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Ministry of Labor and Skills

DAIRY PRODUCT PROCESSING

LEVEL-II

Based on November 2021, Version- 3 Occupational standard

Module Title: Operating Butter Churning and butter Oil Production Process

LG Code: IND DPP2 M09LO (1-3) LG (36-38)

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Table of Contents

Introduction to the Module

This module covers to provide the trainees with the, knowledge, skills and attitudes required to prepare the butter churning, butter oil equipment and Operate and monitor the butter churning and the butter oil process operation.

LG #36	LO #1- Prepare the butter churning and butter oil equipment and process for operation

Instruction sheet

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

- Confirming and making available materials
- Identifying and confirming cleaning and maintenance requirements
- Fitting and adjusting machine components
- Entering processing/operating parameters
- Checking and adjusting equipment performance
- Carrying out pre-start up checks

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Confirm and make available materials
- Identify and confirm cleaning and maintenance requirements
- Fit and adjust machine components
- Enter processing/operating parameters
- Check and adjust equipment performance

Carry out pre-start up checks

Learning Instructions:

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

Information Sheet 1

1.1 Confirming and making available materials

Butter is a dairy product made by churning fresh or fermented cream or milk. Conversion of milk fat into butter is a very old way of preserving milk fat. Butter accounts for a major portion of the nutritive value of milk. Butter is generally used as a spread and a condiment, as well as in cooking applications, such as baking, sauce making, and pan frying.

Butter consists of butterfat, water, and milk proteins. Most frequently made from cow milk, butter can also be manufactured from the milk of other mammals, including sheep, goats, buffalo, camels, and yaks. The most dominant source for production of butter today is bovine milk. Throughout the centuries, butter was manufactured at farms in small quantities with considerable variation in quality. In the nineteenth century, industrial production of the butter started through centralization and mechanization, which resulted in substantial improvement in the quality of butter.

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1.1.1 Cream Neutralization (for butter- making)

Neutralization of sour cream for butter making refer to a partial reduction in acidity. Cream is neutralized to avoid excise fat loss in buttermilk that result from churning highly acid pasteurized cream, to guard against the production of an undesirable off- flavour in cream (which may result when high acid cream is pasteurized), to improve the keeping quality of butter made from high acid cream. Salted acid butter develops a fishy flavour during commercial storage at – 230 C to -290 C. Neutralizers commercially used are Sodium bi carbonate and Calcium hydroxideA temperature maintained thermostatically that encompasses the usual and customary working environment of 20°C to 25°C (68°F to 77°F) that allows for brief deviations between 15°C and 30°C (59°F to 86°F) that are experienced in warehouses.

1.1.2 Standardized Cream

This refers to the adjustment of the fat level in cream to the desired percentage, confirming to standard requirements. The fat percentage in cream is adjusted to the prescribed level by the addition of skim milk or cream. Desired level of fat in cream for butter making is 33 to 40 per cent. Standardization to both higher and lower level leads to higher fat loss in butter milk. Reduction of fat by adding water should be avoided as it interferes with ripening of cream and also results in butter with 'flat' or 'washed off' flavour.

1.1.3 Pasteurized Cream

Cream is pasteurized at 71^{0}C for 20 min in a batch process and 95 to 100 ^{0}C for 15 sec in a high temperature and short time (HTST) pasteurizer. Pasteurization is done mainly to destroy the pathogens, inactivate enzymes, eliminate gaseous tainting substances, and remove volatile off flavours.

1.1.4 Salt

Salt is used to improve the flavour and the shelf-life, as it acts as a preservative. Further, the butter is worked to improve its consistency. Salt used should be 99.5 to 99.8% sodium chloride and microbial count should be less than 10/g. Salt is added at the rate of 2 to 2.5%

1.1.5 Washing Water

In traditional churning, the machine stops when the grains have reached a certain size, whereupon the buttermilk is drained off. With the continuous butter maker the draining of the buttermilk is also continuous. After draining, the butter is worked to a continuous fat phase containing a finely dispersed water phase. It used to be common practice to wash the butter after churning to remove any residual buttermilk and milk solids but this is rarely done today. This washing process would ensure that all the butter milk is washed out of the butter. Otherwise the butter would not have good shelf life and go rancid.

1.1.6 Packaging material

Butter cream is packaged in retail packs in glass bottle, laminated pouches, plastic containers etc. and stored at 4-70 C and distributed as early as possible

1.1.7 Ripening of cream

Ripening refers to the process of fermentation of cream with the help of suitable Starter culture. This step can be eliminated if sweet-cream butter is desired. The main object of cream ripening is to produce butter with higher di acetyl content.

1.2 Identifying and confirming cleaning and maintenance requirements

The arrangements for cleaning equipment that comes in contact with products are an essential part of a food processing plant. Cleaning of dairy equipment was formerly done (and still is in some places) by people armed with brushes and detergent solutions, who had to dismantle equipment and enter tanks to get to the surfaces. This was not only laborious but also ineffective; products were often re infected from imperfectly cleaned equipment.

1.2.1 Cleaning and sterilization of dairy equipment may be broadly classified into:

- **Hand cleaning and sensitization** will apply to small equipment. It should be generally adopted in small dairies or milk collection/chilling centres, where it is uneconomical to have costly machine-cleaning. The temperature of detergent solution in hand cleaning should be such that it does not affect the hands. A bucket of cleaning solution and a hand brush besides some warm water should serve the purpose of cleaning. Sanitization should be effected with the help of steam jet, or steam chest, or chlorine solution.

