6pts)

2 Write the parts of mixers (4pts)

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

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

Information Sheet 7 - Identifying out-of-specification product

7.1 Identifying out-of-specification product

The main quality checks concern raw materials, processing conditions, product quality and packaging and storage conditions. Raw materials should be checked to ensure that there is no moulds growth, and that they are correctly dried, cleaned and sorted. During processing, the temperature and time of conditioning, the moisture content of the raw material, and the yield of oil should be routinely checked. Quality checks on the product include correct color, flavor, odour, clarity, antioxidant amount, mixing or blending ratio and fill weight.

Processed oil should be consistent in all aspects such as colour, taste and viscosity. In addition, the oil should be free of impurities and meet the demands placed upon it for use in cooking. Before being filled, the bottles that hold the oil are cleaned and electronically inspected for foreign material. To prevent oxidation of the oil (and therefore its tendency to go rancid), the inert (non-reactive) gas nitrogen is used to fill up the space remaining at the top of the bottle.

Self-Check 7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1 What are the indicators of out-of-specification oil products (6pts)

2 Why we need to check raw materials before processing it? (4pts)

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

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

Information Sheet 8 - Maintaining the work area

8.1 Introduction

Maintaining the work area cleanness is playing the vital role of the organizational success. It includes keeping work areas neat and orderly; maintaining halls and floors free of slip and trip hazards; and removing of waste materials (e.g., paper, cardboard) and other fire hazards from work areas. It also requires paying attention to important details such as the layout of the whole workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of accident and fire prevention. A safe work environment Including facilities, Amenities and accommodation. Facilities refer to toilets, washrooms, showers, lockers, dining areas, drinking water, etc. These facilities must be in good working order, clean, safe and accessible. When considering how to provide and maintain facilities that are adequate and accessible, a person conducting a business or undertaking must consider all relevant matters including:

- The nature of the work being carried out at the workplace
- The nature of the hazards at the workplace
- The size, location and nature of the workplace
- The number and composition of the workers at the workplace.

8.2 Maintaining work area

During Conducting work in accordance with workplace guideline a person should ensure the following requirements.

8.2.1 Legislative Requirements

A person conducting a business or undertaking at a workplace must ensure so far as is reasonably practicable, the following:

- The layout of the workplace allows, and the workplace is maintained so as to allow, for persons to enter and exit and to move about without risk to health and safety, both under normal working conditions and in an emergency,

- Work areas have space for work to be carried out without risk to health and safety,
- Floors and other surfaces are designed, installed and maintained to allow work to be carried out without risk to health and safety,
- Ventilation enables workers to carry out work without risk to health and safety,
- Workers carrying out work in extremes of heat or cold are able to carry out work without risk to health and safety,

8.2.2 Responsibilities

- Facilities Management Division (or Equivalent)
  - ✓ Are designed and installed according to company legislative and requirements
  - ✓ Are inspected and maintained to ensure a safe level of hygiene.
- Company Management and Supervisors

Management and supervisors of faculties, divisions and units are to ensure that amenities and facilities in the workplace do not expose workers, or visitors to health and safety risks.

This includes:

- Employees

Employees are responsible for reporting any identified hazard in the work environment, facilities or amenities that they become aware of in accordance with factory or company guidelines.

8.2.3 Needs Assessment

The work environment, facilities and amenities are provided for basic health and welfare of employees. These include items such as:

- Toilets
- Rest rooms
- Shelter sheds
- Dining rooms
- Drinking water
- Accommodation
- Waste receptacles
- First aid facilities/rooms (refer to first aid guidelines).

8.2.4 Work Environment

Work environment includes/consider: work layout, work access, floors and other surfaces, work station, lighting, air quality, and heat and cold.

- **Work Layout**

The layout of the workplace is required to allow persons to enter and exit the workplace and move within safely, both under normal work conditions and in an emergency.

- **Entry and Exit**

Entries and exits are required to be safe to allow impeded access and egress for all workers, students and visitors including those with special needs.

- **Housekeeping**

Untidy workplaces may lead to injuries e.g. slips and trips, therefore good housekeeping practices are essential for all workplaces.

For example:

- ✓ Spills on floors should be cleaned up immediately
- ✓ Walkways should be kept clear of obstructions
- ✓ Work materials should be neatly stored
- ✓ Any waste should be regularly removed
- ✓ Suitable containers for waste should be conveniently located and regularly emptied.

- **Work Areas**

The layout of the work area should be designed to provide sufficient clear space between machines, fixtures and fittings so workers can move freely without strain or injury also evacuate quickly in case of an emergency.

