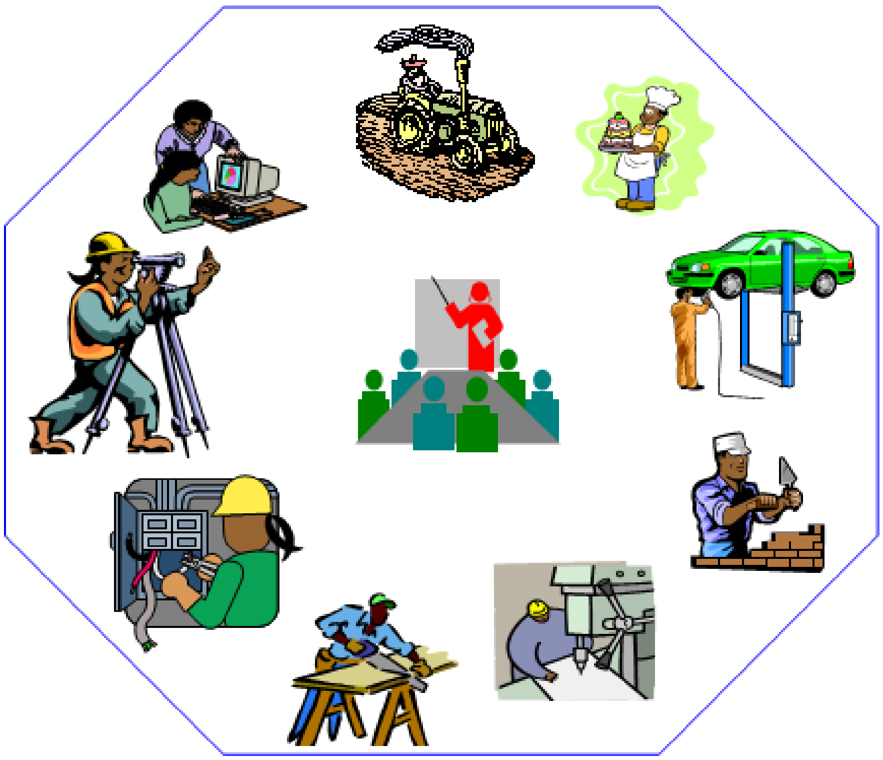
Cereal Processing
Level III



Based on May 2019, Version 2 OS and March 2021, V1 Curriculum

Module Title: Baking Bread

LG Code: IND CRP3 M06 LO (1-2) LG (19-20)

TTLM Code: IND CRP3 TTLM 0321v1

March, 2021
Bishoftu, Management Institute

With the support of
United Nations Educational, Scientific and Cultural Organization
Republic of Korea Funds-in Trust

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LG #19	LO #1- Prepare to bake dough

Instruction sheet

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

- Selecting baking parameters
- Loading dough pieces into the oven
- Confirming ingredients and available for finishing 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:

- Selecte baking parameters
- Load dough pieces into the oven
- Confirm ingredients and available for finishing 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
5. Perform operation sheets
6. Do the “LAP test”

Information Sheet 1- Selecting baking parameters

1.1. Selecting baking parmeters

Temperature – is an important parameter that has influence on the entire technological flow, from the raw materials to the final product storage space. Every recipe has the specific temperature for each step in the process, but there are some milestones to be kept in mind and to be used for the calculation of others temperatures. The optimum temperature for the yeast multiplication is 25 - 30°C, therefore for facilitate the multiplication, the dough temperature should be between 25 and 28°C, depending on the dough type: 25°C – soft dough, 27°C – very soft dough, 23°C – dry dough. The final dough temperature depends on: ambient temperature, flour temperature, water temperature and the increasing of the temperature caused by the mixing device. On the other hand, the water temperature could be calculated depending on the final dough temperature, ambient temperature, flour temperature and so on.

Duration – time involved for the developing of phases, operations – is an important parameter too. The time for fermentation of the pre-dough is variable, depending on the consistency and temperature of the mixture; it could be very long, even 48 hours for certain types of biga. The mixing time is also different, depending on the method (direct, semi-direct and indirect), on the mixer type (spiral, fork form or hands movement imitation), on the rotation speed - but in every case it is important to set and follow the optimum time that assures a homogenous dough.

The fermentation time depends on many factors (product type, yeast quality, dough characteristics, ambient conditions, the obtaining dough method, flour properties) and it will be decreased when:

- the yeast quantity in the recipe is high
- high temperature and humidity of the ambient zone
- dough hidratation is high
- the flour is weak

The fermentation time will be increased when:

- the flour is too strong
- dough humidity is low
- low temperature and humidity of the ambient zone
- the dough content is rich in sugars, fats.

Self-check 1	Written test

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

Test I Short Answer Questions

1. List some of parametrs for baking?(2pts)

Test II choose the best answer.

1. Which one of the following optimum temperature for the yeast multiplication?
   A. 10 - 25°C
   B. 25 - 30°C
   C. 35 - 40°C
   D. 0 - 4°C
   E. All of the above
   F. None of the above
2. The final dough temperature depends on:
   A. Ambient temperature,
   B. Flour temperature,
   C. Water temperature and
   D. The increasing of the temperature caused by the mixing device
   E. All of the above
   F. None of the above
3. The fermentation time does not depends on
   A. Product type, and Yeast quality,
   B. Dough characteristics,
   C. Ambient conditions,
   D. Flour properties
   E. All of the above
   F. None of the above
4. The fermentation time will be decreased when:
   A. The flour is too strong
   B. Dough humidity is high
   C. Low temperature and humidity of the ambient zone
   D. The dough content is rich in sugars, fats
   E. Dough humidity is high

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

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

Answer Sheet

Score = ___________

Rating: ____________

Name: _________________________ Date: _______________

Test I

1. ____

Test II

1. _______________
2. _______________
3. _______________
4. _______________
5. _______________
6. _______________
7. _______________

Information Sheet 2- Loading dough pieces into the oven

2.1. Introduction

Biochemical processes occur also in this phase of dough formation: lipids, carbohydrates and proteins transformations, facilitated by the enzymes (from flour and yeast) presence. Various bonds formed between the gluten proteins and others components, as soluble proteins, mineral salts, starch, lipids, lead to the formation of a homogeneous and uniform mass – the dough.

The microbiological processes, that involve the dough microbiota, are represented by the yeast cells and lactic bacteria multiplication, followed by the alcoholic and lactic fermentation. The fermentation goal is to obtain such a dough that could optimum perform during developing, fermentation and baking phases. During fermentation the processes initiated in the mixing period are going on: the proteins molecules in gluten swell and absorb the CO_2 formed by the yeast, therefore realize a network between them and conferring a spongeous structure. Under the reaction of proteolytic enzymes more malleable dough is obtained.

During the fermentation, the dough had undergone a temperature increasement of 2 – 3 °C, due to the sugars decomposition by the yeast. In the same time the dough weight at the end of the fermentation is lower with 2-3%. The losses are caused by the fermentation of sugars (solid) in volatile substances (CO_2 and ethyl alcohol) that partial evaporate, and by the water vaporization.

After mixing and bulk fermentation, the dough pass through other operations as dividing, rounding**,** resting, conveying, sheeting, curling, elongating, cutting, folding and panning depending on the shape of the final product that could damage the gluten formed. If the dough is squeezed, sheared or screwed the structure breaks down the result in the loaf is streaks of coarse, firm texture with poor color. If dough structure is weak from the use of low protein flour, high starch damage and high water addition, it needs to be handled very gently to get the best performance. If the structure is strong from the use of a combination of good quality high protein flour, moderate starch damage and water addition, properly formulated and fully developed, there is a high built in resistance to changing shape particularly from a ball to sheeting and more relaxation time is required between these molding operations.

Figure 1: Moulding and proofing opration

Figure 2: Loading dough in to oven

Self-Check – 2	Written test

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

Test I: Short Answer Questions (2pts for each)

1. What is the goal of fermentation?

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

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

Answer Sheet

Score = ___________
Rating: _____________

Name: _________________________ **Date:** _______________

1.____

Information Sheet 3- Confirming ingredients and available for finishing requirements

3.1. Confirming ingredients and availibe for finishing requrement

The following materials shall be used in the preparation of dough for bread

- Essential ingredients:White flour and /or whole meal flour, yeast, edible common salt, potable water.
- Optional ingredients: Milk/milk products, wheat gluten, sugar/sugar products, edible oils and etc…..
- Improvers
- Bacterial and mold inhibitors
- Dough conditioners

Bread making stages include mixing the ingredients, dough resting, dividing and shaping, proofing, and baking, with great variation in the intermediate stage depending on the type of product. In bread making, mixing is one of the key steps that determine the mechanical properties of the dough, which have a direct consequence on the quality of the end product. Mixing evenly distributes the various ingredients, hydrates the component of the wheat flour, supplies the necessary mechanical energy for developing the protein network, and incorporates air bubbles into the dough. The rheological properties of wheat flour dough are largely governed by the contribution of starch, proteins, and water.

The viscoelastic properties of the dough depend on both quality and quantity of the proteins, and the size distribution of the proteins is also an important factor. Two proteins present in flour (gliadin and glutenin) form gluten when mixed with water and give dough these special features. Gluten is essential for bread making and influences the mixing, kneading, and baking properties of dough.

During proofing or fermentation, yeast metabolism results in carbon dioxide release and growth of air bubbles previously incorporated during mixing, leading to expansion of the dough, which inflates to larger volumes and thinner cell walls before collapsing. The growth of gas bubbles during proof and baking determines the characteristics of the bread structure and thus the ultimate volume and texture of the baked product. The yeast breaks carbohydrates (starch and sugars) down into carbon dioxide and alcohol during alcoholic fermentation. The carbon dioxide produced in these reactions causes the dough to rise (ferment or proof), and the alcohol produced mostly evaporates from the dough during the baking process. The size, distribution, growth, and failure of the gas bubbles released during proofing and baking have a major impact on the final quality of the bread in terms of both appearances (texture) and final volume.

During bread making there is general agreement that gluten is the main contributor to the unique properties of wheat dough properties, affecting dough characteristics and, consequently, the quality of the fresh bread. Gluten proteins comprise two main sub fractions: glutenins, which confer strength and elasticity, and gliadins, which impart viscosity to dough.

Different features have been defined and quantified to evaluate breads, including volume (rapeseed displacement), weight, specific volume, moisture content, water activity, color of crust and crumb, crust crispiness, crumb hardness, image analysis of the cell distribution within the loaf slice, and volatile composition.

The perceived quality of bread is a complex process associated with sensory sensations derived from product visual appearance, taste, odor, and tactile and oral texture.

