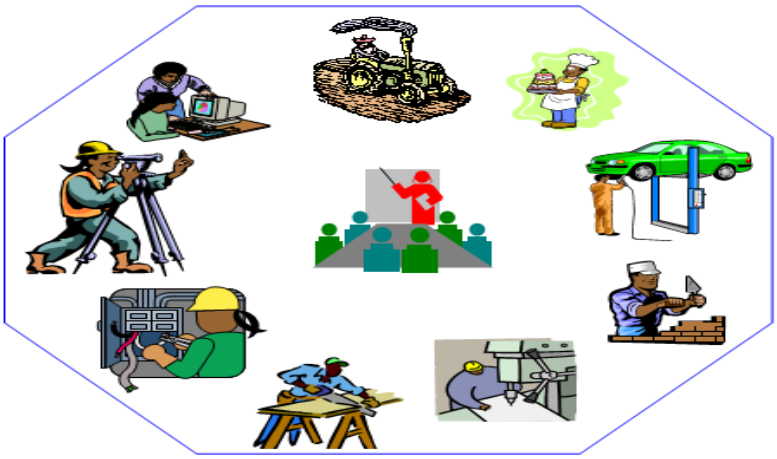
Meat and Meat Products

Processing Level

Level-III

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



Module Title:- Operating Continuous cooker

LG Code: INDMPP3 M15 LO (1-2) LG (55-56)

TTLM Code: INDMPP3 TTLM 0321

Bishoftu, Ethiopia

March 2021

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

TABLE OF CONTENTS

LG #55	LO #1- Feed cooker, Operate and monitor cooker

Instruction sheet

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

- Carrying out start-up process
- Operating cooker
- Monitoring flow into cooker
- Monitoring level in cooker
- Monitoring and adjusting temperature
- Monitoring outflow
- Identifying and complying OHS 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:

- Carry out start-up process
- Operate cooker
- Monitor flow into cooker
- Monitor level in cooker
- Monitor adjust temperature
- Monitor outflow
- Identify and comply OHS requirements

Learning Instructions:

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

Information Sheet 1- Carrying out Start-Up Process

1.1. Introduction

Meat is one of the highest expenses for foodservice operations. Selecting the right cuts of meat is just the first step. Toa get the most value for its money and to satisfy, or fill, customers' appetites, a foodservice operation must fully understand cooking techniques for meat. Tender cuts of meat become tough when they are cooked improperly. Likewise, tough cuts of meat can become tender when they are cooked correctly. Meat can be delicious and nutritious, but only when it is properly prepared.

If you have ever eaten a burned hamburger, you know what overcooking does to meat. Some dry cooking techniques will firm proteins without breaking down connective tissue. This makes meat tough. You would not want to use a dry cooking technique with a less-tender piece of meat that has a lot of connective tissue. A better choice would be a moist cooking technique. This exposes the meat to moisture and heat during cooking. Moist cooking helps to break down the connective tissue and tenderize the meat.

1.2. Terminology

Cooker and cook; Cook and Cooker are two words in the English language that are quite often confused. The word ‘cook’ refers to a person who cooks food or prepares food. On the other hand, a cooker is a kind of appliance or an apparatus used in the process of cooking.

Cooking or **cookery; it** is the art, science, and craft of using heat to prepare food for consumption. Cooking techniques and ingredients vary widely across the world, from grilling food over an open fire to using electric stoves, to baking in various types of ovens, reflecting unique environmental, economic, and cultural traditions and trends

1.3. Methods of cooking and cooker

I. **Boiling:** Boiling is a method of cooking foods by just immersing them in water at 100^0 C and maintaining the water at that temperature till the food is tender. Rice, egg, dhal, meat, roots and tubers are cooked by boiling.

Figure 1: (A) Mnual boiler and (B) electrical boiler

- **Merits:**
  - Simple method
  - It does not require special skill and equipment.
  - Uniform cooking can be achieved.
- **Dis merits:**
  - Continuous excessive boiling leads to damage in the structure and texture of food.
  - Loss of heat labile nutrients such as Vitamins B and C if the water is discarded.
  - Time consuming – Boiling takes more time to cook food and fuel may be wasted.
  - Loss of colour – water soluble pigments may be lost.

II. **Stewing:** It refers to the simmering of food in a pan with a tight-fitting lid using small quantities of liquid to cover only half the food. This is a slow method of cooking. The liquid is brought to boiling point and the heat is reduced to maintain simmering temperatures (82^0C -90^0C). The food above the liquid is cooked by the steam generated within the pan. Apple, meat along with roots, vegetables and legumes are usually stewed.

Figure 2: (A) Mnual stewer and (B) Electrical stewer

- **Merits**
  - Loss of nutrients is avoided as water used for cooking is not discarded.
  - Flavour is retained.
- **Dis merits**
  - The process is time consuming and there is wastage of fuel

III. **Pressure cooking :** When steam under pressure is used the method is known as pressure cooking and the equipment used is the pressure cooker. In this method the temperature of boiling water can be raised above 100^0C. Rice, dhal, meat, roots and tubers are usually

Figure 3: (A) medium size and (B) large pressure cooker

[https://www.youtube.com/watch?v=TWV3FbgPPXo]

- **Merit**
  - Cooking time is less compared to other methods.
  - Nutrient and flavor loss is minimized.
  - Conserves fuel and time as different items can be cooked at the same time.
  - Less chance for burning and scorching.
  - Constant attention is not necessary.

- **Dis merits**
  - The initial investment may not be affordable to everybody.
  - Knowledge of the usage, care and maintenance of cooker is required to prevent accidents.
  - Careful watch on the cooking time is required to prevent over cooking.

IV. Poaching: This involves cooking in the minimum amount of liquid at temperatures of 80^0C- 85^0C that is below the boiling point. Egg and fish can be poached.

Figure 4: poachings

- **Merits**
  - No special equipment is needed.
  - Quick method of cooking and therefore saves fuel.
  - Poached foods are easily digested since no fat is added.
- **Dis merits**
  - Poached foods may not appeal to everybody as they are bland in asset.
  - Food can be scorched if water evaporates due to careless monitoring.
  - Water soluble nutrients may be

V. Roasting: In this method food is cooked in a heated metal or frying pan without covering it.

- **Merits**
  - Quick method of cooking.
  - It improves the appearance, flavour and texture of the food.
  - Spices are easily powdered if they are first roasted.

Dis merits

- Food can be scorched due to carelessness.
- Roasting denatures proteins reducing their availability.

Figure 5: Roaster

VI. **Grilling:** Grilling or broiling refers to the cooking of food by exposing it to direct heat. In this method food is placed above or in between a red-hot surface. Papads, corn, phulkas, chicken can be prepared by this method.

Figuer 6 :(A) medium and (B) large griller

- **Merits**
  - Enhances flavour, appearance and taste of the product.
  - It requires less time to cook.
  - Minimum fat is used.
- **Dis merits**
  - Constant attention is required to prevent charring.

VII. **Microwave:** Microwaves are electromagnetic waves of radiant energy. Food placed in the oven is heated by microwaves from all directions. Moist foods and liquid foods can be rapidly heated in such ovens. Food should be kept in containers made of plastic, glass or china ware which do not contain metallic

substances. These containers are used because they transmit the microwaves but do not absorb or reflect them.

Figure 7: Microwaver

- **Merits**
  - Quick method – 10 times faster than conventional method. So loss of nutrients can be minimised.
  - Only the food gets heated and the oven does not get heated.
  - Food gets cooked uniformly.
  - Leftovers can be reheated without changing the flavor and texture of the product.
  - Microwave cooking enhances the flavour of food because it cooks quickly with little or no water.
- **Dis merits**
  - Baked products do not get a brown surface.
  - Microwave cooking cannot be used for simmering, stewing or deep frying.
  - Flavour of all ingredients does not blend well as

1.4. Safety Practices for the cooking

A cooking has many safety hazards. It contains hot stoves, electrical equipment, and sharp tools. These hazards, combined with the busy, often frantic pace in a cooking, make it very important that you work carefully while giving constant attention to the safety practices described below.

1.4.1. Lock-out procedures

Work Safe BC regulations require that all powered machinery or equipment shut down for maintenance or repair must be secured against the possibility of the equipment being accidentally turned on while being worked on. To safeguard the person working on such equipment, lock-out procedures must be posted near the equipment, and the procedures listed must be followed before repairs or maintenance can start.

Locking out a machine usually means the power feeding the machine is disconnected either by pulling a plug, placing a switch in the off position, or turning a circuit breaker to the off position. The disconnected circuit is then secured in the inoperative position by the use of a padlock. The person doing the maintenance or repair keeps the key to this lock until the work on the machine has been completed. The worker then removes the lock and the machine is again operable.

Depending on the situation, the lock might be used to secure the power switch of the machine or it might be used to lock shut the door to a circuit breaker panel where the thrown breaker is located.

If the machine is not wired into its own power circuit but simply plugs into the wall, the lock-out procedure may require that the machine be turned off with its power switch and unplugged from the power receptacle. The plug end of the machine must be kept in plain view of the repair person so no one can inadvertently restore power without the repair person’s knowledge.

Cooking machines that must be locked out before repairs or maintenance can commence include, but are not limited to, meat saws, dough mixers, meat grinders, garbage disposal systems and meat slicers.

You must be aware of the lock-out procedures that are to be followed before repairing or cleaning any machine. Lock-out procedures must be clearly posted by management near each machine.

1.4.2. Operation procedures for cooking equipment

i. Never use any machine you have not been trained to use.
ii. Pull plug or throw switch to off position before cleaning or adjusting any machine. Keep fingers, hands, spoons, etc., away from moving parts. Wait until machine stops before moving food.
iii. Check all switches to see that they are off before plugging into the outlet.
iv. Particular care must be taken when cleaning the slicing machine.
    a. First pull the plug.
    b. Turn the gauge to zero in order to cover the edge of the blade
    c. Do not touch the edge of the blade
    d. Clean the blade from the center out.
    e. Clean the inside edge of the blade with a stick that has a cloth wrapped around one end.
v. Do not start a mixer until the bowl is locked in place and the attachments are securely fastened.
vi. When using a mixer, turn off motor before you scrape down the sides of the bowl.
vii. Use a wooden or plastic plunger rather than your hands or spoons to push meat down into a meat grinder.
viii. Keep your hands to the front of the revolving bowl when operating the food cutter. This is one of the most dangerous pieces of equipment in the commercial kitchen.
ix. Never start a machine until you are sure all parts are in their proper places. If it is a machine that operates with gears, check the gear position.
x. You must be aware of the lock-out procedures that are to be followed before repairing or cleaning any machine. Lock-out procedures must be clearly posted by management near each machine.

xi. When using electrical power equipment, always follow the manufacturer's instructions and recommendations. Do not wear rings, a wristwatch, or a tie when operating electrical power equipment.

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 the at least three types of meat cookers? (1pts)

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

2. Cook and Cooker are two words in the English language that are quite often confused? (2pts)

3. Microwaves are electromagnetic waves of radiant energy? (2pts)

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

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

Score = _____

Rating: _____

Information Sheet 2– Operating cooker

2.1. Basic principles of cooking

2.1. 1. purpose of cooking

- To make its maximum value available in palatable form
- To develop and enhance flavor
- To improve its digestibility
- To increase palatability by improving its color, texture and flavor.
- To destroy pathogenic organisms and substances found in row foods

Foods are composed of:

- Proteins
- Fats
- Carbohydrates
- Water

Foods are composed of small amounts of other compounds such as:

- Minerals (including salt)
- Vitamins
- Pigments (coloring agents)
- Flavor elements

I. Carbohydrates

- **Starches and sugars are carbohydrates**; both of these compounds are present in foods in many forms and can be found in:
  - Fruits
  - Vegetables
  - Grains
  - Beans
  - Nuts
  - Meats and fish contain a small amount of carbohydrate

Caramelization and Gelatinization are the two most important changes in carbohydrates caused by heat.

- **Caramelization**: the browning of sugars.
- **Gelatinization:** occurs when starches absorb water and swell.
  - Acids inhibit gelatinization.
- **Fiber**: a group of complex substances that give structure and firmness to plants.

- Fiber cannot be digested.
- The softening of fruits and vegetables in cooking is, in part, the breaking down of fiber.
- Acids and sugar make fiber firmer.
- Baking soda (and other alkalis) makes fiber softer.

II. Proteins

- **protein is a major component of:**
  - Meats
  - Poultry
  - Fish
  - Eggs
  - Milk and milk products
  - It is present in smaller amounts in nuts, beans, and grains**.**
- Proteins consist of long chains of components called amino acids.
- These chains normally form tight coils.
- As proteins are heated, the coils gradually unwind.
- At this point, the protein is said to be denatured.

- **Coagulation**
  - Protein coils unwind.
  - Proteins become attracted to each other and form bonds.
  - The coagulated proteins form a solid network of bonds and become firm.
  - Exposure of proteins to excessive heat toughens them and makes them dry.
  - Most proteins complete coagulation or are cooked at 160°-185°F (71°-85°C).
- **Maillard Reaction**
  - Occurs when proteins are heated to about 310°F (154°C).
  - The amino acids in the protein chains react with the carbohydrate molecules and undergo a complex chemical reaction.
  - The result is that they turn brown and develop richer flavors.
  - Takes place only on the dry surface of the food.
- **Connective Tissue**
  - Special proteins that are present in meats.
  - Some connective tissues are dissolved when cooked slowly with moisture.