- **Floors and Other Surfaces**

Floor surfaces shall be suitable for the work area and be chosen based on the type of work being carried out at the workplace, as well as the materials used during the work

process, the likelihood of spills and other contaminants, including dust, chemicals, and the need for cleaning.

- **Workstations**

Workstations should be designed so workers are comfortable undertaking their task and allow for a combination of sit and standing tasks.

For tasks undertaken in a seated position, workers should be provided with seating that:

- ✓ Provides good body support, especially for the lower back
- ✓ Provides foot support, preferable with both feet flat on the floor, otherwise a footrest shall be provided
- ✓ Allows adequate space for leg clearance and freedom of movement
- ✓ Is fully adjustable to accommodate different size workers (e.g. seat height, back rest height and back rest tilt adjustments) and should not tip or slip utilizing a five-point-base
- ✓ Chairs shall be fitted with castors for carpeted surfaces and glides or braked castors on hard surfaces.

- **Lighting**

Sufficient lighting is required to allow safe movement around the workplace and to allow workers to perform their job without having to adopt awkward postures or strain their eyes to see. Emergency lighting is to be provided for the safe evacuation of people in the event of an emergency. The following factors are to be taken into account:

- ✓ The nature of the work activity
- ✓ The nature of hazards and risks in the workplace
- ✓ The work environment
- ✓ Illumination levels, including both natural and artificial light
- ✓ The transition of natural light over the day
- ✓ Glare Workplace Environment Guidelines
- ✓ Contrast
- ✓ Reflections.

- **Air Quality**

Workplace are to be adequately ventilated which includes provision of fresh, clean air drawn from outside the workplace, uncontaminated from flues or other outlets and be circulated through the workplace.

Workplace inside buildings may have natural ventilation, mechanical ventilation or air conditioning.

An air-conditioning system should:

- ✓ Provide a comfortable environment in relation to air temperature, humidity and air movement
- ✓ Prevent the excessive accumulation of odors.
- ✓ Reduce the levels of respiratory by-products, especially carbon dioxide, and other indoor contaminants that may arise from work activities
- ✓ Supply an amount of fresh air to the workplace, exhaust some of the stale air as well as filter and recirculate some of the indoor air.

- **Heat and Cold**

Refer to the Thermal Comfort Guidelines for further information on managing health and safety risks associated to hot and cold environments.

8.2.5 Welfare Facilities

- **Access**

Workers, including those who have particular needs or disabilities, must have access to the facilities provided.

Workers are to be provided with:

- ✓ Adequate breaks to use the facilities
- ✓ Facilities which are within a reasonable distance from the work area
- ✓ Shift workers have similar access to those who work during the day
- ✓ A means of access which is safe.

- **Personal Storage**

Accessible and secure storage should be provided at the workplace for personal items belonging to workers. This storage should be separate from that provided for personal protective equipment in cases where contamination is possible.

- **Change Rooms**

Persons required to change clothes before and after work should be able to access a change room.

This includes workers who need to:

- ✓ Wear personal protective clothing or uniforms while they are working
- ✓ Leave their work clothing at the workplace.

- **Shower Facilities**

Where dirty, hot or hazardous work is undertaken showering facilities should be provided. Showers should have:

- ✓ Floor area of not less than 1.8m2
- ✓ A Slip resistant surface that is capable of being sanitized
- ✓ A Partitions between each shower that are at least 1650mm high and no more 300cm above the floor
- ✓ An adjacent dressing area for each shower containing a seat and hooks
- ✓ A Lockable door enclosing the shower and dressing cubicle

- **Shelter Facilities**

Where persons are required to be performing tasks offsite and can be exposed to environment elements appropriate shelter is to be provided.

8.2.6 Inspection and Monitoring

The work environment, facilities and amenities need to be periodically inspected to ensure they conform to relevant legislation, standards and codes of practice and are maintained and serviced appropriately. Any non-conformances identified throughout the inspection require a risk control assigned to an appropriate person.

Review of the work environment, facilities and amenities are required when:

- Work practices, equipment or workplaces are modified

- Employees numbers increase
- New work processes are introduced
- An incident impacting on the health, safety or welfare of employees occurs.

Where it is identified that the workplace environment, facilities or amenities pose a health and safety risk, the issue should be reported to the supervisor and recorded.

Corrective actions may include a review of the area in relation to the information contained in guideline, WHS Regulation, Code of Practice or other information.