Self-Check – 3	Written test

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

Test I: Short Answer Questions

1. List materials some dough preparation for bread. (2pts)
2. List the stages of bread making. (2pts)
3. List the different features to evaluate breads. (2pts)
4. List the sensory quality parameters for bread. (2pts)

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

1. Milk/milk products, wheat gluten, sugar/sugar products, edible oils and etc….. are essential ingredients. (2pts)
2. White flour and /or whole meal flour, yeast, edible common salt, potable water are optional ingredients.(2pts)

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

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

Score = ___________

Rating: ____________

Answer Sheet

Name: _________________________ Date: _______________

Test I

1.____

2. ____

3.____

4. ____

Test II

1.____

2. ____

Operation Sheet 1– Preparing dough to bake

Objective: To prepare to bake dough

List of materials needed:

- Flours
- Yeast
- Salt
- Baking powder
- Sugar
- Fat
- Eggs
- Water
- Thermometer
- Fermentation tank
- pH meter
- oven
- Tray

Procedures:

1. Wear aproparate PPE
2. Prepare tools, equipment and machineries
3. Prepare raw materials (flour and raw ingrediants) for dough process
4. Montoring/check the quality of raw materials by visual observation and laboratory analysis
5. Remove all the contaminated or undesirable raw materials
6. Prepare dough(mixing, fermentation, dividing, moulding)
7. Load or transfer prepared dough to oven/prover until final proofing.

LAP TEST	Performance Test

Name……………………………   ID…………………Date………………

Time started: ________________________ Time finished: ________________

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **3** hour. The project is expected from each student to do it.

Task 1: Perform bake dough preparation.

LG #20	LO #2- Bake bread

Instruction sheet

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

- Conducting pre-start checks
- Settings, operating requirements and safety features of oven
- Baking product with food safety, quality and legislative requirements
- Identifying, rectifying and/or reporting unacceptable baked product
- Shutting down ovens
- Maintaining the work area with housekeeping standards
- Conducting work with workplace environmental guidelines
- Operating work with relevant policies and procedures

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

- Load dough pieces into the oven
- Set, operate requirements and safety features of oven
- Bake product with food safety, quality and legislative requirements
- Identify, rectify and/or reporte unacceptable baked product
- Shut down ovens
- Maintain the work area with housekeeping standards
- Conduct work with workplace environmental guidelines
- Operate work with relevant policies and procedures

Learning Instructions:

1. Read the specific objectives of this learning guide.
2. Follow the instructions described below.
3. Read the information written in the information sheets
4. Accomplish the self-checks
5. Perform operation sheets
6. Do the “LAP test”

1.1. Conduct pre- start checks

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

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

Check all the tools and equipment before use.

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

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

- Checking the all guards are in place at moulder and oven.
- Visually inspecting all doors and hatches to oven and prover are closed.
- Checking the safety/risk of anyone working on the machine.
- Checking the all guards are in place and in good condition.
- Checking all emergency stops are free of damage and in working order.
- Checking the shelves are clean and free of old dough for prover.
- Checking the floor around prover are swept for prover.
- Checking all weste dough are removed from prover area.
- Checking the light curtain sensors on the prover are cleaned for prover.
- Checking the shelves are clean and free of old burnt dough for oven.
- Checking the floor has been swept for oven.

- Checking all the light, covers and clips are in place and in good condition.
- Checking all weste dough has been removed from oven area.
- Checking all weste product has been removed from oven area.

Self-Check – 1	Written test

Name…………………………………………… ID……………………… Date…….

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

Test I: Short Answer Questions

1. List the stages of pre-start check? (3pts)
2. List the importance of cleaning spice and herbs raw materials? (2pts)

Test II: Write true if the statement is correct and false if the statement is incorrect (2pts for each)

1. Visually inspecting all doors and hatches to oven and prover are closed.
2. the safety/risk of anyone working on the machine will Checked.
3. Checking the all guards are in place and in good condition.
4. Checking all emergency stops are free of damage and in working order.
5. Checking the shelves are clean and free of old dough for prover.
6. Checking the floor around prover are swept for prover.
7. Checking all weste dough are removed from prover area.
8. Checking the light curtain sensors on the prover are cleaned for prover.
9. Checking the shelves are clean and free of old burnt dough for oven.
10. Checking the floor has been swept for oven.
11. Checking all the light, covers and clips are in place and in good condition.
12. Checking all weste dough, weste product has been removed from oven area.

***Note:* Satisfactory rating - 30 points** **Unsatisfactory - below 30 points**

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

Answer Sheet

Score = ___________

Rating: ____________

Name: _________________________ **Date:** _______________

Test I

1. ____
2. ____

Test II

1. _______________
2. _______________
3. _______________
4. _______________
5. _______________
6. _______________
7. _______________
8. _______________
9. _______________
10. _______________
11. _______________
12. _______________

Information Sheet 2- Settings, operating requirements and safety features of oven

2.1. Introduction

Oven temperature is one of the key baking parameters. It can be measured, modified, and controlled in order to influence process conditions directly, thereby affecting a product's final characteristics. Heat in transferred from the oven to the baked good by the following mechanisms, depending on the type of oven:

- Conduction heat
- Convection heat
- Radiation heat

2.2. Oven

An oven is an enclosed cavity or tunnel where dough or batter is surrounded by a hot environment and becomes baked and transformed into bread, cookies, or other products.

In order to bake the products, ovens use energy generation sources, e.g., combustion of fuels such as gas or oil, or electricity. The released available energy from these sources is transferred to the products by means of radiation, conduction, and/or convection. The oven sets and maintains the proper conditions of heat flux, humidity, and temperature to carry out the baking process and the removal of moisture from the products.

2.3. Origin of oven

The fundamental oven model, with stone floor and dome structure, has been around for many years. It was the Egyptians who initially utilized a handcrafted oven cavity made from clay. The lower section formed the firebox in which pieces of dried wood and charcoal were burned. The upper section, accessible from the top, was the baking chamber.

Several centuries later, the Roman Empire began to create more refined ovens with better baking quality and higher efficiency ovens. Brick and stone ovens were constructed inside the bakery's premises, with thermostable materials for the baking chamber, and other high-temperature-resistant materials to insulate the oven and keep the warm environment for prolonged time frames. These ovens were powered by burning wood directly inside the heating chamber, removing the ashes, and then putting the dough/batter pieces inside for baking.

2.4. The relevant of oven

An oven is the most important processing step in the baking industry for several reasons:

1. It is the workhorse of the bakery. The production output of a bakery is usually controlled by the capacity of the oven.
2. Heat and mass transfer phenomena both take place simultaneously inside this piece of equipment, triggering physicochemical and biochemical changes in the product.
3. Baking in the oven is the step that imparts the final characteristics to the products (e.g., shelf life, flavor, texture, color, aroma).
4. It provides a crucial kill step that prevents pathogens from thriving within the product.

2.5. Types of ovens

Depending on their mode of operation and heat transfer mechanism, ovens can be classified as either batch or continuous equipment and as using either direct or indirect heat exchange.

The type of oven that suits a bakery's operation may be a function of production capacity, product specifications, floor space, available energy sources, operation efficiencies, construction materials, and maintenance needs.

These are the common type of commercial ovens:

1. Direct-fired oven (DFO): Direct-fired oven place combusting gas (energy source) inside the baking chamber to heat the air and the products. The heat transfer in a direct gas-fired oven is primarily carried out by radiation from the flames (ribbon burners placed above and below the oven band), top, base and walls of the baking chamber. Direct-fired ovens are very efficient because they convert most of the fuel to heat and process the products, and this lowers fuel consumption and operating costs.

2. Indirect-fired oven (IFO): Indirect-fired oven indirectly heat the baking chamber by using exchangers. This oven is suitable for sensitive bakery products (e.g., cakes, pastries) since the by products of combustion remain inside the heat exchanger structure and do not come into direct contact with the dough pieces. This eliminates the risk of contamination and of impregnation of off-odors in the products.

This type of oven is less often used nowadays because of its limited power for heat transfer and energy efficiency (amount of fuel burned in a given time versus water loss (evaporated moisture) of the products during baking).

3. Electric oven: Electric ovens have construction features similar to those of DFOs, and operate similarly in terms of heat transfer mechanism to bake the products. This type of oven uses electrical resistances in place of the traditional gas burners of DFOs.

Electric-fired ovens have limited use in the baking industry due to their power consumption and costs per kWh. They also face scale-up challenges that require further research and industry application.

4. Peel brick oven: The peel brick oven was one of the first constructed baking units in human history. It consists of a massive brick material chamber. The chamber is connected to a refractory tile floor that holds the dough pieces. Coal and wood are used as fuel (combustion source).

Because of their construction features (insulation capacity of materials and thickness of the walls), these ovens are able to steadily transfer radiant heat to the products, and also maintain high temperatures inside the baking chamber for prolonged periods of time. The ovens are operated manually and require special skills from the baker.

5. Rack oven: A rack oven is a batch vertical oven into which racks full of sheet pans can be wheeled for baking. This unit can hold 8 to 20 sheet pans per baking cycle. Some units make use of electric or fuel sources, and place fans inside the baking chamber (generation of convection drying) to speed up baking times and to develop special features in the products.

This oven is suitable for retail operations due to its floor space economy, and medium to long baking cycle times. The products are baked upon customer order, and are often offered directly (unpackaged) for immediate consumption. These ovens usually have programmable (saved) recipes so that the operator can change baking time and temperature, intensity of air ventilation, and steam impingement frequency.

6. Reel oven (also known as revolving tray oven): A reel oven is an oven in which trays or shelves are placed on platforms rotating on a central horizontal axis. A high baking chamber is required to accommodate the reel structure, thereby saving floor space. Reel ovens are normally directly fired with gas or electricity, with the heating source located centrally across the floor of the chamber. This type of oven is mostly designed for retail bakeries or baking plants with small-scale production.

Reel ovens often do not generate uniform distribution of heat transfer due to their revolving nature and interfering structure for radiant heat transfer. Products placed on sheet pans or trays continuously rotating may present uneven coloring or poor final moisture distribution.

7. Conveyorized oven (also known as traveling tray oven): Conveyorized ovens replace the reel ovens concept with two parallel endless conveying chains that carry trays of products through the length of the baking chamber, so the dough pieces continually enter and leave the oven. Their main advantages are simplicity of design, and uniformity of baking as the products travel the same path through the baking chamber. A motor drive directly controls band speed, thereby determining baking cycle time.

Conveyorized ovens may be single-lap or double-lap. In single-lap ovens, the trays containing the products travel a single pass (back and forth). The trays in a double-lap oven travel through four heat zones instead of the two zones of the single-lap oven.

8. Tunnel oven: Tunnel ovens are continuous mode operation baking units, and are commonly used in large-scale bakeries. This unit typically has a long baking chamber (usually more than 80 meters in length), which goes from one side (loading point) to another (unloading point) in a straight conveying band. The conveyor band material may be built of wire mesh or carbon steel sheets.