- **Acids, such as lemon juice, vinegar, and tomato products, have two effects on proteins:**
  - They speed coagulation.
  - They help dissolve some connective tissues.

III. Fats

- **Fats are present in:**
  - Meats
  - Poultry
  - Fish
  - Eggs
  - Milk and milk products
  - Nutsand whole grains
  - Fruits and vegetables (to a lesser extent)
  - Fats are also important as cooking mediums, as for frying

- Can be either solid or liquid at room temperature.
- Liquid fats are called oils.
- When solid fats are heated, they melt, or change from solid to liquid.
- The melting point of solid fats varies.
- When fats are heated, they begin to break down.
- Smoke point: The temperature at which fats deteriorate rapidly and begin to smoke.
  - Smoke point varies by type of fat.
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IV. Minerals, Vitamins, Pigments, and Flavor Components

- Important to:
  - The nutritional quality of the food
  - Food's appearance and taste
- Some of these components are soluble in water, and others are soluble in fats.
- All of these components may be leached out, or dissolved away, from foods during cooking.
- Select cooking methods that preserve, as much as possible, a food's nutrients, taste, and appearance.

V. Water

- Nearly all foods contain water.
- Water exists in three states: solid (ice), liquid, and gas (water vapor or steam).
- At sea level, pure liquid water becomes solid, or freezes, at 32°F (0°C) and turns to steam at 212°F (100°C).

2.3. Heat transferring

2.3.1. what is Heat?

- It is a toms or molecules.
- When a substance absorbs heat, its molecules move faster.
  - In liquids and gases, the molecules move more quickly from place to place and bounce off each other more frequently.
  - In solids, the molecules stay mostly in place, but they vibrate with more energy.
- Heat must be transferred from a heat source to and all throughout the food in order for it to be cooked. Heat is transferred in three ways:
  - **Conduction, Convection and Radiation**

A. Conduction

- Occurs in two ways:
  I. When heat moves directly from one item to something touching it.

II. When heat moves from one part of something to an adjacent part of the same item.

Figure 8: conducting

B. Convection

- Occurs when heat is spread by the movement of air, steam, or liquid (including hot fat). Convection is the process that carries the heat from the heat source to the food. There are two kinds of convection:

I. Natural

- Hot liquids and gases rise, while cooler ones sink.

II. Mechanical

- In convection ovens and convection steamers, fans speed the circulation of heat.

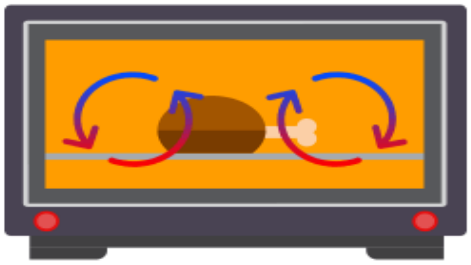


Figure 9: convecting

C. Radiation

- Radiation occurs when energy is transferred by waves from a source to the food.
- These waves are changed into heat energy when they strike the food being cooked.
- Infrared
  - ➢ Broiling is the most familiar example of infrared cooking.
- Microwave

- The radiation generated by the oven penetrates part way into the food where it agitates the molecules of water.
- The friction this agitation causes creates heat, which cooks the food.

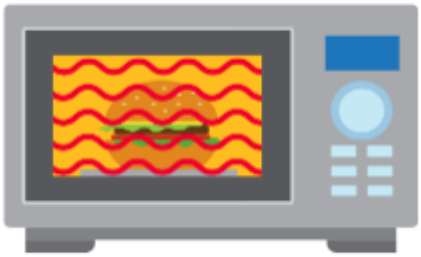


Figure 10: Radating

2.4. Heat managments

2.4.1. Doneness and Cooking Times

- We say a food is “done” when two things have happened:
    a. The interior temperature has risen to the desired degree.
    b. The desired changes have taken place in the food.
- The time it takes to achieve doneness is affected by three factors:
    I. Cooking temperature
    II. The speed of heat transfer
    III. Size, temperature, and individual characteristics of the food

2.5. pressure cooker operation

When you think of pressure cooking, you may envision exploding pots of stew that ended up on the ceiling of your grandma's cooker. You will be happy to know that today this accident is non-existent due to safety features included on each pressure cooker. With these added safety features and a few general safety tips you will be on your way to delicious fool proof cooking [https://www.youtube.com/watch?v=YEhvpJT0_rI/].

- Never over fill the pressure cooker. The pressure cooker releases excess pressure automatically to keep the pressure constant inside. If the cooker is too full these parts cannot function properly.
- Never fill the pressure cooker more than 2/3 full (for most foods). When cooking foods that expand significantly like rice, beans (dried vegetables), grains, and

soups do not fill the cooker more than 1/2 full and follow the recommended instructions for cooking these items in your specific owner's manual.

- Some food foams, froth, and sputter so much that they should be cooked with caution or not at all in the pressure cooker. These foods include things such as applesauce, cranberries, rhubarb, split peas, pearl barley, oatmeal or other cereal, noodles, macaroni, or spaghetti. If you want to cook these types of foods, use a recipe designed for a pressure cooker and follow specific instructions to safely cook these foods.
- Replace the sealing ring and overpressure plug. Replace the overpressure plug if it becomes hard or when replacing the sealing ring. Replace the sealing ring if it becomes hard or soft and sticky. If water is dripping down the sides of the cooker and it is not coming up to pressure, this is a good indication you may need to replace the sealing ring.
- Always look through the vent pipe before closing the cooker to make sure it is clear. Make sure no food or particles are stuck inside it. If the vent pipe is blocked, it cannot function as it should and thus cannot relieve excess pressure. This may cause pressure to build to unsafe levels.
- Keep an eye on the pressure regulator. When the pressure has built up, it will start rocking. Then turn down the heat. If you keep the heat on high the pressure will continue to build. The goal is to maintain high pressure with as little heat as needed.
- Read the instructions that came with the model of pressure cooker you are using and be sure you know the proper way to operate your specific model. If you bought the cooker used or no longer have the instruction manual, check online. You most likely will be able to find it there.
- Make sure pressure is released before opening the lid. (As a safety feature most modern pressure cookers will be automatically locked until pressure is low enough to safely remove the lid). You can reduce pressure by letting the pressure cooker sit (natural release), with the manual release system or by running cool water over the pressure cooker (quick release.)

Pressure cooker recipes usually state which way to release pressure for that particular recipe. Be sure to follow the instructions specified by the recipe to get perfectly cooked food.

- Always use cooking liquid. If an empty pressure cooker is left on a hot burner or if a cooker boil dry and is left on a heated burner, the cooker will overheat excessively causing possible discoloration and warping of the cooker. Any liquid will work in the pressure cooker including bouillon, fruit juices, and water. You will need much less liquid than in a regular recipe, but you must have some type of liquid so the cooker can build up steam.

2.6. Operating Microwave, Grill & Convection Oven (NN-CF760M)

Figuer 11: Micrwave(NN-CF760M)
[https://www.youtube.com/watch?v=-3XBM0-jaYQ}

2.6.1. Controlling programs

A. Control and operation procedures

Clock Setting:

- **Press Clock Button Once**
  "SET TIME" will appear in the display window and the colon starts to blink.
- **Enter the time by turning the Time/Weight Dial.**
  Enter time of day by using Time/Weight Dial e.g. 13.25pm (24 hr clock).
- **Press Clock Button.**
  The colon stops blinking and the time of day is entered.

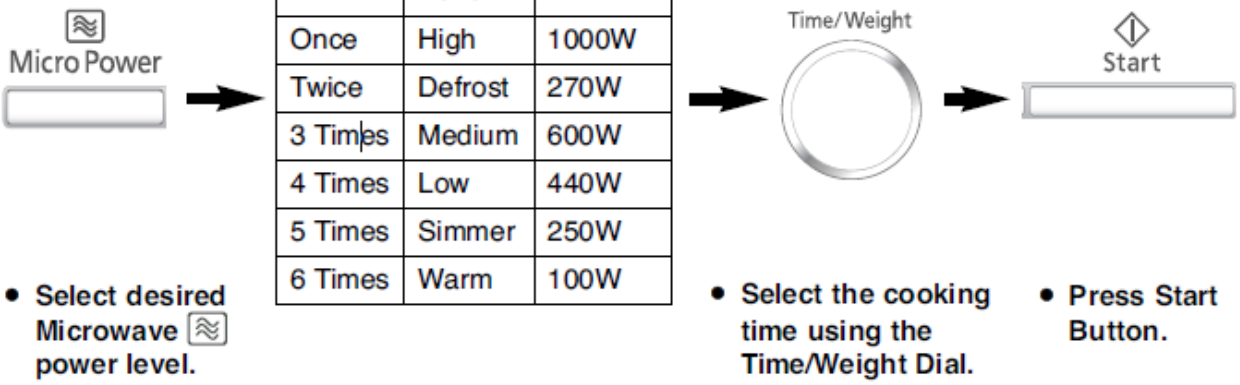
NOTE:

1. To reset the time of day repeat all the above steps.
2. The clock will keep the time of day as long as the oven is plugged in and electricity is supplied.
3. **This is a 24 hour clock.**

B. Microwave Cooking and Defrosting

There are 6 different microwave power levels available.
Do not place food directly on the ceramic plate. Place on glass dish supplied with the oven or use your own dishes, plates or bowls directly on the ceramic plate.

Selecting Microwave Power Level:



Press	Power Level	Wattage
Once	High	1000W
Twice	Defrost	270W
3 Times	Medium	600W
4 Times	Low	440W
5 Times	Simmer	250W
6 Times	Warm	100W

- Select desired Microwave power level.
- Select the cooking time using the Time/Weight Dial.
- Press Start Button.

C. Auto Weight Defrost - Chaos Defrost

With this feature you can defrost frozen foods according to the weight. Select the category and set the weight of the food. The weight starts from the minimum weight for each category.

- Press the Chaos Defrost Button.
  Once bread
  Twice Mince/chops
  Three times meat Joints.
- Set the weight of the food by using the Time/Weight Dial.
- Press Start Button.

Program	Weight Range	Suitable
1 Bread	100 - 900g	Bread and rolls. Place on a plate. Turn at beep. See standing times on page 37.
2 Mince/Chops	200 - 1200g	Small pieces of meat, minced meat, chicken portions, steaks, chops. Place on a plate or shallow dish. Turn at beeps. See standing times on pages 35-36.
3 Meat Joints	400 - 2000g	Whole chicken, meat joints. Place on a plate on an upturned saucer. Turn at beeps and shield. See standing times on pages 35-36.

2.6.2. General Guidelines

- **Piercing;** The skin or membrane on some foods will cause steam to build up during cooking. These foods must be pierced or a strip of skin should be peeled off before cooking to allow the steam to escape. Eggs, potatoes, apples, sausages etc, will all need to be pierced before cooking. DO NOT ATTEMPT TO BOIL EGGS IN THEIR SHELLS.

- **Moisture Content;** Many fresh foods e.g. vegetables and fruit, vary in moisture content throughout the season. Jacket potatoes are a particular example of this.

For this reason, cooking times may have to be adjusted throughout the year. Dry ingredients e.g. rice, pasta, can dry out further during storage and cooking times may differ from ingredients freshly purchased

- **Cling film;** Cling film helps keep the food moist and the trapped steam assists in speeding up cooking times. However, it should be pierced before cooking, to allow excess steam to escape. Always take care when removing cling film from a dish as the build-up of steam will be very hot. Always purchase cling film that states on the packet “suitable for microwave cooking” and use as a covering only. Do not line dishes with cling film. Do not cover foods when cooking by COMBINATION, CONVECTION or GRILL.
- **Dish Size;** Follow the dish sizes given in the recipes, as these affect the cooking and reheating times. A quantity of food spread in a bigger dish cooks and reheats more quickly.
- **Quantity;** Small quantities cook faster than large quantities, also small meals will reheat more quickly than large portions.
- **Density;** Porous airy foods heat more quickly than dense heavy foods.
- **Shape;** Even shapes cook evenly.
- **Arranging;** Individual foods e.g. chicken portions or chops, should be placed on a dish so that the thicker parts are to the outside.
- **Spacing;** Foods cook more quickly and evenly if spaced apart. NEVER pile foods on top of each other.
- **Ingredients;** Foods containing fat, sugar or salt heat up very quickly. The filling may be much hotter than the**;** pastry. Take care when eating. Do not overheat even if the pastry does not appear to be very hot.