Self-Check 8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the requirements a person should ensure during conducting work in accordance with workplace guideline(6pts)
2. Write at list five items that a work environment, facilities and amenities are provided for basic health and welfare of employees. (5pts)

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

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

Information Sheet 9 - Conducting workplace environmental guidelines

9.1 Introduction

Environmental implications associated with oil seed cleaning are identified, assessed and reported to the supervisor. Environmental implications may be negative environmental impacts may result from excessive noise and exhaust emissions, the incorrect use and disposal of maintenance debris (oil seed residues, chemical residues), and hazardous substances (fuel, noise). Impacts may also include run-off flows of water and cleaning agents from servicing, maintenance and cleaning activities, soil disturbance and dust problems from high activity of oil seed cleaning. Routine oil production activities can have detrimental environmental effects during each of the main phases of exploration, production, and decommissioning. During the exploration phase, impacts can result from indirect (sound and traffic) and direct physical (anchor chains, drill cuttings, and drilling fluids) disturbance. Additional direct physical impacts occur in the production phase as pipelines are laid and the volume of discharged produced water increases. Lastly, decommissioning can result in a series of direct impacts on the sea floor and can re-introduce contaminants to the environment. It is critical that all of the potential impacts of routine operations are accounted for when designing management strategies, whether local or regional, for offshore oil activities. Workplace policies are designed as guidelines for employee behavior, criteria for performance evaluations and ways to make the workplace more productive. A variety of policies for the workplace will be included in the employee manual. It is still necessary to find ways to conciliate industry development with environmental protection that is with sustainable development.

9.2 Environmental Protection and Management Requirements

An environmental protection and management requirement prescribes operational requirements with respect to the items listed below:

- Water quality (for operating areas and adjacent areas).

- Aquifers.
- Crossings of streams, wetlands and lakes.
- Deleterious materials into streams, wetlands or lakes
- Operations within wetlands.
- Natural range barriers.
- Invasive plants.
- Forest health.
- Soil conservation.
- Seismic lines.

9.3 Work place environmental guidelines

Checking of work environment should include

- Ventilations
- Lighting
- Noise
- Heat

✓ **Definitions of some terms used in work place environmental guidelines**

- **Ventilation:** From the worker should expect to report to his/her supervisor if any occurrence which related to ventilations such as Odors, Dusts, Gases, Vapors, Fumes and Smoke. And ensure that ventilation system conforms to the National Building Code and the Local Fire and Public Health Regulations.
- **Lighting:** Make sure that your eyes have time to adapt to changes in lighting level as you move from one area to another. We cannot see properly when we first move from a brightly illuminated area to a darker area. The eyes need a few minutes to adjust to the dark area.

Noise: - The best method of protection is to use quieter equipment, enclosures, and noise reducing materials. Using hearing protection is recommended as required

Heat: - the most serious illness is heat stroke, which may be fatal. Heat stroke occurs as a result of working in very hot environments. The symptoms include poor

coordination and abnormal behavior which the person may not be aware of, hot and dry skin, and loss of consciousness.

9.4 Types of workplace policies

Here are some examples of common workplace policies that could assist your workplace:

- Recruitment policy
- Internet and email policy
- Mobile phone policy
- Non-smoking policy
- Drug and alcohol policy
- Health and safety policy
- Anti-discrimination and harassment policy
- Grievance and termination policy

Self-Check # 9	Written Test

Name_____ ID_____ Date_____

Directions: Answer all the questions listed below.

I. Say true for correct statement and say false for incorrect statement (3 points each)

1. There are different policies for the work place included in the employee manual
2. Environmental protection and management requirement prescribes operational requirements with respect to different items like water quality and forest

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

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

Information Sheet 10 - Maintaining workplace records

10.1 Record keeping systems

There are certain written records or kinds of documentation that are needed in order to verify that the system is working. These records will normally involve the Implementing Hazard Analysis and Critical Control Point (HACCP) plan itself and any monitoring, corrective action, or calibration records produced in the operation of the Hazard Analysis and Critical Control Point (HACCP) system. Verification records may also be included. Records maintained in a HACCP system serve to document that an ongoing, effective system is in place. Record keeping should be as simple as possible in order to make it more likely that employees will have the time to keep the records.

10.2 The purpose of records

Accurate record keeping is essential to the application of a preventive control plan. Your records should be sufficient to enable you to confirm easily and with confidence that your preventive control plan is implemented and working effectively. Records can also help you improve your preventive control plan by providing a means for you to, for example:

- Identify the root cause of an issue
- Analyze and improve a process or procedure
- Identify gaps in training and in training needs

The following make up the records of a Hazard Analysis and Critical Control Point (HACCP) Plan

- List of HACCP team and their assigned responsibilities
- Description of each menu item
- Flow diagram for each menu item indicating CCPs
- Hazards associated with each CCP and preventive measures
- Critical limits
- Monitoring procedures

- Corrective actions plans
- Record keeping procedures
- Procedures for verification of the HACCP plan
- Production process
- Variation of results

Self-Check – 10	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. Makeup hazard analysis and critical control point plan includes? (5 points)
2. Write the purpose of recording? (4 points)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**
You can ask you teacher for the copy of the correct answers.