Tunnel ovens are commonly powered by fuels such as natural gas (used for baking), and electricity (for powering air circulation and conveying system). The baking chamber may be divided into several baking zones. This makes the application of a temperature sequence possible, which provides the baker more flexibility in baking conditions and more complexity for controlling baking parameters.

9. Hybrid oven: Hybrid ovens combine the three modes of heat transfer and take advantage of their synergistic effect on products.

This type of oven usually requires a high degree of automation since its construction, control systems, and energy sources are too complex to be manipulated manually.

2.6. Maintenance of ovens

Oven maintenance focuses on two major goals:

1. Prevent food safety hazards (physical, biological, and chemical) from occurring by reducing the likelihood of foreign material contamination, under-processing, and contamination with lubricants. These hazards may pose a food safety risk to customers, not to mention the loss of a good reputation and money.
2. Prevent mechanical, electrical, and thermal equipment failures that could negatively impact normal oven operation; and increase downtime, which could trigger significant economic losses.

Inspection and maintenance of equipment and calibration of measuring and instrumentation devices are vital for smooth oven operation. Special attention must be paid to: welded components, drive chains and belts, motors and drives, steam lines and fittings, air lines and fittings, seals and gaskets in piping, bearings, conveyor belts, bands, temperature indicators and controllers, in-line humidity meters and humidity exhaust systems, electrical control systems, and fans (axial or centrifugal).

Figure 3: Different type of bekery oven

Oven temperature causes physical transitions and chemical reactions to take place in the dough/batter. The following stages are temperature-dependent, and participate in the sequential transformation of bread dough.

- Development (also known as oven spring)
- Drying (reduction of dough/batter moisture)
- Color formation

2.2. Development (also known as oven spring)

As temperature increases, the free water/alcohol mixture in the product vaporizes, fermentation gases (CO2) dissolved in the liquid dough phase become less soluble, and are released into the cells, causing them to expand in response to the rise in pressure.

As a result, cells increase in volume by retaining gases due to their deformable nature as these are surrounded by the continuous gluten/starch soft matrix. This results in a large reduction in the density of the dough as the product gradually develops an aerated structure. Note that the size to which the gas bubbles can grow is limited by the ability of the gluten/starch film surrounding them to stretch without rupturing.

In this stage, the product undergoes a series of irreversible chemical and physical transformations. Oven spring is accompanied by the following changes and conditions:

- Killing of yeast cells at 50–60°C (122–140°F)
- Maximum enzymatic activity at 60°C (140°F). The enzyme-driven reactions that convert starch into sugars and break proteins into amino acids increase with heat, so they increase most near the dough surface.
- Starch gelatinization. It starts at 55–65°C (130–150°F) as granules become fully swollen with local free water.
- Denaturation of gluten proteins at 50°C (122°F) and coagulation at 70–80°C (160–180°F). As a consequence, gluten becomes increasingly tough and stiff as it irreversibly forms a gel.
- Above 85°C (185°F), starch looks glassy, and gluten looks rubbery. This is the start of the dough-crumb transition process (setting).

- Inactivation of naturally-occurring and added enzymes inside the dough (70–85°C) (160–185°F).

2.3. Drying (reduction of dough/batter moisture)

- Under the action of the heat transfer mechanisms, high temperatures develop inside the baking chamber (200–300°C) (390–570°F), and water molecules at the dough surface absorb latent heat and start to evaporate.
- Due to the low humidity of the air inside the baking chamber, a water vapor pressure (air moisture concentration) gradient is created. Liquid-state water starts to diffuse, and migrates from the product core to the surface, where it evaporates and is lost to the oven atmosphere.
- The loss of moisture from the dough piece is dependent on the baking chamber temperature, colligative properties of the free water in the product, heat transfer methods used, and the humidity of the oven.

2.4. Color formation

The external surface of the product is exposed directly to the high temperatures of the oven, and readily absorbs the heat from the energy sources. These high temperatures trigger non-enzymatic reactions that give rise to the desirable brown crust:

- Maillard browning takes place above approximately 105°C (220°F) and requires the presence of a reducing sugar (glucose, maltose, or lactose) together with an amino acid, the type of which determines color and flavor.
- Sugars caramelize at 160°C (320°F). This reaction will happen only in the presence of water.

2.5. Oven temperature vs. internal product temperature

- In most baking processes, the dough pieces are placed into the oven at an initial temperature of 20–30°C (70–86°F). The oven temperature is usually set constant at 150–300°C (300–570°F), and baking usually takes 5–25 minutes.
- Because baking takes place at atmospheric pressure, and moisture escapes freely from the product without leaving it completely dried, the internal temperature of the food does not exceed 100°C (212°F) (boiling point of water).
- The core temperature of the product reaches 90–97°C (194-207°F). The thicker the bread, the longer it takes for conduction heat transfer to reach the center of the product and increase its temperature.
- Through baking temperature/time profiling, it is possible to quantify the difference between the product core temperature and the temperature in the oven. In some cases this difference can be high.
- The bigger the difference between external and internal temperature, the larger the temperature gradient will be for heat transfer to bake the product.
- A data logger may be used to check the temperature profile of the oven and identify variations from set temperatures and other problems.
- Variations in oven temperature need to be addressed properly, as these can be caused by unbalanced heat transfer generated by the incorrect location of energy sources across the width of conveying bands or decks. This imbalance can cause unevenness in coloring and final moisture content distribution in products.

2.6. Controlling oven temperature

Specific temperatures are set inside the baking chamber to achieve the required baking profile of a given product. Controlling the heat input from the energy sources (e.g., burners, electric resistances) is then vital for maintaining the set baking temperatures. Control of oven temperature can be achieved by two means: automatically and manually.

2.6.1 Automatically

i. A temperature sensor (thermocouple probe) senses, measures, and transmits the temperature (controlled variable) of the air inside the baking chamber.

ii. As the demand for hot air increases or decreases (e.g., in moments when the load of the oven increases, oven temperature goes down; fuel combustion must then increase to return oven temperature to its set point).

iii. A change in oven temperature is sensed and converted to an electrical signal, amplified, and sent to a controller that evaluates the signal and sends a correction signal to an actuator.

iv. The actuator (gas valve) opens or closes to adjust the flow rate of the air and fuel (carbureted mixture) in the burner (manipulated variables) to keep flame intensity such that it can consistently deliver the power required. In this way, the temperature of the baking chamber is returned to its predetermined value.

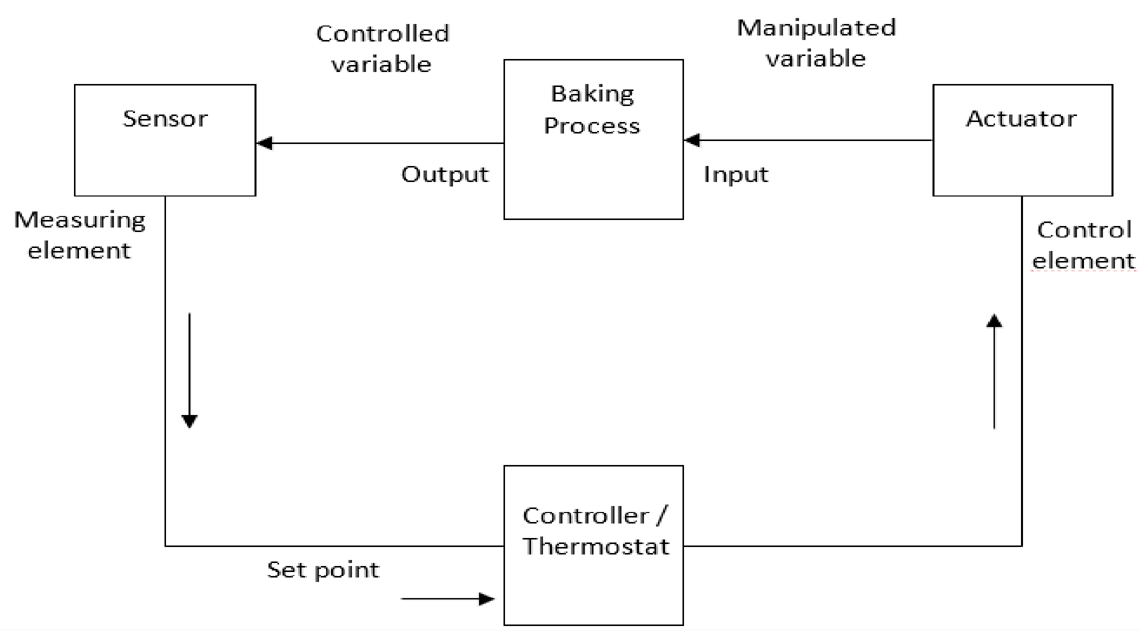

Figure 4: Automatic bakery process control

2.6.2 Manually

i. Dough pieces are loaded into the oven, where heat from the energy sources is used to bring the products to the required temperature in order for them to cook and dry.

ii. A thermometer is used to measure the temperature of the product (the measured variable). The temperature is observed by an operator who adjusts the flow of air and gas in the burner (the manipulated variables) to keep the baking chamber at the constant set temperature.

Self-Check – 2	Written test

Name…………………………………………… ID……………………….. Date…….

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

Test I: Short Answer Questions

1. List mechanisms (mode) of heat in transferred from the oven to the baked good. (3pts)
2. List the sequential stages for transformation of bread dough. (3pts)
3. What is oven? (3pts)
4. Why oven is relevant? (3pts)
5. List the common type of commercial ovens. (3pts)
6. What are major goal of oven maintenance? (3pts)

Test II: Choose the best answer?

1. Which of the following is true about oven spring?
   A. Killing of yeast cells at 50–60°C (122–140°F)
   B. Maximum enzymatic activity at 60°C (140°F). The enzyme-driven reactions that convert starch into sugars and break proteins into amino acids increase with heat, so they increase most near the dough surface.
   C. Starch gelatinization starts at 55–65°C (130–150°F) , denaturation of gluten proteins at 50°C (122°F) and coagulation at 70–80°C (160–180°F). As a consequence, gluten becomes increasingly tough and stiff as it irreversibly forms a gel.
   D. Above 85°C (185°F), starch looks glassy, and gluten looks rubbery. This is the start of the dough-crumb transition process (setting).
   E. Inactivation of naturally-occurring and added enzymes inside the dough (70–85°C) (160–185°F).
   F. All of the above

2. Which of the following is **not true** about reduction of dough/batter moisture?
   A. Under the action of the heat transfer mechanisms, high temperatures develop inside the baking chamber (200–300°C) (390–570°F), and water molecules at the dough surface absorb latent heat and start to evaporate.
   B. Due to the low humidity of the air inside the baking chamber, a water vapor pressure (air moisture concentration) gradient is created.
   C. Liquid-state water starts to diffuse, and migrates from the product core to the surface, where it evaporates and is lost to the oven atmosphere.
   D. The loss of moisture from the dough piece is dependent on the baking chamber temperature, colligative properties of the free water in the product, heat transfer methods used, and the humidity of the oven.
   E. All of the above
   F. None of the above

3. Which of the following is not true about desirable brown crust formation?
   A. Maillard browning takes place above approximately 105°C (220°F) and requires the presence of a reducing sugar (glucose, maltose, or lactose) together with an amino acid, the type of which determines color and flavor.
   B. Sugars caramelize at 160°C (320°F) in the presence of water.
   C. Enzymatic reactions
   D. All of the above
   E. None of the above

4. Which of the following is true about automatic oven temperature controlling?
   A. A temperature sensor (thermocouple probe) senses, measures, and transmits the temperature (controlled variable) of the air inside the baking chamber.
   B. As the demand for hot air increases or decreases (e.g., in moments when the load of the oven increases, oven temperature goes down; fuel combustion must then increase to return oven temperature to its set point).