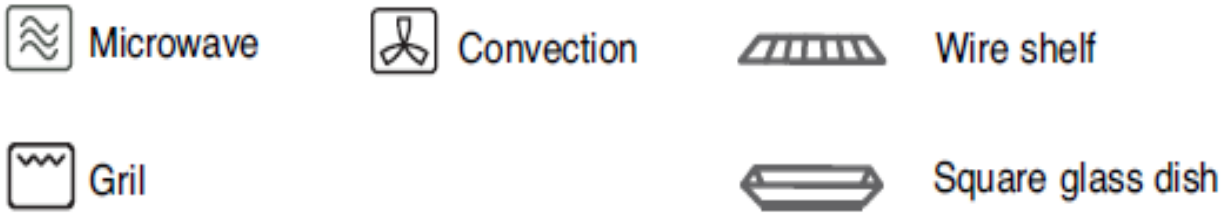
- **Starting Temperature;** The colder the food, the longer it takes to heat up. Food from a fridge takes longer to reheat than food at room temperature. Food temperature should be between 5-8^{o}C before cooking.
- **Turning and Stirring;** Some foods require stirring during cooking. Meat and poultry should be turned after half the cooking time.

- **Checking Food;** It is essential that food is checked during and after a recommended cooking time, even if an AUTO PROGRAM has been used (just as you would check food cooked in a conven tional oven). Return the food to the oven for further cooking if necessary.
- **Covering;** Cover foods with microwave cling film or a self-fitting lid. Cover fish, vegetables, casseroles, soups. Do not cover cakes, sauces, jacket potatoes, pastry items. Please refer to cooking charts and recipes for more information.
- **Liquids;** All liquids must be stirred **before, during and after heating**. Water espe cially must be stirred before and during heating, to avoid eruption. Do not heat liquids that have previously been boiled. DO NOT OVERHEAT. Stir before serving.
- **Cleaning;** As microwaves work on food particles, keep your oven clean at all times. Stubborn spots of food can be removed by using a branded oven cleaner, sprayed onto a soft cloth. Always wipe the oven dry after cleaning. Avoid any plastic parts and door area. Customers should not spray directly into the cavity. The catalytic lining at the back of the oven is self-cleaning. See page 12 point 4.
- **Auto Weight Cook Programs;** This feature allows you to cook or reheat most of your favorite foods by setting the weight only. The oven determines the Microwave power level and/or Combination setting, then the cooking time automatically. Select the category of food and then just enter the weight. Only enter the weight of the food. Do not include the weight of any added water or the container weight.

eg.

- Press the Auto Weight Program Button to select the desired program.
- Set the weight of food by using the Time/ Weight Dial.
- Press Start Button. The display reminds you which accessory to use and which cooking modes are in use.

When you select an automatic program symbols will appear in the display to show the cooking mode that will be used and the accessories that are needed. See below to identify the symbols: -



2.6.3. Guidelines for Use

The Auto Weight Programs are designed to take the guesswork out of cooking or reheating your food. They must ONLY be used for the foods described.

I. Only cook foods within the weight ranges described (see table below).
II. Only use the accessories as indicated on pages 60-63.
III. DO NOT cover food unless stated. Combination auto programs use a Combination of Microwave and Grill and/or Convection and covering will prevent the food browning. The heat of the grill will also melt any plastic covering
IV. Most foods benefit from a STANDING time after cooking on an Auto Program, to allow heat to continue conducting to the centre.
V. To allow for some variations that occur in food, check that food is thoroughly cooked and piping hot before serving.
VI. ALWAYS weigh the chicken for the whole chicken Auto program. DO NOT rely on the packet weight.

2.6.5. Auto Weight Cook Programs

- **Chicken Pieces (with Bone);** To cook FRESH chicken pieces. Place chicken, skin side up, on glass dish on wire shelf in lower shelf position. Press chicken button twice. Enter weight. Take care with hot juices. Stand for 5 minutes.

Figure 12: **Chicken Pieces**

- **Chilled Pizza;** For reheating and browning chilled, purchased pizza. Remove all packaging and place on wire shelf in lower shelf position. Press pizza button once. Enter weight. Press START.

Figure 13: **Chilled Pizza**

- **Frozen Pizza;** For reheating and browning frozen, purchased pizza. Remove all packaging and place on wire shelf in lower shelf position. Press pizza button twice. Enter weight. Press START. Please note this program is not suitable for very deep pan pizzas.

Figure 14: **Frozen Pizza**

2.6.6. Recipes

- **Meat & Poultry Defrosted joints; If** the meat has previously been frozen, ensure it is properly thawed before cooking. Defrosted joints of meat must be allowed to STAND for up to an hour before cooking to ensure the centre is fully defrosted.
- **Fat;** Large amounts of fat absorb microwave energy and can cause the meat next to it to overcook. Always choose meat that isn't excessively fatty. Braised and stewed meat cooked in a microwave has a slightly firm texture and therefore it is essential to purchase good quality meats.
- **Standing time;** Meat and poultry joints require a minimum of 15 mins. STANDING TIME. Roast meat is always easier to carve after STANDING and the meat will continue to cook during the STAND TIME.
- **Turning;** Joints and poultry should be turned over halfway through cooking.
- **Roasting bags;** Roasting bags are useful when split up one side to tent a joint for roasting by microwave and time. Do not use the metal twists supplied when operating with microwave.

I. Chicken Casserole

Ingredients

- 4 x 225g (8oz) boneless skinless
- chicken breasts, cut into small
- chunks
- 50g (2oz) plain flour
- 15ml (1tbsp) oil
- 15g (½oz) butter
- 1 garlic clove, crushed
- 4 shallots, chopped
- 150g (5oz) mushrooms, sliced
- 15ml (1tbsp) Dijon mustard
- 200ml (7fl.oz) hot chicken or
- vegetable stock
- 200ml (7fl.oz) dry white wine
- 225g (8oz) baby new potatoes,
- halved
- 225g (8oz) baby carrots halved
- 100g (4oz) asparagus tips
- 100g (4oz) frozen broad beans
- 45ml (3tbsp) double cream
- 30ml (2tbsp) mixed fresh parsley

- and tarragon, chopped
- crusty bread, to serve

Dish: 3 litre (6pt) large casserole with lid; Coat chicken with flour and place in fridge. Place oil, butter, garlic, shallots and mushrooms into casserole. Place on base of oven and cook on HIGH MICROWAVE for 3 mins. Stir in Dijon mustard and add chicken. Then stir in stock and wine. Add potatoes and carrots. Cover casserole, place on base of oven and cook on CONVECTION 160°C + WARM MICROWAVE for 1 hr stirring halfway. Stir in asparagus, broad beans and cream and cook on CONVECTION 160°C + WARM MICROWAVE for a further 30 mins. Stir in herbs and serve with crusty bread.

II. Sticky Ribs

Ingredients

- 1kg (2lb2oz) pork spare ribs
- 150ml (¼pt) water
- **For the glaze**
- 150g (5oz) orange marmalade
- preferably shred less or fine shred
- 25g (1oz) dark muscovado sugar
- 100ml (4fl.oz) fresh orange juice
- 5cm (2inch) piece fresh root ginger,
- peeled and coarsely grated
- 75ml (5tbsp) tomato ketchup
- 30ml (2tbsp) white wine vinegar

Dish: 20 x 25 cm (8 x 10 inch) rectangular dish, large bowl Oven Accessory: no accessory then wire shelf in lower position. Place the ribs in a single layer in dish with the water. Cover and place on base of oven and cook on MEDIUM MICROWAVE for 10 mins. Drain. Meanwhile, mix together all the ingredients for the glaze in a large bowl. Place on base of oven and cook on HIGH MICROWAVE for 5 mins. Pour glaze over ribs and place dish on shelf. Cook on Combination: 230°C + GRILL 3 + LOW MICROWAVE for 20-25 mins. Turn halfway and baste.

III. Spicy Lamb Tagine

Ingredients

- 10ml (¾tbsp) ground ginger
- 3ml (½tsp) coarsely ground black
- pepper
- 8ml (1½tsp) ground cinnamon
- 10ml (¾tbsp) turmeric
- 15 ml (1tbsp) paprika
- 3ml (½tsp) chilli powder/flakes
- 800g (1lb12oz) cubed boneless
- lamb
- 30ml (2tbsp) oil
- 300g (11oz) onions, chopped
- 2 crushed garlic cloves
- 3ml (½tsp) salt
- 150g (5oz) sliced carrots
- 150g (5oz) ready to eat dried
- apricots, chopped
- 40g (1½oz) sultanas or seedless
- raisins
- 65g (2½oz) toasted flaked almonds
- 10ml (¾tbsp) honey
- 150 ml (¼pint) tomato juice
- 400g (14oz) can chopped tomatoes
- 300ml (½pint) vegetable stock

Dish: 3 litre (6pt) large casserole with lid; Put spices into bowl and mix well. Add lamb and evenly coat with spices. Place oil, onions and garlic in casserole. Place on base of oven and cook on MEDIUM MICROWAVE for 5 mins. Add lamb mixture and mix thoroughly. Stir in remaining ingredients and cover. Cook on CONVECTION 160°C + WARM MICROWAVE for 1-1 ½ hours or until tender, stir halfway.

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

1. List the three ways of heat transferring? (1pts)

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

2. It is not recommended over fill the pressure cooker? (3pts)
3. Conduction is not the heat moves directly from one item to something touching it? (3pts)

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

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

Score = _____

Rating: _____

Information sheets 3- Monitoring flow into cooker

3.1. Preventing and Detecting Foreign Matter in Foods

Food safety is important throughout the food flow process. Food safety concerns are different at each stage of the food flow process. We must be careful every time we handle food. Food safety is something we need to be concerned about at every step in the food-preparation process. Food flow considers every step, from receiving food through reheating food for service.

There are about 12 common foreign substances found in food as glass, metal, stones, wood, jewelry, insects, insulation, bone, plastic, personal effects, bullets, and needles. Any of these could cause injury and thus pose a hazard, but most are routinely removed by standard operations in food processing.

i. **Glass.** Glass chips may be created by breaking of glass containers or by accidental breaking of light fixtures or windows. Glass containers are routinely cleaned before filling, and filling lines are designed to prevent jams and bottle-to-bottle contact.
ii. **Metal.** Metal contamination may come from metal-to-metal wear, loose machine parts, staples, broken screens, wire snipped during maintenance, tools, and broken structural members
iii. **Stones.** Field stones can be a common contaminant of many raw materials, especially cereal grains. Special equipment for cereals and other seeds rely on size and density differences to remove field stones, so they rarely are found in foods.
iv. **Wood.** A common source of wood contamination is from pallets, widely used in shipping raw materials and finished goods. Pallets should be kept in good condition, and many plants have a special area for repairing pallets.
v. **Jewelry.** Jewelry gets into food by falling from workers or visitors. The obvious and common practice is to forbid wearing of jewelry in food-contact areas.

vi. **Insects.** Many foods, such as grains, are almost always contaminated by insects. Some are routinely fumigated with chemicals, but the list of acceptable agents is reduced because most are toxic or may threaten the ozone layer.

vii. **Insulation.** Fiberglass and polystyrene foam are common insulation materials found in food plants and therefore potential sources of contamination.

viii. **Bone.** Bone can be found in any meat or meat-containing product and can be difficult to detect. Often meat is ground, so bone chips are also relatively small and more of a nuisance than a hazard.

ix. **Personal Effects.** These may include pens and pencils falling from shirt pockets, tools, notebooks, coins, and other objects. Good practice is to forbid anything loose above the waist.

x. **Needles.** Needles get into meat when an animal twitches while receiving an injection from a veterinarian and the needle breaks off.

3.2. Detection and Removal Methods

Preventing foreign matter contamination of foods depends on understanding the source of each potential material and taking appropriate steps to prevent contamination. Even after installing such steps, most manufacturers rely on some final inspection to ensure safe and unadulterated food. The three instrumental methods of detecting foreign matter are potentiometric (conventional metal detection, using the same principle used in airline passenger screening), X-ray, and optical sorting. Young says that X-ray is quickly becoming almost an industry standard because it can detect contamination by nonmetallic materials, such as bone and glass.

In addition to detecting nonmetallic contaminants, X-ray is often used in place of a metal detector, where metallic packaging (e.g., foil or metallized film) prevents use of a conventional metal detector or seriously compromises its sensitivity. A common example would be pies on aluminum foil trays, or cookies in metallized film bags.

Also, some products are so conductive that the sensitivity of a metal detector (especially to stainless steel) is unacceptable. X-ray detects only density differences and is not influenced by product conductivity, so it is becoming more commonly used as a “better metal detector.” Pipeline X-ray systems have replaced metal detectors at a tomato sauce producer, and X-ray is increasingly becoming of interest to meat and cheese processors as well.

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 at least four food foreign materials? (4pts)

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

2. Food safety concerns are different at each stage of the food flow process? (2pts)
3. Potentiometric (conventional metal detection), X-ray, and optical sorting are) the three methods to detecting fat contents of meat meal? 2pts)

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

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

Score = _____

Rating: _____

Information sheet 4- Monitoring level in cooker

4.1. Introduction

The nutritive value of food depends not only upon what and how much is consumed but also how it is prepared. Given that food is unlikely to be eaten unless it is appetising, its preparation is very important to maintaining good nutrition. However, the process of preparing and cooking food changes, not only its appearance and texture, but also its nutrient content and the availability of those nutrients. In this portion we will assess the way in which nutrients are affected by the variety of processes that occur during the growth of foods, harvest, processing, storage, preparation and cooking. This will be followed by an examination of diet planning and assessment and the nutrient requirements of special needs groups.