Operation Sheet - 1: Procedures for blending roasted sesame oil with sun flower and soya bean oil

Sequence for blending roasted sesame oil with sun flower and soya bean oil

1. Wear personal protective equipment's
2. Clean sesame oil seeds (soil, metals, glass etc.)
3. Roast sesame seeds at 200^0c for 20 minutes.
4. Extract roasted sesame seed oil using hydraulic oil press
5. Blend roasted sesame oil with soya bean oil or sun flower oil with blending ratio of roasted sesame oil at 10, 20, and 40.
6. Blend roasted sesame oil with soya bean oil at (10:90 or 20:80 or 40:60) blending ratio(use this ratio for sunflower blending)
7. Pack the blended oil
8. Store at room temperature
9. Apply 5S
10. Record blending process and maintenance activities

LAP TEST # 1	Practical Demonstration

Name…… ID …….. Date……

Time started: _____ Time finished: _____

I- Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 4 hour. The project is expected from each student to do it.

Task- 1: Conduct blending of roasted sesame oil with sun flower and soya bean oil

LG #37	LO#3- Shut down the mixing and blending process

Instruction sheet
This learning guide is developed to provide you the necessary information regarding the following content coverage and topics: • Identifying shutdown procedure • Shutting down the process of 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 shutdown procedure • Shut down the process of workplace procedures. • Identify and Report Maintenance requirements
Learning Instructions:
1. Read the specific objectives of this Learning Guide. 2. Follow the instructions described below. 3. Read the information written in the information Sheets 4. Accomplish the Self-checks

Information Sheet 1- Identifying shutting down procedure

1.1 Identifying shutting down procedure

Shutdown procedure which will be done after extracting oils may include but not limited to:

- Workplace procedures in the process of shutting.
- Equipment is dismantled and prepared for cleaning.

1.2 Seven steps/procedures for a successful shutdown

Follow these steps to ensure a successful outage and restart. Scheduled outages may be plant wide, occur through different sections or be cold or running. Job plans for each asset is a prerequisite.

Step 1: A comprehensive list

A checklist with every piece of equipment involved in the outage should be available for review. Every stakeholder should examine this list to ensure nothing is missing. Examples of assets for most plant checklists include: Agitators, Airlocks, Conveyors, Doors, Dust baggers, Gearboxes, Mixers and blenders, Motors, Piping, Pumps, and Valves.

Step 2: Have it in inventory

Ensure that all replacement parts, accessories and rebuilt equipment are in stock before the shutdown. The last thing any team needs is to have staff on hand to conduct maintenance, replacements and new installations only to be held up waiting for rebuilt equipment to return from a shop.

Step 3: Safety first

Safety should be the top priority during any outage. Before beginning work, all lock out/tag out (LOTO) procedures should be followed and personnel must wear all required

personal protective equipment (PPE). Because equipment is shut down, personnel may have a false sense of security.

Step 4: Within current specifications

Double check that all equipment (new and rebuilt) is within current operating parameter specifications. When assets were specified, they met the requirements of the process at that time. Condition changes, such as fluid temperature, flow requirement or process fluid pH must be considered. Different parts or different equipment may need to be used.

Step 5: Inspect before installation

Personnel should inspect all equipment before anything is installed; look for wear or damage. Installing new components into a worn piece of equipment is almost always counterproductive. Demise of the new components begins immediately.

Step 6: Precise installation

While this step seems obvious, improper installation happens all the time. Reliability begins with the asset selection and correct installation. If installed imprecisely, failure begins at startup

Step 7: Inspection before restart

The plant team should give everything one more look before restarting the plant or process. Even when every step is taken and every job plan is followed, stuff happens. A motor is bumped during work on another piece of equipment, causing misalignment. Housekeeping staff accidentally hits a piece of equipment. A wrench left on an asset may have fallen.