C. A change in oven temperature is sensed and converted to an electrical signal, amplified, and sent to a controller that evaluates the signal and sends a correction signal to an actuator.
D. The actuator (gas valve) opens or closes to adjust the flow rate of the air and fuel (carbureted mixture) in the burner (manipulated variables) to keep flame intensity such that it can consistently deliver the power required.
E. All of the above
F. None of the above

5. Which of the following is **not true** about manual oven temperature controlling?
   A. A temperature sensor (thermocouple probe) senses, measures, and transmits the temperature (controlled variable) of the air inside the baking chamber.
   B. Dough pieces are loaded into the oven, where heat from the energy sources is used to bring the products to the required temperature in order for them to cook and dry.
   C. A thermometer is used to measure the temperature of the product (the measured variable).
   D. The temperature is observed by an operator who adjusts the flow of air and gas in the burner (the manipulated variables) to keep the baking chamber at the constant set temperature.
   E. All of the above
   F. None of the above

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

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

Score = ____________

Rating: ______________

Answer sheet

Test I

1. ____
2. ____

Test II

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Information Sheet 3- Baking product with food safety, quality and legislative requirements

3.1. Baking product with food safety, quality and legislative requirements

Batters and dough pass through 9 stages during the baking process:

- Gasses form
- Gasses are trapped
- Starches gelatinize
- Proteins coagulate
- Fats melt
- Water evaporates
- Sugars caramelize
- Carryover baking
- Staling

The baking process consists of 7 steps

1. Formation and expansion of gases
2. Trapping of gases in air cells
3. Gelatinization of starches
4. Coagulation of proteins
5. Evaporation of some of the water
6. Melting of shortenings
7. Crust formation and browning

3.1.1 Formation and Expansion of Gases

Primarily carbon dioxide formed by

- Yeast
- Baking Soda
- Baking Powder
- Steam is also formed by evaporating moisture

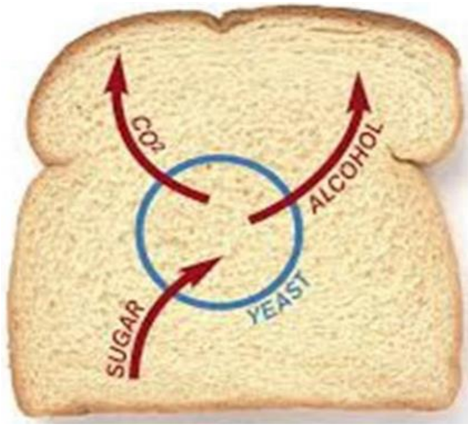

Figure 5: Formation of gas

3.1.2 Trapping of gases in Air Cells

- Stretched gluten proteins for a matrix of air cells which trap gases produced by leavening agents

3.1.3 Gelatinization of Starches

- Contributes to overall structure of bread as starches firm during cooking
- Gelatinization begins at approximately 150 °F

Starch gelatinization is the irreversible loss of the molecular order of starch granules (crystallinity). It is considered a glass transition from an ordered initial state to a disordered final state, usually resembling a “melting” process, that requires water and heat. In the cooking or baking process, it’s the stage where starch granules swell and absorb water, becoming functional.

Native starch is partially crystalline and highly organized, a result of interactions between amylose and amylopectin fractions which also reduce its water solubility. When dispersed in excess water at room temperature, starch granules only take up about 30–40% of their dry weight as moisture, causing them to swell slightly and settle to the bottom. However, this process can be reversed.

Starch in hot water

During heating and in the presence of excess water, starch granules initially imbibe (bind) water causing them to gradually swell and form a viscous slurry. As heating continues and temperature increases, the granules start losing their crystallinity becoming amorphous as evidenced in the disappearance of the Maltese cross (birefringence) observed via light microscopy.

Subsequent heating causes the granules size to increase until they can no longer absorb more water and burst. Rheologically, this is accompanied by maximum viscosity build up followed by a drop to a plateau. As molecules making up the granule start to leach out from the swollen granules and disperse/solubilize in the aqueous medium, yield a gel or paste whose properties depend on the concentration and type of starch in the slurry.
The amylose and amylopectin fractions start to solubilize at 158°F (70°C) and 194°F (90°C), respectively. These fractions become loose and eventually become more reactive and prone to enzyme attack (especially amylases).

Application

During baking, gelatinized starch absorbs free water in the dough. As gas bubbles in the dough expand and eventually burst to form an air-continuous or porous structure. The starch gel/coagulated protein matrix surrounding these bubbles increase in **viscosity** to form a firm structure, essential for setting bread structure and crumb texture.

Extent of starch gelatinization varies with:

- Temperature
- Heating rate and extent of heating
- Available water (a_w)
- pH
- Type of starch (source)

Impact of water activity on gelatinization

The presence of dissolved solids and low molecular weight compounds such as salts, sugars, amino acids and alcohols (e.g. polyols and glycerol) lowers the amount of free or unbound water, thus necessitating higher temperatures for the starch to gelatinize. This is the reason why bakery formulas rich in sugar and fat and low in water, such as pie crusts and cookies, never attain complete starch gelatinization.

Such formulations delay the set of crumb (firming) in doughs and batters during baking. Therefore, for optimum expansion volume build up during oven spring, the dough/batter needs to remain somewhat flexible or viscous to allow leavening gases to expand.

Gelatinization temperature of starches from select plants

The following table summarizes the gelatinization temperature of various starch sources

Methods used to study starch gelatinization

This phenomena can be studied using techniques such as:

- Optical microscopy
- Amylography
- Rapid visco-analysis (RVA)
- Differential scanning calorimetry
- Time-resolved X-ray diffraction analysis

3.1.4 Coagulation of Proteins

- Contributes to overall structure of bread as proteins coagulate during cooking
- Protein coagulation begins at approximately 165°F
- Oven temperature is critical to proper protein coagulation

3.1.5 Evaporation of Some of the Water

- Weight allowances must be made for water loss during baking

3.1.6 Melting of Shortenings

- Different shortenings melt and release trapped gases as different temperatures therefore proper shortening should be used for each baked product

3.1.7 Crust Formation and Browning

- Crust is formed when water evaporates from the exterior of the dough

- Caramelization is responsible for browning effect of bread
- Milk sugar and eggs increase browning

3.2. Quality Control for Baking Ingredients

Commercial or high-speed bakeries rely on advanced processing technology and high-quality ingredients to consistently deliver delicious and nutritious baked goods to their customers. Quality control for ingredients and raw materials is an essential part of food safety and quality management systems. These are commonly documented and implemented by industrial food processors and commercial bakeries.

Quality control is the sum of all controllable factors that influence positively or negatively the quality of the finished product.

Example:-

- Selection of raw materials.
- Processing methods
- Packaging
- Methods of storage distribution

There are many baking ingredients, these include but are not limited to:

- Flour
- Process water
- Yeast
- Granulated, refined sugar
- Liquid sweeteners
- Eggs
- Milk solids
- Salt
- Enzymes
- Dough conditioners
- Hydrocolloids / gums
- Preservatives

The starting point for the quality control of baking ingredients is the establishment of specifications. They should be properly set by the research & development department and mutually agreed between supplier and bakery in terms related to the use and against reasonable analytical procedures. The quality assurance/ quality control department should be able to make analytical checks using similar methods to those in the supplier's laboratory.

Quality refers to the attributes of the food which make it agreeable to the person who consumes it. This involves the positive factors such as: - color, flavor, texture & nutritive values as well as the negative characteristics such as: - harmful micro organisms & undesirable substances. In food processing, the general rule is the effective methods must be carefully applied to conserve the original qualities of the raw materials. Processing cannot improve the raw material.

3.2.1 Aims & principles of quality control

The aim of quality control is to achieve as good and as consistent a standard of quality in the product compatible with the market for which the product is designed.

The Principles of quality control are:-

- Raw material control
- Process control
- Finished product inspection

The food industry is highly competitive and food manufacturers are continually trying to increase their market- share and profits. To do this they must ensure that their products are of higher quality, less expensive, and more desirable than their competitors whilst ensuring that they are safe and nutritious. To meet these rigours standards food manufacturers need analytical techniques to analyze food materials before, during and after the manufacturing process to ensure that the final product meets the desired standards. In a food factory one starts with a number of different raw materials, processes them in a certain manner (e.g. heat, cool, mix, dry), packages them for consumption and then stores them. The food is then transported to a warehouse or retailer where it is sold for consumption.

One of the most important concerns of the food manufacturer is to produce a final product that consistently has the same overall properties, i.e. appearance, texture, flavor and shelf life. When we purchase a particular food product we expect its properties to be the same (or very similar) to previous times, and not to vary from purchase-to-purchase. Ideally, a food manufacture wants to take the raw ingredients, process them in a certain way and produce a product with specific desirable properties. Unfortunately, the properties of the raw ingredients and the processing conditions vary from time to time which causes the properties of the final product to vary, often in an unpredictable way. How can food manufacturers control these variations? Firstly, they can understand the role that different food ingredients and processing operations play in determining the final properties of foods, so that they can rationally control the manufacturing process to produce a final product with consistent properties. This type of information can be established through research and development work. Secondly, they can monitor the properties of foods during production to ensure that they are meeting the specified requirements, and if a problem is detected during the production process, appropriate actions can be taken to maintain final product quality.

Raw material control: Manufacturers measure the properties of incoming raw materials to ensure that they meet certain minimum standards of quality that have previously been defined by the manufacturer. If these standards are not met the manufacturer rejects the material. Even when a batch of raw materials has been accepted, variations in its properties might lead to changes in the properties of the final product. By analyzing the raw materials it is often possible to predict their subsequent behavior during processing so that the processing conditions can be altered to produce a final product with the desired properties.