Cooking involves the application of heat using moist or dry methods cooking might (in the process) increase palatability and appearance of food by:

- Enhancing and conserving natural flavours
- Blending flavours (e.g. in cakes, casseroles etc.)
- Producing the most suitable colour, form and texture
- Improve digestibility - For example tough meat should be more tender and easier to chew after cooking.

Add variety to the diet - In terms of taste, appearance, aroma and texture and so encourage foods to be eaten. Cooking can also improve the safety of food this is achieved by destroying pathogenic microorganisms. It can also bring about changes in the nutrient value of food for example:

- Some fat is absorbed when foods are fried increasing their energy value.
- In grilling some fat may be lost.
- Nutrients may be lost by chemical breakdown or by being leached into cooking waters.
- Cooking may enhance or degrade the availability of different nutrients.

Cooking may therefore affect the nutrient value of food either beneficially, or negatively.

4.2. Overcooking

Overcooking your food isn't as simple as just plain burning it. Cooking food over a certain temperature has been linked to many health risks, some far more serious than others. Here are three of the main reasons that you should be careful about overcooking your food. You're most likely familiar with the negative health consequences associated with undercooking your food, such as the intake of harmful bacteria such as E. coli, salmonella, and staphylococcal infections, particularly with respect to animal products such as meat, poultry and fish, but few people have ever considered the risks associated with overcooking your food.

Many people would be surprised to find that, in fact, nutritional experts have urged caution with regard to overcooked foods, suggesting that they may actually increase our risk of developing cancer, and that people may even be losing vital nutrients when their foods are overcooked. Keep reading to find four major reasons why you should be more cautious about eating overcooked foods.

4.3. Impairment of Proper Digestion and Metabolization

Discoveries concerning the ways in which cooking food over a certain minimum temperature affects the biochemical content of the blood. The researchers found that processed and overcooked foods both resulted in a marked increase in the concentration of white blood cells, whereas the consumption of lightly cooked or unprocessed foods had no effect on white blood cell count. This increase in white blood cells is referred to as digestive leukocytosis. This condition reflects the same stress response induced by the body in reaction to infections and inflammation.

The scientists found that the greater the degree of overcooking, the greater the increase in white blood cell concentration. The research indicates that the body has a far more difficult time digesting overcooked food compared to raw or lightly cooked foods. The longer food is cooked, particularly at high temperatures, the longer it remains in the gut, as the digestive tract takes longer to break down and absorb nutrients at the cellular level.

I. Increased Risk of Cancer

Foods cooked at high temperatures over long periods of time, especially meat products, release chemicals known as heterocyclic amines (HCAs) and polycyclic aromatic hydrocarbons (PAHs) which have well established carcinogenic properties. Meats that are charred or exposed to smoke during the cooking process contain especially high concentrations of HCAs and PAHs. Scientific research has established a strong correlation between overcooked meats and numerous forms of cancer. Clinical trials on animals fed with food containing high concentrations of HCA quickly developed tumors of the skin, lung, breast, prostate, and liver.

A crylamide has only been found to develop in foods heated to temperatures over 120 degrees Celsius (248 degrees Fahrenheit), and concentrations of this harmful chemical have been found to increase the longer foods are kept at high temperatures. The World Health Organization has expressed “major concern” over the risk of acrylamide consumption. Studies have shown a strong correlation between levels of dietary acrylamide intake and several types of cancer, including cancers of the breast, kidney, and esophagus.

II. Loss of essential nutrients

Some vitamins are highly temperature sensitive. In particular, the vitamins thiamine, niacin, and folate can be destroyed due to overexposure to heat. This means that periods of prolonged overcooking result in steadily depleted amounts of vitamins in food. This is especially true with respect to green vegetables.

III. Overcooked foods promote chronic ailments

The development of a strain of intestinal fungus known as candida which has been known to cause frequent stomach upset has been associated with overcooked foods. This is caused by insufficiently digested food particles lingering in the intestinal tract. The resulting gastrointestinal irritation has also been a proven contributor to heartburn and food allergies.

4.4. Weight and nutrient changes

Weight change is the yield value (expressed in per cent) minus 100. In some countries, handbooks dealing, entirely or partly, with weight yields or weight changes are published. The most internationally known is probably 'USDA Handbook.

As already mentioned, the aim of this lesson is collected data related to nutrient losses or gains in the preparation of foods with a view to recommend factors for use in the calculation of the nutrient content in foods and recipes. Two main types of factors are needed:

- yield, weight yield or weight change factors and
- nutrient yield or nutrient retention factors.

4.4.1. Calculation of weight yield factors (YF)

The following equations have been adapted from the mentioned work and examples have been added for better understanding. Note that the cooking medium (water or fat) is not included in any of the following calculations. Water and fat are considered as ingredients only if they are part of the recipe (e.g. water needed to prepare a dough, fat added to a salad dressing, etc.). However, fat and water uptake should be calculated and included in the recipe as an ingredient

a) Weight yield factor, including waste ($YF_{with\ waste}$):

$$YF_{with\ waste} = \frac{\text{Prepared dish, including waste (g)}}{\text{Total quantity of ingredients (ready-to-cook) (g)}}$$

The weight yield, including waste, for the solid and the liquid part of a dish can be calculated in a similar way.

Examples: 1) Roasted chicken with bones and skin:

$$YF_{with\ waste} = \frac{\text{Roasted chicken, whole (g)}}{\text{Raw chicken, whole + other ingredients (g)}}$$

2) Pot roast lamb (leg), with bones and gravy :

- Whole dish: $YF_{with\ waste} = \frac{\text{Pot roast lamb, with bones and gravy (g)}}{\text{Raw lamb meat, whole + other ingredients (g)}}$

- Solid part: $YF_{with\ waste} = \frac{\text{Pot roast lamb, with bones (g)}}{\text{Raw lamb meat, whole + other ingredients (g)}}$

- Liquid part: $YF_{with\ waste} = \frac{\text{Gravy, with waste* (g)}}{\text{Raw lamb meat, whole + other ingredients (g)}}$

* Gravy may not contain waste. However, some spices such as laurel could be present and need to be removed before being consumed.

b) Yield factor, edible part (YF_{edible})

$$YF_{edible} = \frac{\text{Prepared dish, edible part (g)}}{\text{Total quantity of ingredients (ready-to-cook) (g)}}$$

or

$$YF_{edible}{}^{*} = \frac{\text{(Prepared dish, whole) x((100- \%waste)/100) (g)}}{\text{Total quantity of ingredients (ready-to-cook) (g)}}$$

The former examples should serve as a guide on how to calculate yield factors. In practice,

some problems may arise while calculating the edible part of a prepared food or even the weight of the ingredients “ready to cook”. For instance, some vegetables need to be washed, peeled or part of them need to be removed before getting into the “ready to cook” stage. A detailed protocol recording the changes in weight during all these preparation steps is usually needed, unless each “ready to cook” ingredient is weighed right before being added to the recipe.

4.5. Factors affecting weight and nutrients

In the cooking of foods, the weight and nutrient changes in the foods are mainly depending on conditions affecting the water content, but there are also other factors. Some of these factors are:

Cooking method

- Cooking utensils, such as size and volume of cooking vessel
- Lid or foil covering food during cooking
- Cooking time
- Cooking temperature
- Final internal temperature, e.g. in cooked meat

Food quality

- The part of animal or plant
- Physical state, shape or form of foods
- Surface to volume ratio
- Food tissue type and texture of food surface
- Amount food cooked
- Amount liquid added
- Temperature of liquid added
- Amount fat added

Type of fat added

- Food cooked with or without bones
- Time passed between the termination of cooking and measuring the yield.
- For nutrient changes in vitamins and minerals, the following factors, besides
- leaching of nutrients into cooking liquid or drippings from foods in frying,
- are of special importance:

Temperature

- Time
- Catalysts such as iron and copper in the metal of cooking utensils, as knives,
- saucepans, frying pans, etc.
- Water (water activity and content in the foods or added water)
- pH

4.6. Nutrient change

In the research on retention of nutrients, two methods can be used: apparent retention (AR) and true retention (TR). The two methods can be defined as follows:

Apparent retention

$$\% AR = \frac{\text{nutrient content per g cooked food}}{\text{nutrient content per g raw food}} \text{(dry wt)} \times 100$$

True retention

$$\% TR = \frac{\text{nutrient content per g cooked food x g food after cooking}}{\text{nutrient content per g raw food x g food before cooking}} \times 100$$

Self-check-4	Written test

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

Test I: Short Answer Questions

1. What mean weight change? (4pts)
2. What are the factors affecting weight and nutrients? (4pts)

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

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

Score = _____

Rating: _____

Information sheets 5- Monitoring and adjusting temperature

5.1. Proper temperatures for cooking raw animal foods

Temperatures will be taken at all steps in the food flow–receiving, storing, preparing, cooking, transporting, and serving –with calibrated thermometers to ensure the safety of food served to customer.

Food-service regulations require thorough cooking of raw animal foods to kill foodborne-illness-causing bacteria; there are three required temperatures, depending on the food. Of the foods handled in food service, raw animal foods are the ones that most frequently contain pathogens. Some ballpark examples of raw animal food contamination, all of which are destroyed by cooking, include

- Raw poultry—20% carry Salmonella; 20% to 100% carry Campylobacter.
- Ground beef—fewer than 1% contain E. coli 0157:H7.
- Eggs—1 in 20,000 contains Salmonella.

5.1.1. Required Minimum Cooking Temperatures

- Intact (not injected or ground) beef, pork, lamb, fish, and eggs for immediate service must be cooked to at least 145°F in the center of the food and held at that temperature or higher for 15 sec.
- Eggs prepared for hot holding (for example, on a buffet) must be cooked to a minimum temperature of 155°F for 15 sec. Many meat cuts are injected with a brine to aid moisture retention during cooking for a more flavorful and tender product. Injected and ground meats or fish must also be cooked to an internal temperature of 155°F for 15 sec.
- Poultry, wild game, stuffed meat, and pasta must be cooked to an internal temperature of 165°F for 15 sec.
- Microwave cooking. If a microwave is used for cooking raw animal foods, the food must be heated to 165°F and left to stand for 2 min after cooking to allow the

temperature to equalize throughout the food. Verify the temperature after the two-minute stand time.

- Summary of cooking temperature requirements. The chart below summarizes the required minimum cooking temperatures for Idaho food establishments by the Idaho Food Code discussed so far.

Type of Food	**Idaho Food Code** Section 3-401.11 & 3-401.12
Beef, Pork, Lamb, Fish, Eggs*	145°F for 15 sec
Injected Meat, Ground Meat and Fish	155°F for 15 sec
Poultry, Wild Game, Stuffed Meats, Microwaved Foods**	165°F for 15 sec

*If eggs are prepared for hot holding, minimal cooking temperature is 155ºF
**Microwaved food must be allowed to stand for 2 min

5.1.2. Variations and Exceptions to Requirements

- **Roasts:** Oven-temperature requirements depend on roast size as do a variety of internal temperature-time cooking options for beef and pork roasts and ham. These can be found in section of the Idaho Food Code.

- **Serving Undercooked Meat and Eggs**. Rare steaks may be served in food-service establishments if certain requirements are met. Raw or undercooked eggs, steak tartare, fish, and other foods may be served if the consumer has been informed that there is a food-safety risk, but only if the establishment does not predominantly serve people who are at high risk of foodborne illness (children, the elderly, or hospital patients).

5.2. Thermometers

5.2.1. A Closer Look at the Dial or Bimetallic Thermometer.

A dial (bimetal) thermometer is a type of an instant-read thermometer that registers a temperature within 15 to 40 sec. This slide shows a cut-away view. In the photograph, the

outer metal stem of the thermometer has been removed to show the inside of the stem. You can see the bimetal coil that measures temperature.

- The coil expands and contracts with temperature change. The moving coil changes the pointer location on the dial.
- Temperature registers along the coil; therefore, the thermometer stem must be inserted at least 2–2½ in into the food.
- Don't leave these thermometers in food during cooking, because they are not heat resistant. They are only used to periodically check temperatures. Remove food from the cooking unit, insert the thermometer, check its temperature, and remove the thermometer. If the target temperature has not been reached, place the food back into the cooking unit and continue cooking.

5.2.2. Digital Thermometers.

Instead of a bimetal coil, digital thermometers have a temperature-sensing unit called a thermistor, which requires a battery to power it. Because the thermistor occupies the bottom ½ in of the stem, the stem must be inserted at least ½ in into the food to obtain an accurate reading. Two types of digital thermometers are shown as follow.

- An electronic thermometer has a digital readout and can be programmed to ring when it reaches a preset temperature. A timer feature may be included. The thermometer face stays outside the oven; the probe or stem attaches to the display portion by a wire. The probe on this type of thermometer can be left in food during cooking.
- A digital instant-read thermometer is battery operated, so it must be turned on to take a temperature reading. Digital instant-read thermometers cannot be left in food during cooking. They are only used to periodically check temperatures. Most digital thermometers cannot be adjusted for accuracy, so if it isn't reading properly, it should be replaced.