1.3 Advantage of appropriate shut down procedure

- Reduced unplanned downtime
- Reduced overtime and
- Reater operational efficiencies

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. Write the seven steps/procedures for a successful shutdown (10 points)

Note: Satisfactory rating – 5 points Unsatisfactory - below 5

You can ask you teacher for the copy of the correct

Information Sheet 2- Shutting down the process

1.1 Shutting down process

Shut down is a term used to describe the process of closing all systems of process control systems. Normal shutdown includes steps to render the systems safe, such as removal of hazardous process materials and inert (asphyxiating) gases. The systems might be cleaned as part of the shutdown; cleaning is often a machine shutdown is a temporary closure of a building to perform maintenance. The main activities should be preventative in nature with the focus on equipment inspections. This is the best time to replace worn-out or broken process materials and equipment at their useful end-of-life process unto itself requiring its own set of startup, operation, and shutdown procedures.

1.2 Shut down the process includes

Shutdown procedure may include but not limited to:

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

During oil mixing operation, after extracting the oil and separating the by-product (cake or meal) you have to shut down the extraction process. This process are;

- First switch off power of mixer
- Un-plug power socket
- Clean external parts of mixer
- Clean internal parts like, agitators
- If maintenance are needed, list out damaged parts in maintenance check list and report to maintenance operators or supervisors.

1.3 Uses of Shutdown Processes

- Safely shut down of the equipment.
- To locate emergency stop functions on the equipment.

Self-Check # 2	Written Test

Name… ..... ID…..… Date…….....

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

Test –I. Short answer questions

1. Define shutdown process mean (4 points)
2. Shut down the process includes (6points)

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

You can ask you teacher for the copy of the correct

Information Sheet 3 - Identifying and reporting maintenance requirements

3.1 Definition of maintenance

Maintenance requirements are the processes of maintaining work area to meet housekeeping standards and Respond to and/or report equipment failure within level of responsibility. Maintenance is a general upkeep and repair of equipment, buildings and grounds, heating and air-conditioning; removing toxic wastes; parking; and perhaps security. Food premises and equipment that are not kept in good repair and condition are a potential source of microbiological and physical contamination of food. Poorly maintained premises and equipment cannot be cleaned effectively. Poor maintenance may allow the entry of other sources of physical, microbiological and chemical contaminants such as water, pests and dust. Poor maintenance can have health and safety implications for workers.

3.2 Identifying and reporting maintenance requirements

To minimize the hazards that might be happen during equipment operation, you have to check that the equipments are in a god operating condition or not. If there is a defects on it, report and undertake maintenance before starting operate equipment. The maintenance that needed may be adjusting thermocouple, pressure sensors, some components of a machine or equipment and etc. Maintenance requirement requires that all sorting and grinding, extracting, refining and desolventizing equipment be maintained in an efficient state, in efficient order and in good repair. Where any machinery has a maintenance log, the log is kept up to date; and that maintenance operations on work equipment can be carried out safely.

3.3 Maintenance activities

Maintenance of equipment was the basic and mandatory activities in an industry. Many hazards that might be happen was due to lack of maintenance activities before, during and after operating a machine or an equipment. The following are the maintenance activities that will be done in a food processing industries. Such as: Operational

maintenance (e.g. connection-disconnection of hoses, greasing, lubrication and lubricant systems, adjusting sealing glands, cleaning and changing filters, 'nipping up' flanges) General cleaning Removal and replacement (e.g. gland packing, changing blades or cutters, replacing gaskets, replacing /maintaining seals, changing filter elements, servicing strainers).

3.4 Uses of Maintenance Requirement

Are used to maintain typical equipment faults and related causes, including signs and symptoms of faulty equipment and early warning signs of potential problems

3.5 Routine maintenance checklist

- An example of a checklist used for maintenance request was given below:

Table 3. Routine maintenance checklist

Date	Tool	Maintenance check points	Signature	Maintenance required	Signature
14-10 /2020	mixer	agitator	Mr. A	Agitator	
		Shaft	Mr. A	Shaft	Mr. B
		Screw	Mr. A	None	

Maintenance performed were reported using a checklist below.

Table 4. Maintenance report checklist

Maintenance Performed	Date	Signature
The dies was replaced	16-10/2020	Mr. C
The shaft was replaced		

Self-Check # 3	Written Test

Name…… ID…… Date……..…

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

Test - Short Answer Questions

1. Define maintenance requirement (3points)
2. Describe uses of maintenance requirement (3pts)

Operation Sheet - 1: Procedures of Shutting down the process of mixers

Sequence for procedures of shutting down the process of mixers

1. Wear personal protective equipment's
2. First switch off power of mixer
3. Un-plug power socket
4. Clean external parts of mixer
5. Clean internal parts like, agitators
6. If maintenance are needed, list out damaged parts in maintenance check list and report to maintenance operators or supervisors.
7. Record all activities

LAP TEST # 1	Practical Demonstration

Name…… ID …….. Date……

Time started: _____ Time finished: _____

I- 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- 1: Conduct shutdown process of mixer

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