Process control: It is advantageous for food manufacturers to be able to measure the properties of foods during processing. Thus, if any problem develops, then it can be quickly detected, and the process adjusted to compensate for it. This helps to improve the overall quality of a food and to reduce the amount of material and time wasted. For example, if a manufacturer were producing a salad dressing product and the oil content became too high or too low they would want to adjust the processing conditions to eliminate this problem. Traditionally, samples are removed from the process and tested in a quality assurance laboratory. This procedure is often fairly time-consuming and means that some of the product is usually wasted before a particular problem becomes apparent. For this reason, there is an increasing tendency in the food industry to use analytical techniques which are capable of rapidly measuring the properties of foods on-line, without having to remove a sample from the process. These techniques allow problems to be determined much more quickly and therefore lead to improved product quality and less waste. The ideal criteria for an on-line technique is that it be capable of rapid and precise measurements, it is non-intrusive, it is nondestructive and that it can be automated .

Finished product inspection: Once the product has been made it is important to analyze its properties to ensure that it meets the appropriate legal and labeling requirements, that it is safe, and that it is of high quality. It is also important to ensure that it retains its desirable properties up to the time when it is consumed.

Quality control for baking ingredients encompasses:

- Physicochemical parameters related to technological functionality (e.g. solids content, protein content, ash content, moisture content, particle size distribution)
- Microbiological specifications (aerobic mesophilic count, mold count, absence of pathogenic bacteria)
- Maximum or permissible levels of food contaminants (e.g. mycotoxins and heavy metals)
- Rheological tests, both fundamental and empirical (e.g. farinograph, mixolab, alveograph, RVA)
- Specialized tests (e.g. yeast gassing power, fermentable solids, enzyme level/activity)

In an ideal world a bakery would make each product with exactly the same quality characteristics, and this would satisfy customers 100% of the time. However, in the real world, bakers know that their products will have some slight variations in the production process. Bakery managers and plant staff should measure these variations and exert control over them in such a way that the consumers do not notice big variations in product quality.

Food Safety

Quality control of ingredients is the first line of defense against inherent process and ingredient variability. Generally speaking, customer complaints normally can be classified into the following categories:

- Foreign material in the finished product. This could be anything from dirt, whole wheat dough in a white pan bread, sesame seeds in a product that should not contain them, pieces of cloth, brittle plastic, glass, metal, etc. In summary, the product contains something that does not belong there.
- Violation of label declarations. This happens if a product is underweight, contains an undeclared allergen, or does not comply with labeled amounts of sodium, fat, or trans-fat.
- Shelf life issues. This could be due to the presence of mold or undesirable change in texture as in the case of stale bread.
- Off-flavors or off-aromas. This could be due to undesirable enzymatic activity or microorganisms.
- Poor product quality. This could involve breakdown of icings, melting of chocolate enrobing, bread with low volume, cakes with too open grain and tunneling, texture problems, color problems, symmetry problems.
- Physically damaged product. Smashed, leaking, change of appearance.

How often a given ingredient is tested or analyzed should be based on how critical the raw material is or how important it is for keeping product quality. For example, wheat flour and yeast should have specific quality control schedules and procedures to always have the best materials for bread production

Clean label

The clean label trend is forcing bakers to replace traditional dough conditioners with functional enzymes which can provide similar functionality and dough processability. In this case, enzymes become a critical and key ingredient that ensures the quality characteristics expected by customers. In such scenarios it would be reasonable to implement testing methods to assess enzymatic activity of amylases, oxidases, lipases and xylanases.

Quality Assurance

Quality Assurance (QA) is a set of activities used by food companies to ensure that the process by which products are developed and produced meets a set of standards and specifications. The goal of QA is to prevent defects with a focus on the process used to make the product. Tools commonly used in a QA program are process checklists, project audits, and developing standard operating procedures.

Quality Assurance Relevance

Increased incidence of foodborne illnesses, large-scale outbreaks and the emergence of new foodborne pathogens and chemical hazards led to the need for food safety programs. Near the end of the 20th century, food had become industrialized. Agricultural production, mass production of food products, and an increase in the number of food service establishments were all important drivers of the increase in food safety incidents.

Though the first registration of the ISO900 standard occurred in 1991, it was 1994 before a food manufacturing company achieved registration. ISO 9001 is a management tool that, when integrated into a process, provides documentation and objective evidence to promote consistency throughout the entire operation while focusing on continuous improvement and meeting customers' needs and expectations.

The modern approach to food safety management requires participation from government public health and food control authorities.

They are responsible for the following:

- Foresee all infrastructures and public health services that are necessary for good food safety management, such as public health laboratories, water supply, and sanitation;
- Promulgate laws and regulations that give priority to public health but can also address other societal and environmental factors;
- Enforce legislation through the provision of advice to trade and the commercial sector, inspection and monitoring of food supply, and, where necessary, prosecution of offenders;
- Provide education to caregivers, consumers, travelers, health professionals, and the public at large

The goal of quality assurance is to establish a system that will reduce and eliminate defects and risks in food manufacturing. QA can be defined as all the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality.1

As new products and processes are developed, quality analysis is performed to determine best practices for food safety. A QA program would verify suppliers, co-manage plant trials from a safety perspective, oversee production activities for best safety practices, and establish quality control steps.

The following outline exemplifies a QA management program:

- Supplier Verification
    - ✓ Allergen declaration
    - ✓ Certificate of Analysis (COA)
    - ✓ Raw material specifications
- R&D Plant Trials
    - ✓ Formula development
    - ✓ Rework use
    - ✓ Batch sheets
    - ✓ Finished product specifications
- Production

- ✓ Statistical Process Controls (SPC)
  - ✓ HACCP
  - ✓ Good Manufacturing Practice (GMP)
- Quality Control
  - ✓ Non-conforming materials or products
  - ✓ Root cause analysis
  - ✓ Quality reference card
  - ✓ Metal detection monitoring

6.1. Working safely

Employers have a responsibility under Occupational Safety and Health Act 1984 (the Act) to provide and maintain a safe working environment in which employees are not exposed to hazards. This responsibility includes providing information, instruction, training and supervision so that workers are not exposed to hazards. It also includes addressing any health risks such as occupational asthma that could arise at the workplace. Additionally, employers are required to consult with safety and health representatives (if any) and employees on safety and health matters. Employees have a responsibility under the Act to take reasonable care for their own safety and health and that of others

6.1.1 The risk management process

The Occupational Safety and Health Regulations 1996 (Regulation 3.1) require employers to carry out a risk management process at the workplace. This involves a three-step process to:

I. identify hazards;
II. assess the risks; and
III. control risks.

The third step in the risk management process is to implement control measures to eliminate or reduce the risks from hazards. An additional step is to ensure the measures are monitored and reviewed on an ongoing basis to check that they are working.

6.1.2 Manual handling in bakeries

Manual handling related injuries account for more than half of the total lost time injuries/diseases in the bakery industry. Most of the injuries occur when lifting, handling or reaching and most commonly result in sprains and strains of muscles and joints.

The Commission for Occupational Safety and Health **Code of practice: Manual tasks** outlines a three-step approach to control manual handling risks:

1. Identify all hazards associated with manual handling by looking at:
   - actions/postures;
   - load;
   - work environment and layout;
   - work organisation; and
   - skills and experience of workers.
2. Assess the risk arising from the hazards.
3. Decide on and use appropriate control measures.

Manual handling hazards and possible controls

Actions and postures

Reaching above shoulder height: Many bakeries require workers to carry out manual handling tasks above shoulder height and below knee height where baking trays, flour and other stored items are kept. When reaching for items above shoulder height, the back is arched and the arms act as long levers, making the load difficult to control and significantly increasing the risk of injuries such as falls, sprains or strains.

Heavier items and more frequently used items should be stored between knee and chest height. If this is not practical, workers should be provided with adequate means to retrieve and place items in storage areas without lifting above head/shoulder height.

Bending forward to pick up low level loads: Bending forward to pick up loads from a low level may cause strains, particularly to the lower back. To reduce the risk of injury, review storage systems in the bakery.

Holding load away from trunk: The risk of injury increases, as the load or arms are held further away from the front of the body. This is most evident when workers reach into display cabinets and ovens. Consideration should to be given to size and accessibility. For example, display cabinets are available with a side opening and completely removable doors. Using baskets in chest freezers will minimise the reaching involved.

Awkward and static postures while working at workbenches and sinks: Awkward and static postures are a hazard, especially when working at benches or sinks for long periods of time, and particularly if the surfaces have not been set at appropriate heights. Such tasks include scrubbing dishes in troughs that are too deep and preparing food at benches that are either too low or too high for the worker. It is not always practical or feasible to provide adjustable surfaces. Individuals can raise themselves up by standing on low, stable platforms to work at surfaces that are too high. Platforms on the floor should be placed in a position/area where they are not a trip hazard.

The load Moving baking trays: Moving large baking trays and tins is a high-risk task. They may be heavy, bulky and often hot. Where practical, this task should be eliminated by using trolleys or modifying the load by using smaller trays. When removing hot trays from the oven, long gauntlet gloves protect forearms.

Environment Handling stock: Many bakeries receive bulk deliveries of goods. Handling bulk deliveries is another high-risk task. Where possible, the deliveries should be placed near where they will be stored. If this is not practical, place the goods where they will not cause a slip, trip or fall hazard. When placing stock into storage, heavier items and more frequently used items should be stored between knee and chest height. If that is not practical, workers should be provided with a stepladder or safety step to reduce reaching above shoulder height. Consideration should also be given to using bulk storage bins for products such as flour. Stock levels should be managed to ensure there is adequate room to store items in shelving and storage areas.

Slips trips and falls in bakeries

Identify slip, trip and fall hazards and possible controls: Slips, trips and falls are among the most common hazards in the bakery industry. Most of the injuries occur from falls on the same level and are due to slippery floors and obstructions resulting in fractures, sprains, bruises and cuts.

Slippery floors: In the bakery industry, floors with flour and/or water spills are the greatest cause of slip, trip and fall injuries. There are several simple ways of minimising the risk of slips and falls.

Minimising spills by design: Sinks and troughs should be designed to avoid water dripping onto the floor.

Environmental design

Install non-slip floor surfaces:

- non-slip tiles - especially in areas easily contaminated by flour and water;
- floor treatments;
- non-slip mats; and
- drainage in wet areas.

Administrative controls: Cleaning floors - effective scheduling and adequate frequency. Transporting fluids - where mechanical aids are not practical, fluid should be transported in a suitable container, such as a bucket with sturdy handle and secure lid. Appropriate footwear - to be used by workers.

Changes in floor levels: There are several simple ways of minimising the risk of trips and falls as a result of changes in floor levels. These include:

Elimination: Although it is not always practical to eliminate a change in floor levels in an existing bakery, as part of a redesign or refit, eliminating this risk factor would be the preferred control option.

Environmental design: Small ramps may be an effective way of graduating the change in floor levels, to reduce the risk.