5.2.3. How to Measure the Temperature of Food:

A. Use a calibrated thermometer. Calibrate thermometers on a weekly basis, or whenever they are dropped or suffer a shock.
B. Sanitize stem of clean thermometer with an alcohol wiper insert stem into sanitizing solution for at least 5 seconds, then air dry.

C. Insert the end of the sanitized thermometer into one of the following locations, depending on the type of food [https://www.youtube.com/watch?V=77_c-Uqyd-A]:
   i. The thickest part of the product for meat, poultry, or fish.
   ii. The center of the item.
   iii. Between two packages of refrigerated or frozen packaged foodsd.
   iv. Until at least 2 inches are submersed in milk and other liquidse.
   v. By folding the bag over the stem of the thermometer or probe for bulk milk or liquids
D. Make sure the tip of the thermometer does not poke through the food.
E. Measure the temperature for at least 15 seconds.
F. Read thermometer and record temperature.
G. Clean and sanitize stem of thermometer and store it in an accessible location.

5.2.4. General Thermometer Guidelines:

- Keep thermometers and their storage cases clean, stored safely, and easily accessible.
- Use bi-metallic stemmed thermometers or digital thermometers. Do not use glass thermometers filled with mercury or spirits.
- Wait at least 15 seconds for the thermometer reading to steady before recording the temperature(bi-metallic).
- Take two temperatures in different locations, because product temperatures can vary throughout the food item.
- Insert the thermometer into liquids and hold. Do not allow the thermometer's sensing area or probe to touch the sides or bottom of the container.

Self-check-5	Written test

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

Test I: Short Answer Questions

1. What are two types of digital thermometers? (4pts)

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

2. A dial (bimetal) thermometer is a type of an instant-read thermometer registers within 1 to 2 sec? (2pts)
3. An electronic thermometer has a digital readout and can be programmed to ring when it reaches a preset temperature? (2pts)
4. A digital instant-read thermometer is battery operated, so it must be turned on to take a temperature reading? (2pts)

Note: Satisfactory rating - 510points Unsatisfactory - below 10 points

Score = _____

Rating: _____

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

Information sheet 6- Monitoring outflow

6.1. Where does the wastewater come from?

The preparation of meat products is a multi-stage process that produces wastewater in each respective step. In general, here's where wastewater comes from in the meat production process:

- **Stockyards and Pens**: live animals stay in holding pens for less than one day prior to slaughter. Wastewater results from watering troughs, washdown, and urine from the animals. Rain run-off from uncovered pens can also contribute to the wastewater flow.
- **Slaughtering**: as animals are stunned, suspended and bled, blood can spill or splash outside the containment area entering the waste stream during clean-up operations. Hogs are dehaired as they pass through a scalding tank. This and carcass wash water enter the wastewater stream.
- **Blood Processing**: as albumin and fibrin are recovered from blood for various uses, the blood water is either evaporated or sent to wastewater.
- **Viscera Handling**: beef and hog paunches are washed and saved for edible products. Wash water goes to waste.
- **Hide Processing**: washing and curing of hides contributes wastewater with high levels of salts.
- **Cutting**: as carcasses are cut and trimmed, some material adheres to saw blades and conveyors. Equipment washdown sends these solids to wastewater.
- **Meat Preparation**: as cuts are cured, deboned, and packaged for distribution, spills from cooking equipment and curing solutions are sent to wastewater.
- **Rendering**: edible and inedible products are created as fats and water are separated from animal tissue. Spills from cooking equipment, collection tanks, and discharge from washdown contribute to wastewater

6.2. Food cooking processing waste

The quantities of fresh water used by a food processor and the volumes and characteristics of wastewater that result is highly variable. Fresh water is used primarily for steam generation, blanching, product cooling, final product washing, freezing or container cooling, plant cleanup (sanitation), and for numerous other minor purposes. Water may be recirculated within dump tanks, flood washers, hydraulic transport systems, and cooling systems with cooling towers. Clean water discharged from operations in the late stages of processing may be reused in earlier operations.

Waste water generations: Fresh water used in numerous food processing operations dissolves organic matter from the raw commodities and becomes a carrier of a variety of undissolved or suspended materials which are ultimately discharged as processing wastewater. The potential impact of wastewater discharges, either upon a receiving stream or a treatment system, can best be evaluated by accumulating specific information with which to determine the “waste load” associated with the discharge. Waste loads are used by engineers to design appropriate waste

6.3. Waste management in the food processing industry

Waste management strategies aim at reducing wastage, recover resources and treat waste before final disposal. The high volumes of solid wastes generated in the agro-food industry are not only a potential environmental problem but also an economic burden for companies in terms of their management. Therefore, the advantages of proper waste management go beyond environmental benefits, and include cost savings and resource efficiency. To minimize costs, food industry will have to concentrate on waste avoidance. Utilization of by-products and wastes as raw materials are the next most preferable methods. Value recovery operations can include additional processing steps such as separation, concentration, biological or chemical conversion, that all add costs and require energy and other inputs.

6.3.1. Waste prevention

The focus should always be on prevention, as waste always costs money and most companies are unaware of the true costs of waste. While the principle of waste prevention is universally accepted, the practice has lagged far behind. Within the food processing stage, **good housekeeping practices, including equipment maintenance, process optimization and design for efficiency are** the best options. It has been demonstrated that a combination of equipment maintenance and design changes can reduce up to 20-30% of costs and efficient process control can reduce costs by an additional 5%. Conversely, inefficient packaging systems can cause a 4% loss.

6.3.2. Solid waste treatment

Considering the landfill ban of organic wastes, the strategy should be to utilize solid wastes, by recovering valuable components nutrients or energy. Composting is currently widely used in Europe as a bio-waste treatment method. It is foreseen that energy use of bio-waste will be more preferred in the future.

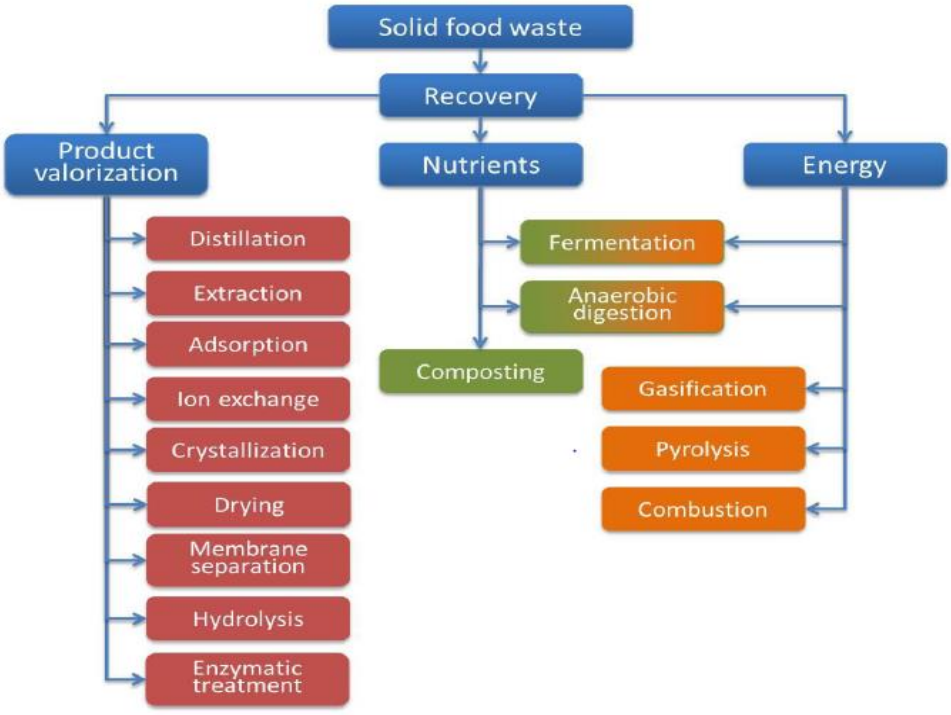


Figure 15: Recovery technologies for solid food waste.

6.3.3. Waste and by-product valorization

Valorization is a term with origins in economy, meaning generating value. This expression is used in connotation to recovering valuable components from waste biomass. The Agro-food wastes minimization and recycling network (AWARENET) defined valorization as: “Increase of technical and/or economic value of by-products and wastes that are generated in different agro-food industries”. Valorization techniques include mechanical and diffusional separation technologies, as well chemical and biochemical modifications.

6.3.4. Mechanical separation methods

From the mechanical separations, the mechanical extraction or pressing is used often for solid-liquid phase separation method. Fat and oil in different oil seeds are separated by pressing, and it can be used for fruit juice extraction.

6.3.5. Diffusional separation methods

Diffusional separation methods, such as distillation, different forms of extraction, adsorption, ion exchange, evaporation, crystallization, drying and membrane separation are widely used in different areas of food industry for by-product valorization. Table 4 summarizes the application areas of these technologies.

Technology	Application
Distillation	• separation of solvent mixtures for recovery and reuse • removal of volatile compounds from aqueous feed streams • production of essential oils • alcohol production from wine pomace and starch rich solid by-products
Extraction	• solid-liquid: isolation of flavors, fragrances, pharmaceuticals • microwave-assisted extraction: anthocyanins, caffeine extraction, flavonoids • ultrasound assisted extraction: isoflavone derivatives, phenolic compounds, anthocyanins • pressurized liquid extraction: Isoflavones, flavonoids, phenolic compounds • enzyme assisted extraction: extraction of oils, phenolic compounds • supercritical fluid extraction: spice oils and oleoresins, essential oils, herbal medicines, natural pesticides, vitamin E (tocopherols), nicotine/tar free tobacco, decaffeinated coffee and tea, cholesterol free food products, bitter from hops • water extraction: collagen and gelatin
Adsorption	• removal of organic components from drinking water • removal of colour-promoting components from sugar solutions
Ion exchange	• demineralization of whey for whey powder and lactose production
Evaporation	• de-watering of salt streams • concentration of highly contaminated wastewaters • concentration of saline effluents (e.g. wastewater from fish and meat industry)
Crystallization	• lactose production • production of natural sweeteners from pomace
Drying	• lyophilization: preservation and drying of food products (meat, vegetables, fish, fruits, instant coffee products) • spray-drying: blood meals, whey protein and powders, soluble and refined fibres • flash drying: fast and suitable for heat sensitive or easily oxidized substances, e.g. fibres from potato pulp
Membrane separation	• whey demineralization • water purification • juice clarification, sterilization, concentration

6.3.6. Chemical separation methods

From chemical modifications, hydrolysis, i.e. breaking up of a chemical compound influenced by water is one of the most often used chemical separation methods in food industry. The addition of strong acids, bases or steam will often be applied if ordinary water has no effect. Some examples for the use of hydrolysis includes;

- The conversion of starch into sugars in the presence of a strong acid catalyst,
- The conversion of animal fats or vegetable oils to glycerol and fatty acids by reaction with steam, or
- Just the conversion of proteins, fats,
- Oils or carbohydrates by enzymes.

Other application of chemical modifications can be calcination which is used for production of construction materials from mollusk's shell.

6.3.7. Biochemical methods

Biochemical modification for food by-product valorization includes pasteurization, fermentation, biogas production and enzymatic treatment. Pasteurization, such as HTST (high temperature short time) and LTLT (low temperature long time) pasteurization in usually applied in dairy industry for utilization of by-products. The product of fermentation processes varies greatly on the particular microorganisms involved, e.g. yeast and fungi result in ethanol production from glucose.

Enzymatic treatment is the other application field of biochemical methods. Enzymes can be used for the degradation of food waste consisting of proteins, lipids and carbohydrates. Enzymes are also used to degrade plant cell walls and help e.g. the extraction of oils or other valuable compounds from seeds, skins and peels. Heating efficiency of the microwaves are determined on the dielectric properties of the materials which is described by the dielectric constant and the dielectric loss.

- **Dielectric constant (ε)** describes the ability of the molecules to be polarized by the electric fields.
- **The dielectric loss (ε')** describes the efficiency to turn the energy of the electromagnetic radiation into heat.

The dissipation factor tanδ is the ratio of the dielectric loss to the dielectric constant of the material, i.e. $\tan\delta = \varepsilon'/\varepsilon$, therefore, the higher the dissipation factor of the sample is, the less microwave energy will penetrate into it.

The efficiency of the microwave assisted extraction will depend on a number of process parameters, such as the applied power, the treatment time, solvent, size distribution of the sample. From all above, crucial role has the applied solvent, since if the solvent is not able to absorb the microwave energy, no heating will occur, and therefore the extraction of the target compounds will fail.

The temperature of the extraction plays also in important role, since it will have an effect on the degradation of the thermo-sensitive components and on the solubilization of the substances. To this end, microwave assisted extraction devices should have a capability for the controlling of the process temperature. The effect of the microwave power on treatment time will be opposite, the more power is applied the less time will be required to reach the desirable process yield.