Administrative controls: Bright markings and warning signs are examples of how changes in levels may be clearly indicated. The risk of injury becomes much greater when changes in floor levels are combined with changes in surfaces, slippery floors or inadequate lighting and manual handling tasks. This risk can be controlled by ensuring that the lighting is good and the floor levels have non-slip tiles and non-slip mats. These areas should be kept clear of fluids or any obstruction that might cause a person to slip, trip or fall.

Obstructions

There are several simple ways of minimising the risk of trips and falls as a result of obstructions. These include controls such as:

Environmental design

Providing appropriate storage design and space:

- where possible, items and equipment should be stored in appropriate storage areas and not blocking walkways, emergency exits or restricting access to other items; and
- workflow should be considered when designing the access to storage areas.

Housekeeping

Make sure:

- items such as flattened cardboard boxes are not used as floor mats, as they are a slip, trip and fall hazard;
- walkways are kept clear of obstacles, especially during peak work times; and
- waste/rubbish is removed regularly from work areas.

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 (2pts each)

1. Quality refers to the attributes of the food which make it agreeable to the person who consumes it.
2. Quality involves the positive factors (color, flavor, texture & nutritive values) as well as the negative characteristics (harmful microorganisms & undesirable substances).
3. What is the aim of quality control?
4. What is the aim of principles of quality control?
5. What is quality assurance?

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

1. Which of the following is true about quality control for baking ingredients? (2pts)
   A. Physicochemical parameters related to technological functionality (e.g. solids content, protein content, ash content, moisture content, particle size distribution)
   B. Microbiological specifications (aerobic mesophilic count, mold count, absence of pathogenic bacteria)
   C. Maximum or permissible levels of food contaminants (e.g. mycotoxins and heavy metals)
   D. Rheological tests, both fundamental and empirical (e.g. farinograph, mixolab, alveograph, RVA)
   E. Specialized tests (e.g. yeast gassing power, fermentable solids, enzyme level/activity)
   F. All of the above

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

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

Answer Sheet

Score = ___________

Rating: ____________

Name: _________________________ **Date:** _______________

Test I

1. ____
2. ____
3. ____
4. ____
5. ____

Test II

1. _______________

Information Sheet 4- Identifying, rectifying and/or reporting unacceptable baked product

4.1. General Quality requirements

Bread crust; The crust shall have a golden brown colour and shall be free from blisters. The crust shall be not burned and shall be free from soot or any other foreign matter. The bread shall be evenly baked on all sides including the bottom. The crust shall not be thin and break easily. It shall not be thick, tough, or rubbery.

Volume: The bread shall have volume to weight ratio of not more than 5.75 to 1

The crumb: The crumb shall be springy, with small pores uniformly distributed throughout and with thin cell walls. It shall be free from non-porous mass, lumps of flour or salt, or any other evidence of incomplete mixing. There shall be no hollow between the crust and the crumb. The crumb shall have colour characteristic of the ingredients used. When sliced, the surface of slices shall present a uniform shade without streaks or dark patches.

Flavour: The flavour shall be characteristic of fresh, well-baked bread, free from abnormal flavour or any other objectionable flavour.

Aroma: The aroma shall be fresh and shall not be musty, metallic or sour.

Mould or Rope: The bread shall be free from indications of rope or mould.

Internal texture: The structure shall be uniform with thin-walled cells. The texture is soft and velvety, without weakness, and shall not crumble.

Taste mastication: The bread shall have a pleasant and acceptable taste. The loaf shall be free from doughtiness and not dry or tough.

Foreign matter: The bread shall be free from any foreign matter except for a small amount of added edible grains dusting bran, maize flour or rice flour from the baker's shovel which may adhere to the bottom of the loaf.

Bread product labelling

Each container of filled or coated bread shall be clearly labelled with the following information:

- Name of the material (white or whole meal bread)
- Name and address of manufacturer
- Declare any added ingredients, conditioners, improvers, preservatives, nutrients, vitamins or minerals
- Trade name
- Mass of the loaf when packed; and
- Quality mark upon approval by designated authority/ Ethiopian standard/

4.2. Identifying, rectifying and/or reporting unacceptable baked product

All out-of-specification products must be clearly identified, rectified, and reported to prevent unauthorized release. Identifying, rectifying and reporting of out-of-specification adhere to the following guidelines for control of non-conforming product.

- Specific individuals should be responsible for decisions pertinent to nonconformance, release, rework, or destruction of product.
- Products that are reported as non-conforming (undesirable particle size; present of on products mould, spoilage, micro-organim, over and under matured, un-recommended moisture conetent and etc.)
- Clearly label and isolate “on hold” products so that they are not accidentally released.
- Products should only be released after necessary controls are made and specification limits are achieved.
- If non-conformance does not affect the use or safety of the product, then corrective action completes the response.

- If non-conformance affects the safety of the product, recall is initiated with management approval.
- Determine the corrective action required to eliminate non-conformance of future product, i.e., through re-work or other means. Upon completion, re-check the quality of the product to ensure the elimination of the non-conformance and seek approval for shipment.
- Document any destruction/disposal of non-conforming product.
- Where customer-branded products not meeting specifications are sold to staff or passed on to charities, this shall be with the prior consent of the brand owner, and shall be fit for consumption, meeting the legal requirements.
- When a quality defect is found and documented, the technician assumes the third role of quality control, which is to report the defect.

This function usually contains four parts:

- Notification to others of the defect;
- Follow-up to make sure the defect does not occur again;
- Documenting how the problem was fixed; and
- Changing the processing specification as needed.

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

Hands should be washed and disinfected thoroughly before handling products at different stages of processing. Out of specification such off flavor, contaminated, discolored products should be report to responsible person. Inspecting fresh produce throughout the processing stream for field contaminants, this may not have been noticed during the incoming produce. Removing from the processing stream damaged or decomposed produce, extraneous matter, and produce that appears to be contaminated by animal feces, fuel, machine grease or oil.

Correcting mistakes

During breadmaking, there are several points where mistakes can be made. It can be difficult to find and rectify the problem as some of the factors are inter-related. The following chart helps to identify some of the common problems:

Table 1: Possible causes of external bread faults.

Possible causes	Nature of fault				
	Lack of volume	Excess volume	Lack of crust colour	Excess crust colour	Shell tops
Dough too tight, especially with tinned bread	*				*
Dough chilled during fermentation	*				*
Dough temperature too high			*		
Dough skinned during proof			*		
Dough too slack		*	*		
Dough under-ripe	*			*	*
Dough over-ripe	*		*		
Too much yeast			*		
Insufficient yeast	*			*	
Insufficient proof	*				*
Slack moulding		*			
Oven temperature too high	*			*	*
Oven temperature too low		*	*		
Too much salt	*			*	
Insufficient salt		*	*		
Over use of chemical improver	*			*	
Excess water			*		
Flour with high maltosefigure				*	
Flour with low maltose figure	*		*		*
Over-bleached flour	*				
Flour too strong	*				
Too much proof		*			
Crust formed before maximum expansion					*

N.B: * indicates presence of the fault

Table 2: Possible causes of internal bread faults.

Possible causes	Nature of fault						
	Coarse texture	**Poor crumb colour**	**Crumbly texture**	**Streaks, cores, seams, condensation marks**	**Holes in crumb**	**Dryness and rapid staling**	**Damp, clammy or close crumb**
Dough too tight, especially with tinned bread		*	*		*	*	
Dough chilled during fermentation				*	*		
Dough temperature too high		*	*	*	*	*	
Dough too slack	*	*					
Dough not properly mixed	*	*	* (over)	* (under)	*		
Dough scraps from machinery		*		*	*		
Dough felling							*
Dough under-ripe			*		*	*	*(cold dough)
Dough over-ripe		*	*			*	
Flour not sifted or blended properly				*			
Flour with low maltose content							*
Flour with high maltose content		*		*			
Too strong flour with excessive yeast					*		
Flour too strong		*			*		
Too much dusting flour or dough skinned during fermentation				*	*		
Rope disease							*(damp)
Too much yeast		*	*		*		
Insufficient yeast					*		
Too much salt			*		*		*
Insufficient salt		*	*			*	
Overuse of mineral/ chemical improver			*	*		*	
Overuse of milk or fat			*				*
Grease from dividers				*	*	*	*
Excessive grease in moulders				*			
Insufficient proof					*		
Too much proof	*	*			*		
Slack moulding	*				*		
Incorrect moulding		*		*	*		
Oven temperature too high	*				*	*	
Oven temperature too low	*	*	*		*		
Flash heat in oven					*		
Excessive top heat in oven					*		
Insufficiently baked							*
Incorrect cooling				*			

N.B: * indicates presence of the fault

Self-Check – 4	Written test

Name…………………………………………… ID……………………….. Date…….

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

Test I: Choose the best answer.

1. **Bread product labelling information shall contain**
   A. Name of the material (white or whole meal bread)
   B. Name and address of manufacturer
   C. Declare any added ingredients, conditioners, improvers, preservatives, nutrients, vitamins or minerals
   D. Trade name
   E. Mass of the loaf when packed

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

1. The crust shall have a golden brown colour and shall be free from blisters. (1pts)
2. The crust shall not be thin, thick, tough, or rubbery and break easily. (1pts)
3. The crumb shall be springy, with small pores uniformly distributed throughout and with thin cell walls. (1pts)
4. The crumb shall be free from non-porous mass, lumps of flour or salt, or any other evidence of incomplete mixing. (1pts)
5. The loaf shall be free from doughtiness and not dry or tough.(1pts)

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

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

Score = ____________
Rating: ______________

Answer Sheet

Name: ___________________________ Date: ________________

Test I

1. ________________

Test II

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

Information Sheet 5- Shutting down ovens

5.1 Introduction

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

5.2 Scheduled shutdown

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

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

5.3 Maintenance shutdown

When maintenance to the cleaning equipment is required, the equipment may need to be entered so that work can take place. The shutdown should be a scheduled or planned shutdown as per standard operating procedures where equipment is: isolated (process, mechanical and electrical), cooled and depressurized, cleaned and electric tested on a continuous basis prior to and during entry

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

✓Possible injury to be occurred

5.4 Emergency shutdown

An emergency shutdown is initiated in the event of a fire, instrument failure, power failure, unexpected hazard etc. Emergency shutdown procedures must be followed during a shutdown sequence. Where a shutdown will affect upstream or downstream process units, advanced warning must be given to the appropriate personnel to allow them to prepare for, and react to, the changing conditions. If the machine or equipment is operating, shut it down by the normal stopping procedure or with manufacturer's or industry specifications.

Self-Check – 5	Written test

Name………………………………………… ID……………………… Date…….

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

Test I

1. List types of shutdowns used. (2pts)
2. Describe what will prevent a planned process shutdown. (2pts)

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

1. Shut down must be conducted using the standard procedures established for the machine or equipment. (2pts)
2. The appropriate shut down procedures depends on the type of shut down. (2pts)
3. An emergency shutdown is initiated in the event of a fire, instrument failure, power failure, and unexpected hazard. (2pts)

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

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

Answer Sheet

Score = ___________

Rating:

Name: _________________________ Date: _______________

Test I

1. _______________
2. _______________

Test II

1. _______________
2. _______________
3. _______________

Information Sheet 6- Maintaining the work area with housekeeping standards

6.1. Maintaining work area with housekeeping

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

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

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

Self-Check – 6	Written test

Name…………………………………………… ID……………………… Date…….

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

Short Answer Questions

1. List the 10 good housekeeping rules? (10pts)
2. What are practice of segregate waste? (3pts)

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

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

Score = ___________

Rating: ____________

Answer Sheet

Name: _________________________   Date: _______________

1. ____
2. ____

Information Sheet 7- Conducting work with workplace environmental guidelines

7.1. Conducting work according with legislative reqiurement

Bread baking should be conducted according food standards code, including labeling, weights and measures legislation covering food safety, environmental management, OHS, anti-discrimination and equal opportunity. Every operator or processer has a legal and moral responsibility to ensure that baked bread offered for human consumption is safe to eat. Risks to food safety can be minimized if basic good processing and good hygiene practices are followed in processing and throughout the postharvest handling operations.

Legislative are applicable to all the bakery operators at all stages in the processing of bakery products and without prejudice to more specific requirements relating to food hygiene. The regulation reinforces the responsibility to ensure food safety and lays down general rules for the in the hygiene of food taking particular account of the following principles: primary responsibility for bakery safety rests with the baking operation-

- Necessity to ensure food safety throughout the processing chain starting from the primary production.
- Provide assurance by the baking operation that the food is fit for human consumption and maintain confidence in nationally traded bakery which cannot be stored at ambient temperature shall be under controlled conditions.
- Implementation of procedures based on the HACCP principles (Hazard Analysis Critical Control Points), fully supported with Good Hygiene Practices (GHPs) that are necessary to maintain hygienic environment throughout the food chain, suitable for the production, handling and processing of clean and safe end product, fit for human consumption.
- Ensure consumers‟ clear and transparent information through proper baking about the use and handling of the products for safe consumption.

In the processing area the rules and procedures for Food Hygiene and Handling Produce are usually documented and available for staff reference. You should be aware of the sorting and grading rules and work procedures and ensure that the rules and procedures are known, understood and implemented by all the workers in your team. In relation to sorting and grading procedures; methodology and standards are based on the type of produce, operation circumstances, (scale of operation and equipment available), Industry Good Practices and Client or market requirements.

Hazard Analysis Critical Control Point (HACCP):

HACCP allows processors/regulator to look at what happens during the process to ensure safety. Major Concepts of HACCP;

1. A preventive system of control particularly on biological hazards
2. A system approach for estimating the risk in producing a food product
3. Universally recognized system as the most effective way to prevent food borne illness
4. Science - based systematic, identified specific hazards and measures for their control to ensure food safety
5. Capable of accommodating change, such as advances in equipment design, processing procedures, or technological developments that can be applied throughout the food chain from the primary producer to the final consumer
6. Applicable to establishments that produce, process, treat, pack, trade, transport, serve, or involve in food production

Implementing Hazard Analysis and Critical Control Point (HACCP) is crucial for any food manufacturing process. A HACCP plan covers the total supply chain, from inbound logistics, through storage, processing, sanitation and maintenance to the final use by the consumer. Across the operations, it must be ensured that procedures are available for internal logistics, processing specifications, working instructions, hygiene procedures and preventive maintenance plans. These procedures must cover start-ups, shutdown and unexpected stoppages during processing. Hazard Analysis Critical Control Point (HACCP) is essential to carry out to identify the weakness of the production line and to suggest critical limits in compliance with legislation and therefore the preventive and corrective measures. Though HACCP system was designed to aim zero defect products, yet it is not feasible to achieve 100% defect free products. However, it sets a goal to minimize the associated risks during production and subsequently reduce unacceptable unsafe products. During implementation of HACCP, it is imperative to set controls at each point of the production line at which safety problems (physical, chemical and microbiological) are likely to occur. A HACCP plan is required to be in place before initiating the HACCP system. A HACCP plan consists of 5 initial steps and 7 major HACCP principles.

			Consequence/ Severity				
			How severe could the outcome be if the risk event occurs?				
			Severe	**Major**	**Significant**	**Minor**	**Insignificant**
Probability/ Likelihood	What's the chance of the risk occuring?	**Frequent**	Extreme	Extreme	Very High	High	Medium
		Likely	Extreme	Very High	High	Medium	Medium
		Occasional	Very High	High	Medium	Medium	Low
		Seldom	High	Medium	Medium	Low	Very Low
		Unlikely	Medium	Medium	Low	Very Low	Very Low

Figure 6: Severity and probability a processing step

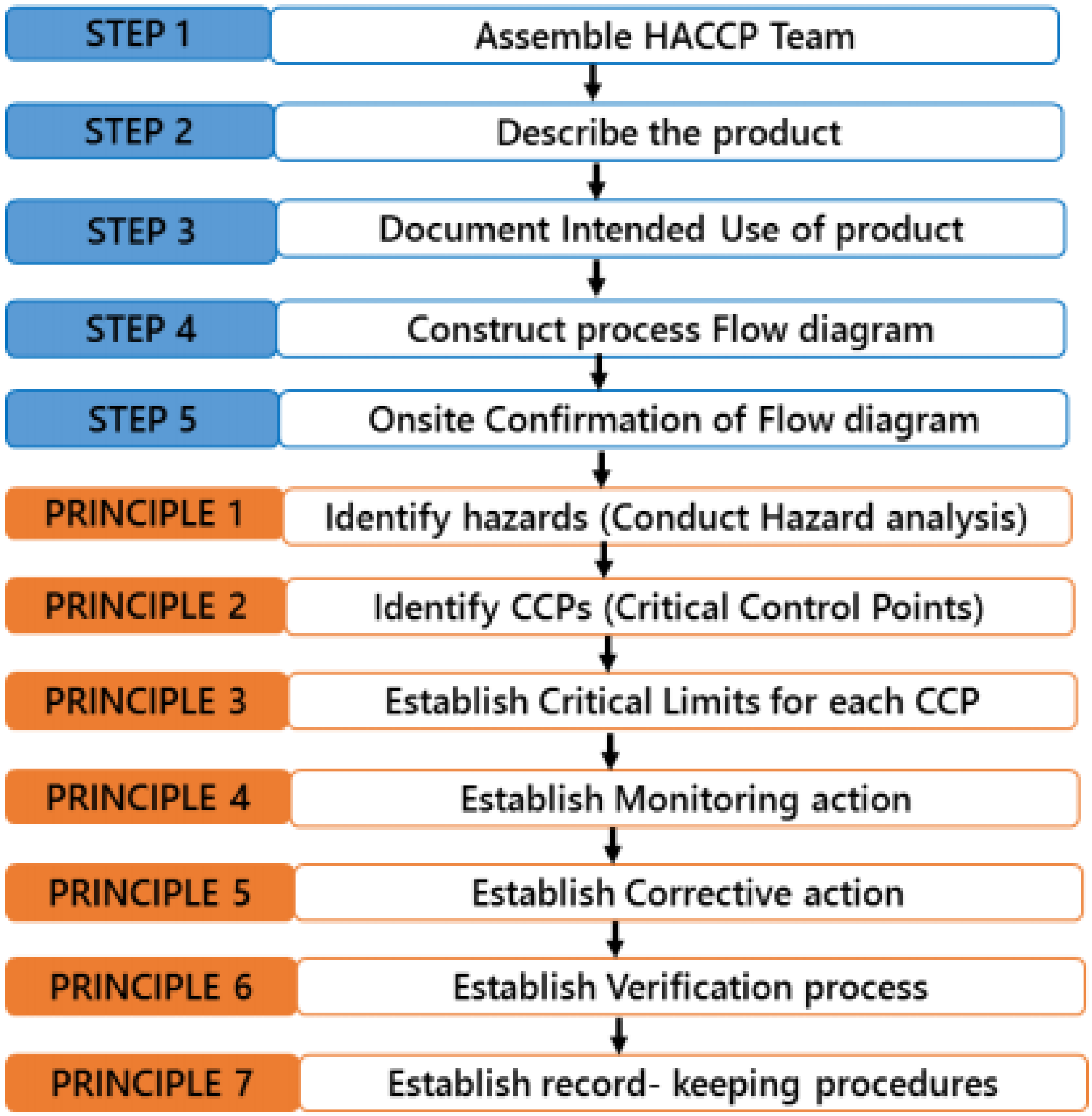

Figure 7: Seven major HACCP principles

The requirements for Sanitation Standard Operating Procedures (SSOPs) along with Good Manufacturing Practices (GMPs) & Good Hygiene Practices should be considered as PreRequisite for HACCP. Risk assessment is a critical step in a HACCP plan. Below is a template to determine what severity and probability a processing step is involved with and therefore what level of criticality is holds in the processing line.

HACCP Plan for Bread

Figure 8: Process Flow Chart for Bread

Seven (7) HACCP Principles

1. Hazard analysis
2. Identify critical control points
3. Establish Control limits
4. Monitor critical limits
5. Establish corrective actions in case of deviation from established critical limits
6. Establish verification procedure to ensure that the system is consistent
7. Establish record keeping procedures

General Hazards Characteristics

- The product contains sensitive ingredients, which can be assumed as potential sources of contamination under normal circumstances.
- The manufacturing process does not contain controlled processing steps that effectively destroy harmful bacteria.
- There is substantial potential for microbiological abuse in distribution or in consumer handling that could render the product harmful when consumed.
- Product is subject to contamination after processing and before packaging.
- No terminal heat process after packaging.

HACCP Pre-Requisite Programs

Good Manufacturing Practices (GMP): GMPs are systems put in place to ensure that food prepared in a plant is sound and free of contamination. GMPs include:

- Plant grounds and building facilities emphasize pest control;
- Equipment design provides ease in cleaning and maintenance;
- Personal hygiene practices and facilities are set;
- Storage and warehousing are free from contamination.

Sanitation Standard Operating Procedures (SSOP): SSOP are components of GMP that emphasize sanitation procedure. They include:

- Safety of water that gets in contact with food and food surfaces;
- Measures to prevent contamination;
- Employee hygiene practices;

- Control of employee health conditions that could result in contamination of food and food surfaces;
- Protection of food and food contact surfaces from adulteration with toxic and other harmful components;
- Proper labelling and storage and use of toxic; and control of pests.