Microwave devices can be classified into two categories; in multimode systems the microwave radiation is dispersed randomly, and in single-mode systems, the microwaves are restricted to the zone where the sample in held. Multimode systems are usually applied in closed-vessel type devices where the extraction is performed at high pressure, while the single mode systems are applied in open-vessel type application usually at atmospheric pressure. This operation condition will also result in some advantages of the closed-vessels across the open-vessel type since, due to the construction of the system, the loss of material due to evaporation is completely avoided and therefore there is no need to replace the evaporated solvent and, therefore, the total amount of 14

solvent used is decreased. In addition, higher temperatures can be achieved during the treatments due to the higher pressure applied. On the other hand, the open vessel type system in safer due to the low pressure applied, and if needed, the excess of solvent can be removed and the sample dried. Considering the process economics, it requires also fewer capital costs when compared to the closed-vessel system.

Self-check-6	Written test

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

Test I: Short Answer Questions

1. Where dose wastes come from? (4pts)

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

2. Heating efficiency of the microwaves are determined on the dielectric? (2pts)
3. properties of the materials may not be described by the dielectric constant and the dielectric loss? (2pts)
4. **Dielectric constant (ε)** describes the ability of the molecules to be polarized by the electric fields? (2pts)

Note: Satisfactory rating - 510points Unsatisfactory - below 10 points

You can ask

Score = _____

Rating: _____

Information sheets 7- Identifying and complying OHS requirements

7.1. OHS requirements for cooking operations

What is OHS, or **Occupational Health and Safety?** is a multidisciplinary practice dealing with all aspects of **health and safety** in the workplace, with a strong focus on preventing workplace hazards. ... You can invest in **occupational health** and training for your current staff.

A worker in the meat department of a grocery store was injured while processing meat using a meat cooker machine. The worker opened the lid/guard of the machine while it was still running and reached inside. The worker's arm became entangled with the moving parts.

Access to moving parts such as mixing arms, worms and other cooking accessories have caused crushing, laceration and fracture injuries. A guard or other device that prevents access to a moving part that may endanger a worker is required under the Industrial Establishments Regulation.

7.2. Personal Protective Equipment (PPE)

Personal protective equipment (PPE) provides two types of protection:

- protection for you
- protection for the meat.

Below are the things you have to wear and use to keep you safe at work.

I. Aoats and Aprons

Aprons are used to protect your clothes and also to avoid contamination of meat. Plastic aprons can be easily cleaned or disposed of if they are covered in blood, meat or guts. This keeps the surfaces that might touch the meat clean so the meat isn't contaminated. Disposable aprons must be changed at breaks. Disposable aprons are the ones that you only wear once then throw away. Disposable: throw it in the bin at breaks Heavy plastic: wash and store and wear again after breaks Heavy duty plastic aprons must be washed thoroughly at breaks and when required by your work instructions (if very dirty, torn or contaminated).

II. Ear plugs

Earplugs are small soft plugs that sit just inside your ear to block some of the noise. They protect you from going deaf

III. Muffs

Ear muffs are much larger than ear plugs. They sit over your ears to block out a lot of noise.Ear muffs are not disposable. They must be cleaned and stored between shifts.

IV. Eye and Facial protection

Safety glasses are often used in meat processing plants. They protect your eyes from blood splatters or other dirt and contamination. You must wear eye protection if your company policy states so. Some safety glasses are disposable, whilst others are not. Ask your supervisor whether you should throw away your glasses at the end of the shift or clean and store them.

V. Snoods

Snoods cover a beard and moustache so that hair does not fall in the product. Hairnets and snoods are disposable. You must throw them in the bin at the end of your shift. Every morning you will get a new one

VI. Mesh approns

Mesh aprons are heavy chain mail aprons that are used to protect your body. A knife cannot go through a mesh apron. Mesh aprons are worn under a plastic apron so they don't get meat and blood caught in them and contaminate product.

VII. Protective Boot Covers

Rubber boots protect your feet from the water, blood and waste that is found on the processing floor. Rubber boots can be easily cleaned so you don't bring dirt into the plant on the bottom of your feet. In some areas such as rendering plants safety boots must be worn to protect feet.

VIII. Protective Hand and Arm Covering

Rubber and plastic gloves protect the meat from contamination from your hands or cut resistant gloves.

IX. Protective Head and Hair Covering

Hair nets must completely cover the head so hair and loose skin cannot contaminate the product

X. Uniform

A uniform must be worn every day. Your uniform will be different depending on which area of the plant you work in. You must wear a clean uniform every day You must not wear dirty clothing or uniforms into areas where edible product is being processed. Companies use different colored uniforms for

- different sections of the plant.
- white on the slaughter floor
- blue in the yards
- green in skins blue for maintenance
- grey in rendering
- red on the slaughter
- floor Stockmen and maintenance personnel must change before coming onto the slaughter floor. Workers who go into areas such as rendering plants or hide sheds must change into clean uniform before going into the boning room or slaughter floor.

7.3. Hygiene and sanitation requirements

7.3.1. Good Hygienic Practices in meat processing

Microbial meat spoilage or meat poisoning through meat can be prevented if the microbial load/bacterial contamination, which occurs during slaughtering and meat handling, is kept as low as possible. The key for achieving this is strict meat hygiene including an uninterrupted cold chain throughout the entire meat production and handling chain. **Meat hygiene** is a complex field, based on regulations by competent authorities and meat plant internal hygiene programmes, to be supervised by the plant management. Those programmes will only be successful if meat plant staff are familiar with and active in observing basic hygiene requirements. In order to facilitate the application of hygiene requirements, it has proven useful to differentiate between:

I. **Personal hygiene**
II. **Slaughter and meat processing hygiene**
III. **Hygiene of slaughter and meat processing premises**
IV. **Hygiene of slaughter and meat processing equipment**

The topics a-d are of equal significance. Negligence in any of the four areas may give rise to hazards, which can cause economic losses and affect consumers' health.

Some key requirements for meat processing plants are listed below. More detailed hygiene requirements are laid down in national regulations and in international codes, such as FAO/WHO CODEX ALIMENTARIUS Code of Hygienic Practice for Meat (CAC/RCP 58-2005). Guidelines on slaughter hygiene or meat transport and storage hygiene are not included hereunder. However, as meat is the primary material for processed meat products, the application of hygienic practices in slaughterhouses and throughout the cold chain is equally important. Principles of sanitation of premises and equipment are described in a separate chapter.

Principles of personal hygiene

- Wear clean protective clothes
- Washing hands before starting work
- Repeatedly washing hands during work
- No finger rings, watches, bracelets
- Access to production areas with working clothes only
- Cleaning/disinfection of hands/tools/clothes if there was contact with highly contaminated subjects or abnormal animal parts likely to contain pathogens.
- Fresh wounds through knife cuts etc. must be covered by a water tight bandage. Workers with purulent wounds are not allowed to work with meat. (Risk of spread of Staph. aureus bacteria).
- Strict toilet hygiene must be observed (removal of apron, hand washing and hand disinfection). Toilets must be kept clean and must not have direct access to production areas. (Risk of spread of Salmonella).
- Periodic medical examination of staff

Self check-7	Written test

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

Test I: Short Answer Questions

1. What OHS? (4pts)
2. What mean by personal hygrines (4pts)
3. PPE for cooking operation (4pts)

Note: Satisfactory rating - 510points Unsatisfactory - below 10 points

Score = _____

Rating: _____

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

Operation Sheet 1– Preparing the sticky ribs food by using microwave (NN-CF760M)

Objective: To operating cookery accordingly manufacture operations

List of Materials needed:

- **Ingredients**
  - bowel oven, microwave (NN-CF760M)
  - 1kg (2lb2oz) pork spare ribs
  - 150ml (¼pt) water
  - For the glaze
  - 150g (5oz) orange marmalade
  - preferably shred less or fine shred
  - 25g (1oz) dark muscovado sugar
  - 100ml (4fl.oz) fresh orange juice
  - 5cm (2inch) piece fresh root ginger,
  - peeled and coarsely grated
  - 75ml (5tbsp) tomato ketchup
  - 30ml (2tbsp) white wine vinegar
- **PPE**
  - Coats and Aprons
  - Protective Boot Covers
  - Protective Hand glove
  - Uniform
  - Hand softe brush

Procedures:

1. Use20 x 25 cm (8 x 10 inch) rectangular dish large bowl Oven Accessory: no accessory then wire shelf in lower position.
2. Place the ribs in a single layer in dish with the water.
3. Cover and place on base of oven and cook on MEDIUM MICROWAVE for 10 mins.
4. Drain. Meanwhile, mix together all the ingredients for the glaze in a large bowl.
5. Place on base of oven and cook on HIGH MICROWAVE for 5 mins.
6. Pour glaze over ribs and place dish on shelf.
7. Cook on Combination: 230°C + GRILL 3 + LOW MICROWAVE for 20-25 mins. Turn halfway and baste.

Operation Sheet 2– preparing the Lamb Shanks by using Pressure Cooker

Objective: To operating cookery accordingly manufacture operations

List of Materials needed:

- **Ingredients**
  - lamb shanks preferably skinless
  - 1/2 cup olive oil divided
  - 1 green chili pepper sliced
  - cloves garlic minced
  - 1 Tbsp. smoked paprika
  - 1 Tbsp. oregano
  - 2 tsp. sea salt
  - 1/4 tsp. ground cumin
  - 2 Tbsp. brown sugar
  - 1 cinnamon stick
  - 1 medium onion roughly chopped
  - medium carrots roughly chopped
  - 2 bay leaves
  - 2 cups red wine
  - cups beef stock
  - 3 Tbsp. corn starch
  - 1/4 cup water

PPE

- Coats and Aprons
- Protective Boot Covers
- Protective Hand glove
- Uniform
- Hand softe brush

Procedures:

1. In large bowl - combine lamb, pepper, garlic, paprika, oregano, salt, cumin, brown sugar, cinnamon sticks, and 1/4 cup oil. Mix well to coat meat, then marinate from 30 minutes to overnight.
2. Using sauté setting, heat Instant Pot. Once hot add 1/4 cup olive oil and thoroughly brown lamb on all sides – making sure to render all the fat. Once browned, remove lamb shanks and set aside.
3. Add onions, carrots, bay leaves, and remaining marinade to the pot. Sauté until onions become translucent – about 5 minutes.

4. Add red wine to deglaze the pot - making sure to scrape all the bits stuck to the bottom. Return lamb to pot. Simmer to reduce by half - about 10 minutes.
5. Add stock. Lock lid and cook for 30 minutes at high pressure.
6. Once cook time is complete, allow pressure naturally release. Remove shanks and set aside.
7. Pour liquid through a fine mesh strainer and return to pot. Discard cooked ingredients. Separately in a small bowl, combine cornstarch and water, then add to pot.
8. Switch Instant Pot back to sauté setting and simmer until sauce reaches desired thickness. Return lamb to pot and let sit in sauce until ready to serve.
9. Serve lamb with polenta or mashed potatoes topped with gravy!

LAP TEST	Performance Test

Name…… ID……Date……

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **2** hours. The project is expected from each student to do it.

Task 1: Preparing the sticky ribs dish by using microwave

Task 2: preparing the Lamb Shanks dish by using Pressure Cooker

LG #56	LO #2- Monitor environmental controls

Instruction sheet

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

- Monitoring vapors
- Monitoring non-condensed emissions
  - scrubber
  - bio-filter or after burner

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:

- Monitor vapors
- Monitor non-condensed emissions
  - scrubber
  - bio-filter or after burner

Learning Instructions:

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

Information sheets 1-Monitoring vapors

1.1. Evaporator Systems

Evaporators are widely used in the food processing industry to remove a portion of the water from food products. This reduces bulk and weight for subsequent processing, increases solids content (as for jams and molasses), helps preserve the product, provides convenience to the end consumer and concentrates color or flavor. Many types of evaporators are in use, most with certain common features:

1.2. Common Type of Evaporator

- **A heat source** (normally steam) that evaporates the water.
- **An evaporation vessel** where water is driven out of the product as vapor.
- **A vapor separation vessel**, where vapor and product are separated.
- **A vacuum system** that draws water vapor out of the separation vessel. This vacuum also reduces pressure in the evaporation vessel, which reduces the boiling point.

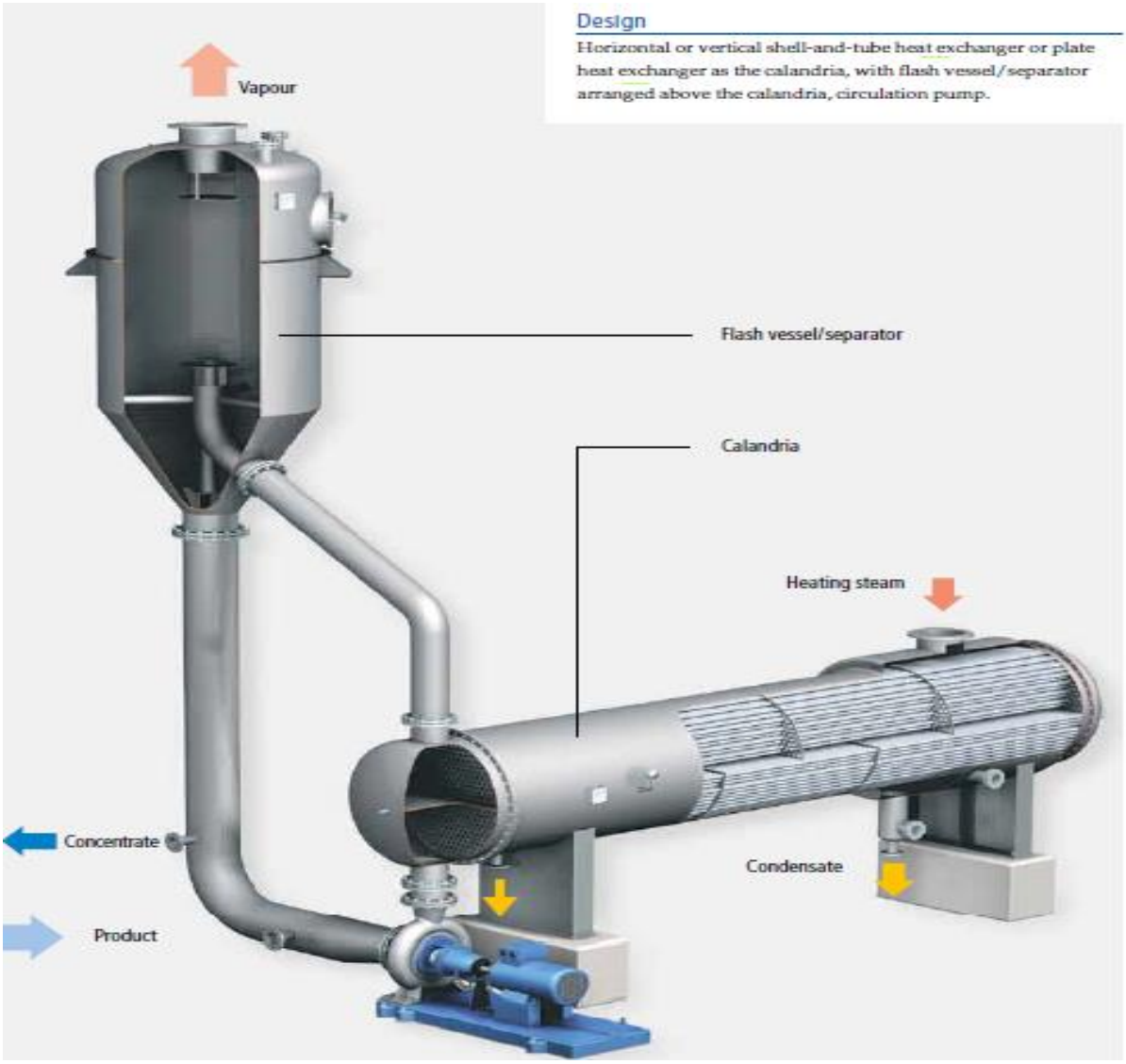


Figure 16: Evaporators
[https://www.youtube.com/watch?v=9lm2ubpOoL4]

Evaporators may operate singly or several may operate in series. Each one is referred to as an effect and in multiple-effect systems, the product output from one effect is the feed for the following effect. Similarly, higher-temperature vapor driven out of the product in one effect is used to heat lower-temperature product in another. Efficiency is gained by using multiple-effect systems.

1.3. Energy Efficiency Measures

Several changes can be made to evaporator systems to improve their efficiency. Here are

some of them:

- **Installation of additional effects** will generally improve the efficiency of an evaporator system. There is a practical limit to how many effects can be used, as each evaporation vessel must have a lower pressure than the previous effect.
- **Preheating feed product** reduces the heat required to achieve boiling in the evaporation vessel. This requires addition of a heat exchanger appropriate to the characteristics of the feed.
- **Vapor recompression** takes advantage of the significant heating value of the vapor driven out of the product. Vapor can be reused in the same evaporator by increasing its temperature and pressure close to those of the steam injected into the heat exchanger. This can be done using a steam jet or a compressor.

1.4. Operations Tips to Improve Energy Efficiency

The following list provides operating practices that can reduce energy consumption in your evaporators:

- ***Optimize the venting rate of non-condensable gases*** to reduce steam waste while

  maintaining appropriate evaporation vessel pressure. Non-condensable gases in the evaporation vessel increase pressure, which increases the boiling point and heat requirements.
- ***Maintain the optimum pressure profile*** as provided in the evaporator's design. Excess pressure inhibits evaporation by raising the boiling point.
- ***Condensed steam can be used*** to preheat feed product or used in the next effect of amulti-effect system. It can also be fed back to the boiler to offset the use of cold makeup water.

- ***Pre-concentration*** of the feed will reduce the energy required to operate an evaporator. For some applications, pre-concentration with separation membranes can save up to 90 percent of energy consumption.

1.5. Maintenance Tips to Improve Energy Efficiency

Regular maintenance will help ensure that equipment serves a long, useful life and also operates efficiently. The following suggestions will help keep your evaporators operating efficiently:

- ***Prevent air leaks*** into the evaporators to minimize venting rates. Air is a no condensable gas and has to be vented to keep evaporation vessel pressure from increasing.
- ***Clean heat transfer surfaces*** to allow the most efficient use of energy to evaporate water from the product. *Inspect and repair or replace* wet or damaged insulation as it is found. Also, make sure insulation is the appropriate thickness.
- ***Keep the vapor separation vessel clean*** to maintain product yields and pressure profiles.
- ***Prevent water leaks*** into the system to avoid diluting the product, which defeats the process.

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. Write types of evaporators? (4pts)
2. What are energy efficiency measure (4pts)?

Note: Satisfactory rating - 510points Unsatisfactory - below 10 points

You can ask you teacher

Score = _____

Rating:

Information sheets 2- Monitoring non-condensed emissions

2.1. Introduction

What are Non-condensable gases (NCG), such as sulfur oxide, carbon dioxide, methane, ammonia, hydrogen sulfide, hydrogen, are the gaseous emissions that are found dissolved in the geothermal water.

Air pollution may be defined as any atmospheric condition in which certain substances are present in such concentrations that they can produce undesirable effects on man and his environment. A considerable amount of air pollution results from the human activities. These activities have a close relationship with life patterns and their restrictions are rarely placed in the planners, procedures, especially in developing countries. Fish and meat processing cover a wide range of activities which produce such pollutants as dusts and unpleasant odors. The production processes include the following.

- **Cooking**: This process coagulates the protein and ruptures the cell walls to release the water and oil.
- **Press**: As the product is moved along the screw press, the pressure is increased and the volume is decreased. The pressing liquor consists of 78% water, 16% oil and 6% small suspended solids. The press cake consists of 50-55 % water and 3-4% oil.
- **Separating the pressing liquor**: The pressing liquor is transported to a centrifuge or desludger where the solids are removed. These solids are later returned to the press cake in the drying step. The oil and water are separated using a disc-type centrifuge in the oil separator.
- **Evaporation**: The water removed from the oil (stick water) goes to an evaporator to concentrate the solids.
- **Drying: The** press cake, stick water, and solids are mixed and sent to either a direct fired or an indirect-fired dryer.

- **Grinding**: The dried meal is cooled, ground by a hammer mill or grinder and transferred by a pneumatic conveyor to storage.

Although smoke and particulate may be a problem, odors are the most objectionable emissions from fish and meat processing plants. The largest odor source in the factory is the drier (especially direct-fired). The three major methods for removing odors and flavor-producing chemicals from such units are dilution in the form of masking, wet scrubbing, and burning

2.2. Scrubber

what is scrubber? are devices that can control pollution by purifying the exhaust streams, which means that hardly any harmful gases or particulates will leave the building and enter the environment.

2.2.1. The Major Types of Industrial Scrubbers

Wet Scrubbers, Dry Scrubbers, and Electrostatic Precipitators Scrubbers are air pollution control devices that use liquid to remove particulate matter or gases from an industrial exhaust or flue gas stream. This atomized liquid (typically water) entrains particles and pollutant gases in order to effectively wash them out of the gas flow. In comparison to other air pollution control devices, scrubbers are very multidisciplinary, with the ability to remove solids, mists, and gases simultaneously while also providing cooling. They are also capable of handling explosive and flammable gases safely. However, scrubbers suffer from high levels of corrosion and produce slurry waste streams which are less convenient for recycling and disposal.

A. Wet Industrial Scrubbers

One of the most basic of the various industrial scrubbers is the wet industrial scrubber. In its most basic form, water is encapsulated in a metal or composite container. Contaminated gas is passed through the water, and the water absorbs the contaminates. Other liquids can be used to effectively remove varied contaminates. These liquids differ in the chemical composition and the overall charge.

These liquids can be anything from highly positively or negatively charged to non-charged. Because pollutants can differ in their charge, scrubbers can be packed with a liquid that will bind most effectively to remove the contaminate from the gas.

The gas exiting the scrubber is thus cleaner. Developments in wet scrubbers have allowed for increased efficiency in pollutant removal. One of the major developments has been to maximize the total surface of the liquid with which the polluted gas associates. More surface area means that more of the contaminates can be pulled out of the gas. Another development in scrubbers has been increasing the mixture of the gas with the scrubber fluid. These aspirators agitate the solution and increase the mixing of the polluted gas and the liquid. The wet scrubber differs from the other different types of industrial scrubbers because the liquid-gas association increases the moisture level of the gas that is being expelled from the scrubber. The increased moisture in the gas will create a visible cloud exiting the scrubber.

B. Dry Industrial Scrubbers

Unlike wet industrial scrubbers, dry scrubbers do not utilize a liquid to absorb contaminants. Because of this difference, steam is not produced by the reaction, and a wastewater system is not needed. A dry industrial scrubber is composed of a reaction center where the sorbent or dry reaction material that absorbs contaminants is mixed with the polluted gas. Also, within the system is a material component that aids in the removal of the reaction product, which is the dry sorbent bound to the pollutant. Dry scrubbers are used primarily to remove acids found within gasses.

The dry sorbent used to remove the acid from the gas is usually made of an alkaline slurry. This slurry is basic in nature and will neutralize the acid found in the gas. This sorbent can be mixed with the acid gas in two ways. There are two different types of dry industrial scrubbers. The first is called dry sorbent injection. During this process, the gas is mixed directly with the alkaline sorbent. The second method is the spray dryer absorbent method. In this method, the contaminated gas is processed through a mist of the sorbent. The sprayer allows for a good mixture and efficient removal of the pollutants from the gas.

C. Electrostatic Precipitators

Electrostatic precipitators function uniquely from the different types of industrial scrubbers by using charged energy to remove dust and other contaminates from a gas. It is important to match the polarity and type of charge to bind to and remove the pollutants from the gas. An example of the design of an electrostatic precipitator is a plate precipitator. The plate is a sheet of metal that is charged with a specific type of charge. These plates are designed to run parallel with the piping so that the gas will pass through by the plates and the plates will remove the dust or contaminate. In addition to metal plate electrostatic precipitators, there are also wet electrostatic precipitators that help to remove high moisture gases. Some of the chemicals that can be removed from gas include sulfuric acid. The resultant slurry that contains the bound pollutant is rotated away from the electrostatic precipitator to remove the contaminates and maintain an effective charged surface for pollutant removal.

2.2.3. Products of the Different Types of Industrial Scrubbers

The products of scrubbers can either be a hazardous waste product or a useful product. In many cases, the scrubber and downstream processing is able to create a solid slurry that is separated from the purified gas. In most cases, the pollutant product will need to have further processing in order to be become a useful end product. An example of a useful product includes gypsum extracted from scrubbers used in coal power plants. This synthetic gypsum can be used as a component of drywall. Companies should be careful to understand the byproducts of their scrubbers and dispose properly of the hazardous waste. Recycling the waste can be a great option to either save on hazardous waste disposal or make money on a byproduct. Secondary processors of scrubber byproducts will actually haul away waste and in certain cases pay a price for the slurry.

2.2.4. Industrial Scrubbers Protect the Environment

The different types of industrial scrubber help protect the environment by removing harmful chemicals and acids from polluted gas. There are multiple types of scrubbers that aid in this process, including wet, dry, and electrostatic scrubbers. With efficient, well-maintained industrial scrubbers, a facility can complete production and protect the

community and their workers. In certain cases, these scrubbers remove pollutants that can be processed and be profitable as end products themselves. STI Group services and maintains dependable industrial scrubbers.