Self-Check – 7	Written test

Name…………………………………………… ID……………………… Date……

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

Test I: Short Answer Questions

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

Test II: Choose the best answer

1. Good Manufacturing Practices (GMP) includes:
   A. Plant grounds and building facilities emphasize pest control
   B. Equipment design provides ease in cleaning and maintenance
   C. Personal hygiene practices and facilities are set
   D. Storage and warehousing are free from contamination
   E. All of the above
   F. None of the above
2. Sanitation Standard Operating Procedures (SSOP) includes:
   A. Safety of water that gets in contact with food and food surfaces
   B. Measures to prevent contamination
   C. Employee hygiene practices and control of employee health conditions
   D. Protection of food and food contact surfaces from adulteration with toxic and other harmful components
   E. Proper labelling and storage and use of toxic; and control of pests
   F. All of the above
3. Which one of the following is a not characteristic of general hazard
   A. The product contains sensitive ingredients, which can be assumed as potential sources of contamination under normal circumstances.
   B. The manufacturing process does not contain controlled processing steps that effectively destroy harmful bacteria.

C. There is substantial potential for microbiological abuse in distribution or in consumer handling that could render the product harmful when consumed.
D. Product is subject to contamination after processing and before packaging.
E. No terminal heat process after packaging
F. None of the above

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

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

Answer Sheet

Score = ___________

Rating: ____________

Name: _________________________ Date: _______________

Test I

1. ____
2. ____

Test II

1. _________________________
2. _________________________
3. _________________________

Information Sheet 8- Operating work with relevant policies and procedures

8.1 Conducting work with policy and procedure

Work is carried out according to company policies and procedures, regulatory and licensing requirements, legislative requirements, and industrial awards and agreements. Adaptability & scalability of best practices to improve the quality & safety standards' for bekery products can be heavily contaminated with micro-organisms and can be below standards because of the environmental and processing conditions under which they are produced. Ensuring the safety of these products, hence food safety, and comply with standards is a first step to enter global market. As a result of this, countries with well-established food safety assurance systems could export and trade their products without any barriers and become competitive in the global trade.

In Ethiopia regulatory system is very little developed and is not able to effectively support the production, supply & distribution of safe and quality products to the domestic consumers and to the export market. By large, regulating food safety is a shared responsibility of Ministry of Health, Ministry of Agriculture and Ethiopia Standards Authority. Food, Medicine and Health Care Administration and Control Proclamation No. 661/2009 and the establishment of Ethiopian Food, Medicine and Health Care Administration and Control Authority under Regulation No, 189/2010 are important milestones in institutionalizing the legal system and hence better reacting to contemporary situation. In connection with this Ethiopian Standards Authority has prepared standards, identical with ISO, for food to this end it is possible to sum up there is yet more to be done in policies and regulatory activities in assuring the quality and safety of food and food additives supplied to domestic consumers and foreign markets. Making the policies more robust and avoiding fragmented linkages among the regulatory body and help them function very well by providing legal and structural framework through formulation and benchmarking with best practice countries is widely requires public intervention.

Self-Check – 7	Written test

Name………………………………………… ID……………………… Date…….

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

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

1. Ensuring the safety of these products, hence food safety, and comply with standards is a first step to enter global market.
2. Food, Medicine and Health Care Administration and Control Proclamation No. is 661/2009.
3. The establishment of Ethiopian Food, Medicine and Health Care Administration and Control Authority under Regulation No, 189/2010 are important milestones in institutionalizing the legal system and hence better reacting to contemporary situation.

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

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

Score = ___________

Rating: ____________

Answer Sheet

Name: _________________________ Date: _______________

1. _________________________
2. _________________________
3. _________________________

Operation Sheet 1– Procedurs for pre-start checks

Objectives: to ensure the pre-start checks

Procedures

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

Operation Sheet 2– Procedures for producing brown wholemeal bread (no-time dough)

Objectives: to produce brown wholwmeal bread

Material and ingrediants

- 2.5kg strong bakers flour
- 2.5kg wholemeal flour
- 75.75g dried yeast (if fresh yeast is used, double the amount) 576g fine salt
- 57.81g granulated sugar
- 124.22g fat or margarine
- 3kg water

Procedure

1. Sift the flour, mix in the wholemeal and rub in the fat.
2. Disperse the yeast and a little sugar into a portion of water at a temperature of 35°C (approximately 5-10 times the yeasts weight in water). Stir vigorously and leave for 12 minutes for the yeast to activate.
3. Add the salt and remaining sugar into the dough water and add to the flour mixture.
4. Once the dough water is almost drawn in, add the activated yeast and continue mixing until an elasticated dough is formed.
5. Cover the dough with a damp cloth and rest for 20 minutes.
6. Divide the dough into equally weighed pieces and mould them into desired shapes.
7. Cover with damp cloths and put in a proving cabinet for final proofing.
8. Bake at 220°C for 30 minutes for a 500g loaf or 40-50 minutes for an 800g -1kg loaf.
9. Remove the bread from the oven, remove from tins and stand on cooling trays to cool.
10. Pack in paper or polythene bags depending on the length of storage time before sale or consumption.

Operation Sheet 3– Procedures for producing standard white bread

Objectives: to produce standard white bread

Material and ingrediants

- 5kg strong bakers flour
- 50.55g dried yeast (if fresh yeast is used, double this amount)
- 0.09kg fine salt
- 47.22g granulated sugar
- 50.55g bakers fat or margarine
- 2.94kg water

Procedures for baking

1. Sift the flour and mix in the fat.
2. Disperse the yeast and a little sugar into a portion of water at a temperature of 35°C (approximately 5-10 times the yeasts weight in water). Stir vigorously and leave for 12 minutes for the yeast to activate.
3. Add the salt and remaining sugar into the dough water and add to the flour mixture.
4. Once the dough water is almost drawn in, add the activated yeast and continue mixing until an elasticated dough is formed.
5. Cover with a damp cloth and rest the dough in 'bulk fermentation' for about 45 minutes.
6. Knock back the dough - lightly knead the dough - to expel the air. This can be done by mixing in a mixer for 1 minute.
7. Rest for 15 minutes (this makes the total bulk fermentation time 1 hour) then divide the dough into equally weighed pieces. Mould these into the desired shape.
8. Cover with a damp cloth and rest for 10 minutes before the final moulding.
9. Place in a steam space or proving cabinet for the final proof.
10. Bake at 220°C for 30 minutes for a 500g loaf or 40-50 minutes for an 800g -1kg loaf.
11. Cover with a damp cloth and rest the dough in 'bulk fermentation' for about 45 minutes.

12. Remove the bread from the oven, remove from tins and stand on cooling trays to cool.
13. Pack in paper or polythene bags depending on the length of storage time before sale or consumption.

Operation Sheet 4– Procedure to produce white bread

Objectives: to produce white bread - overnight dough (12-14 hours)

Dough

Material and ingrediants

- 5kg strong flour
- 3.09g dried yeast (booster)
- 0.15kg fine salt
- 0.12kg granulated sugar
- 1.35kg bakers fat/margarine
- 2.47kg water

Procedure

1. Sift the flour for the dough onto the sponge and rub in the fat.
2. Disperse the booster yeast into 5-10 times its weight of water at a temperature of 35°C. Add a little sugar. Whisk together and set aside to activate the yeast for about 12 minutes.
3. Disperse the salt and remainder of sugar into the dough water (at a temperature of 26.7°C) and add to the other ingredients.
4. Start the mixer and as the ingredients are becoming absorbed, add the booster-activated yeast water and continue mixing to obtain a stiffish dough that comes cleanly away form the side of the bowl.
5. Cover with a damp cloth and rest for about 30 minutes.
6. Knock the dough back to expel the air - knead for about 1 minute with the mixer.
7. Divide the dough into equally weighed pieces and mould into the desired shape.
8. Cover with a damp cloth and rest for 10 minutes before the final moulding.

9. Place in a steam space or proving cabinet for the final proof.
10. Bake at 220°C for 30 minutes for a 500g loaf or 40-50 minutes for an 800g -1kg loaf.
11. Remove the bread from the oven, remove from tins and stand on cooling trays to cool.
12. Pack in paper or polythene bags depending on the length of storage time before sale or consumption.

Operation Sheet 4– Procedures for producing cheese loaf

Objectives: to produce cheese loaf

- 2kg soft flour
- 62g baking powder
- 31g fine salt
- 31g dry mustard
- 480g bakers fat/margarine
- 1kg grated cheese
- 1.24kg milk

Procedures

1. Sift and mix the flour, baking powder, salt and mustard together. Rub the fat into the dry ingredients.
2. Mix in the grated cheese. Add the milk and mix to form a soft dough.
3. Divide the dough into 539g pieces and mould into balls using the minimum of dusting flour.
4. Cover with a damp cloth and rest for 10 minutes before final moulding.
5. Roll into sausage shapes of an even thickness, place on a greased tin and press down level.
6. Cover with a damp cloth and rest for a further 10 minutes.
7. Bake at 204°C for about 20 minutes. After this time, lightly sprinkle some grated cheese on the top of each loaf.

Operation Sheet 5– Fermented sweet bread

Objectives: to produce fermented sweat bread.

Material and ingrediants

- 5kg soft wheat flour
- 1.2 litres water
- 1.25kg sugar
- 0.93kg lard or vegetable oil

- 0.15kg dried yeast
- 0.15kg baking powder
- 99g salt
- 9kg eggs

Method

1. Mix together the flour and water. Mix in the sugar, fat, yeast, baking powder, salt and eggs to form a dough.
2. Cover with a damp cloth or oiled polythene and rest for 20 minutes.
3. Divide the dough into equally sized pieces according to desired shape. Place each shape on a baking tray.
4. Cover the dough pieces with a damp cloth to prevent drying out. Leave for 3 hours at a temperature of 20-24°C.
5. Bake at 180°C for 25 minutes. For large loaves, lower the temperature and bake for longer.
6. The surface should be dark brown when baking is finished.
7. Remove from the oven and cool before packaging.
8. Pack in paper or polythene bags depending on the the length of storage time before consumption.

Operation Sheet 6– Shutting down oven

Objectives: to done successful shut down procedure of oven.

The procedure to successful shut down oven

Following the steps outlined below will help ensure that oven next outage will be successful

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

Step 2: Oven operational function is determined and understood.

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

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

Step 5: Safe shut-down of oven is verified.

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

Step 7: Oven is left in clean and safe state.

LAP TEST	Performance Test

Name………………………………. ID…………… Date………………………………

Time started: ________________________ Time finished: ________________

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

Task 1: Ensure the pre-start checks
Task 2: Produce brown wholwmeal bread
Task 3: Produce standard white bread
Task 4: Produce cheese loaf
Task 5: Produce fermented sweat bread
Task 6: Preform successful shut down activities of oven

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AKNOWLEDGEMENT

We would like to express our appreciation to the TVET instructors and experts of regional TVET bureau, TVET College, and Federal Technical and Vocational Education and Training Agency (FTVETA) who made the development of this learning module with required standards and quality possible.

We wish thanks and appreciation to the representatives of BEAR II UNESCO PROJECT who covers the financial expenses, scarifying their time and commitments to develop this learning module.

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