2.2.5. Advantages and Disadvantages of Scrubbers

Advantages

- Can handle flammable and explosive dusts with little risk
- Provides gas absorption and dust collection in a single unit
- Provides cooling of hot gases
- Compact; can often be retrofitted into existing collection systems
- Corrosive gases and dusts can be neutralized

Disadvantages

- High potential for corrosion problems
- Collected particulate may be contaminated and unrecyclable
- Protection against freezing required. Certain streams may require reheating to avoid visible plume
- Disposal of waste sludge can be very expensive
- Requires makeup water to replace purged liquid and disposed sludge

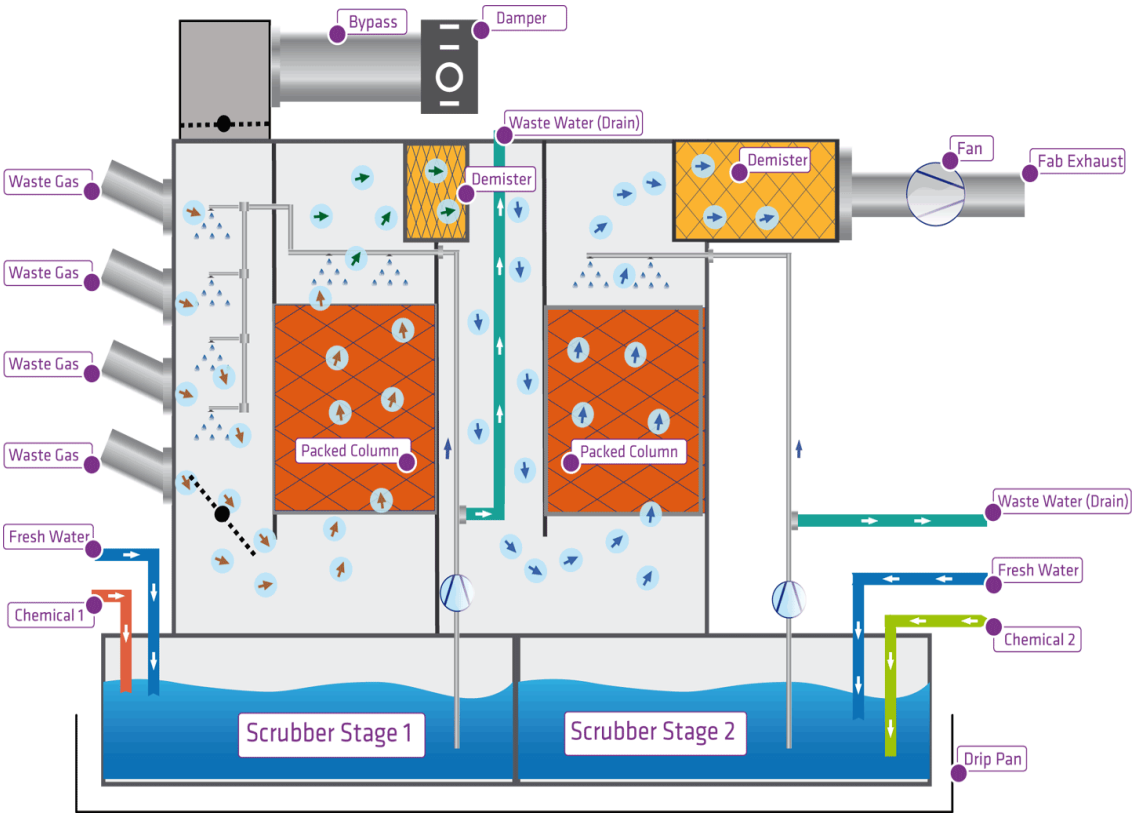


Figure 17: Operating Principle of Wet Scrubber

2.3. Bio filters

Biofiltration is the most typical type of biological air pollution control process, initially developed in the late 1970s. It is now emerging as a sustainable alternative for the treatment of air contaminated with VOCs and odorous compounds. In biofiltration, the polluted air is forced through a bed of packing media covered with a layer of aerobic microorganisms. The microorganisms are immobilized on the surface of the packing media.

The primary role of the packing material in biofilter media bed is to support the microbial community through the attachment of microbial biofilm to the surface of packed media.

2.3.1. Advantage and dis advantages of biofilters

Biofilter Advantages:

- Installation costs are low. Most biofilters are constructed from common materials locally available such as lumber, fiberglass, and plastic pipe. They can be assembled using carpenters, plumbers, and earthmovers.

- Depending on the amount of pretreatment the emissions require, operating costs are usually low. These costs consist of electricity to operate the primary blower and the humidification pump, part-time labor to check on the process, and small quantities of macronutrients.
- Biofilters have high DREs f for certain compounds such as aldehydes, organic acids, nitrous oxide, sulfur dioxide, and hydrogen sulfide.

Biofilter Disadvantages:

- Large land requirement for traditional design.
- No continuous internal liquid flow in which to adjust bed pH or to add nutrients.
- Traditional design does not have a covered top, making it difficult to obtain representative samples of exhaust emission and to determine DREs.
- Natural bed media used in biofilters must be replaced every 2 to 5 years. Bed replacement can take 2 to 6 weeks, depending on bed size. Over time, some modifications have been developed to overcome some of the specific deficiencies in the traditional biofilter design. To increase contact time with microbes, some facilities recycle a portion of the exhaust back through the bioreactor. This is done by adding a cover and vent to the biofilter. A slipstream is taken from the vent and is recycled back to the intake of the primary blower. See Figure 18. Also, if land is available, biofilters modules may be added horizontally, in series. This configuration is shown in Figure19.

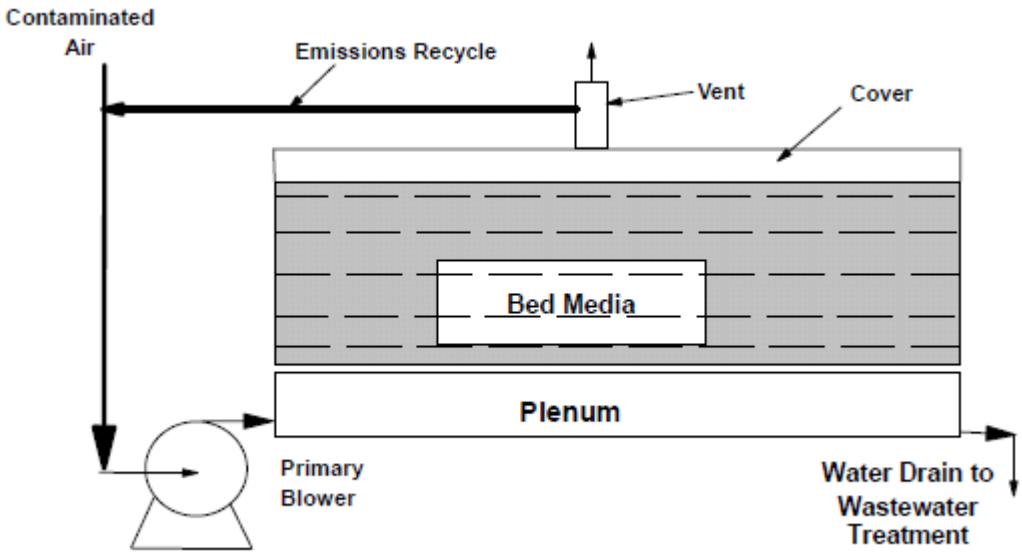


Figure 18: Biofilter with Emissions Recycle.
[https://www.youtube.com/watch?v=axmicJjtXw0]

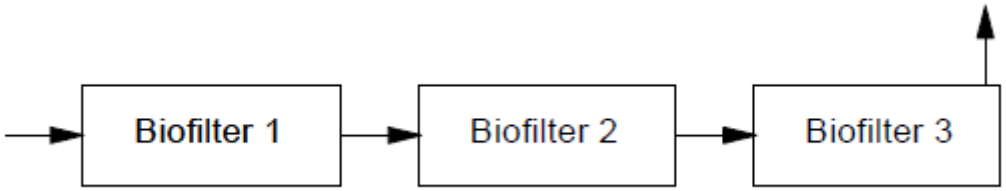


Figure 19: Biofilters in Series, Horizontally

To reduce land requirement, some operators have stacked biofilter modules vertically. As mentioned in Factors Affecting Performance, above, some operators have installed soaking hoses in the bed media to control pH and to add nutrients. Some have added sealed top covers to keep rain out and heat in. The cover also provides a vent in which to obtain a representative sample of the exhaust to calculate a more accurate DRE.

One of the earliest modifications was to install the biofilter in the ground, see Figures 20 and 21. This may be done by: digging a hole in the ground the size of the biofilter; placing a lining of coarse gravel several inches thick on the bottom; installing an emissions distribution piping system on top of the gravel; covering the piping system with additional few inches gravel; and covering the gravel with several feet of packing media.

Biofilter Design Characteristics: Allen Boyette (Ref. 21) did research and wrote a paper

on existing biofilters installations presenting design characteristics and cost information a few

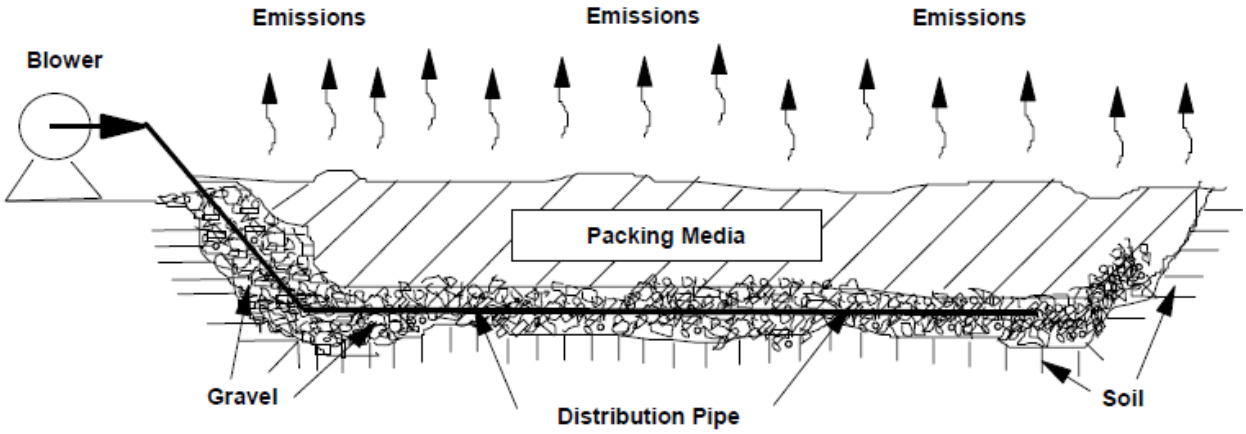


Figure 20: In-Ground Biofilter

Figure 21: Photograph of four Biofilters being installed in Arlington, TX At Central Regional Wastewater System Plant

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. Discusses the scrubber and bio filtration? (4pts)
2. What are Non-condensable gases? (4pts)

Note: Satisfactory rating - 510points Unsatisfactory - below 10 points

You can ask you teacher

Score = _____

Rating:

REFERENCE MATERIALS

Book:

AMPC (2006) Meat technology information: Microwave Method for Chemical Lean Determination.

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J. Peter Clark (2005) Preventing and Detecting Foreign Matter in Foods processing

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United States Environmental Protection Agency Office of Wastewater Management Washington (2011) Exhaust gas scrubber wash water effluent

WEB ADDRESSES

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4.7. 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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4.8. SELF-CHECK ANSWERS

Lo-1: Feed cooker, Operate and monitor cooker

Self-checks 1 answers

Test I

- boiler
- stewer
- pressure cooker
- Roaster
- Micro waver

Test II:

1. True, 2. True

Self-checks 2 answers

Test I:

- Conduction,
- Convection
- Radiation

Test II:

1. True, 2. False

Self-checks 3 answers

Test I:

- Glass
- Metal
- Stones
- Wood
- Jewelry
- Insects…,

Test II:

1. True, 2. False

Self-checks 4 answers

Test I:

1. Weight change is the yield value (expressed in per cent) minus 100
2.
   - Cooking method
   - Food quality
   - Type of fat added
   - Temperature

Self-checks 5 answers

Test I:

- An electronic thermometer
- A digital instant-read thermometer

Test II:

1. False, 2. True and 3. True

Self-checks 6 answers

Test I:

- **Slaughtering:**
- **Blood Processing**
- **Hide Processing:**
- **Meat Preparation**
- **Rendering, …**

1. **Test II:**

1. True, 2. False and 3. True

Self-checks 7. answers

Test I:

1. It is a multidisciplinary practice dealing with all aspects of **health and safety** in the workplace, with a strong focus on preventing workplace hazards
2.
   - Wear clean protective clothes
   - Washing hands before starting work
   - Repeatedly washing hands during work
   - No finger rings, watches, bracelets
   - Access to production areas with working clothes only
   - Cleaning/disinfection of hands/tools/clothes
3.
   - A oats and Aprons
   - Ear plugs
   - Muffs
   - Eye and Facial protection
   - Snoods
   - Mesh approns
   - Protective Hand and Arm Covering
   - Protective Head and Hair Covering
4. Uniform

LO 2: Monitor environmental controls

Self-checks 1 answers

Test I:

1.

- A heat sources
- An evaporation vessel
- A vapor separation vessel
- A vacuum system

2.

- Installation of additional effects
- Preheating feed product
- Vapor recompression

Self-checks 2 answers

Test I:

1. It is a methods of control pollution by purifying the exhaust streams, which means that hardly any harmful gases or particulates will leave the building and enter the environment

   Biofiltration is the most typical type of biological air pollution control process, initially developed in the late 1970s. It is now emerging as a sustainable alternative for the treatment of air contaminated with VOCs and odorous compounds

2. Which is sulfur oxide, carbon dioxide, methane, ammonia, hydrogen sulfide, hydrogen, are the gaseous emissions that are found dissolved in the geothermal water.