- **mechanical cleaning and sanitization** should be generally adopted for milk cans and milk bottles in milk plants ,

- **In-place cleaning and sanitization**. Circulatory cleaning-in-place (CIP) systems adapted to the various parts of a processing plant have been developed to achieve good cleaning and sanitation results. Cleaning operations must be performed strictly according to a carefully worked out procedure in order to attain the required degree of cleanliness. This means that the sequence must be exactly the same every time.

1.2.2 Detergent/sanitizer

Table 2.1 concentration of detergent/sanitizer

Ingredients	**Quantity per 1000gm**	**Remark**
Washing soda (commercial hydrated sodium carbonate)	850gm	For general use
Tri-sodium phosphate Sodium meta silicate	100gm	For general use
Sodium sulphite Tri-sodium phosphate	50-150gm	For general use excluding aluminium utensil

The sanitizer may be either scalding water (90^{o}C to 95^{O}C) or chlorine solution (200 ppm available chlorine).

- **Cleaning Procedure**

Cleaning of utensils should be done as follows:

I. Mix the ingredients in proportion mentioned and add sufficient water to make a paste. About 15 g of the mixture will be required for cleaning a utensil of l0-litre capacity.
II. Rinse the utensil with cold water (tepid water in cold season) and drain out the rinsing's.
III. Scrub the utensil (inside and out) with the above detergent paste using a clean brush or coir to loosen and remove all milk residues.
IV. Wash the utensil again with enough cold water (tepid water in cold season) to remove traces of' detergent, and allow them to drain and dry.

The cleaned utensils may be sanitized by rinsing with either scalding water, or chlorine solution, just prior to use. Disinfection by heating or with chemical agents (optional); if this step is included, the cycle ends with a final rinse, if the water quality is good. Each stage requires a certain length of time to achieve an acceptable result

1.2.3 Butter churner Cleaning procedure

The churn and butter making equipment should washed as soon as possible, preferably while the wood is still damp in the case of wooden churns. Cleaning of the bowl and the mixing device Remove the cover.

I. Partially fill the churn with water .at about 80°C. If considered necessary, add a small quantity of a suitable wetting agent. Rotate the churn (with the worker) for 3 to 5 minutes. Drain off this water as rapidly possible, and flush out any remaining fat from the bottom of the churn by rinsing with hot water.

II. Fill the churn to one-fourth capacity with 0.5 percent general-purpose alkaline detergent solution at 80°C. Close the churn door. Remove sight glass. (This is necessary to avoid development of pressure when the churn is rotated, with possible cracking of the sight glass.) Rotate the churn for 5 to 10 minutes, first slow then fast. Stop the churn and drain as quickly as possible, again flushing the residue from the bottom of the churn with hot water.

III. Fill the churn to one-fourth capacity with hot water at 95°C. Rotate the churn for 15 to 20 minutes, first slow then fast. Drain off the water as rapidly as possible.

IV. Open the churn door, as soon as water has drained off. Position the churn with open drain cocks at top. This will induce a draught which, will carry off the steam and dry the surface of wood.

V. Use clean long handled brushes, preferably of nylon and of various shapes and sizes, to clean the interior surfaces, opening,

- Wooden churns left unused for long time should be treated-with hot lime water at intervals during the idle period. The churn at each treatment should be washed with the hottest water available, and then be dried out. Metal chums do not require treatment during the idle period.
- The churn prepared for butter making by:-
  - ✓ Rinsing with cold water
  - ✓ Scrubbing with salt
  - ✓ Rinsing again with cold water.
  - ✓ Alternatively, it can scalded with water at 80°C.
- After the butter removed, the churn should be
  - ✓ washed well with warm water,
  - ✓ Scalded with boiling water and left to air.
  - ✓ When not in use wooden churns should be soaked occasionally with water.
- A new churn should first be:
  - ✓ washed with tepid water
  - ✓ scrubbed with salt
  - ✓ Washed with hot water until the water comes away clear.
  - ✓ A hot solution of salt should allowed standing in the churn for about ten minutes.
  - ✓ After rinsing again with hot water the churn should left to air for at least one day before being, used.

1.2.4 Homogenizers cleaning procedure

The homogenizer is a particularly difficult piece of equipment to wash and sterilize adequately. The piston rods of such machines are generally provided with a type of packing gland which it is not possible to remove daily for cleaning purposes, and this part of the equipment may, therefore, be a source of trouble.

- The following cleaning procedure is recommended, it being assumed that the inlet side of the machine is connected to a hopper of feed tank which is normally used to provide an adequate head of milk to the machine:

- ✓ The control valve should be adjusted to give reduced pressure.
- ✓ The feed tank should be filled or partly filled with warm water and all milk residues flushed out. This would involve starting up the machine.

1.2.5 Cream Separator cleaning procedure

- Flush out thoroughly with clean cold water (tepid water in cold season) while the separator is still running.
- Dismantle the separator completely.
- Wash each part by thorough scrubbing with a clean brush using hot detergent solution. Rinse well each part with hot water to remove trace of detergent.
- Arrange neatly on a clean rack for drying.
- Re-assemble and sterilize with scalding water or chlorine solution before use.

1.2.6 Hygienic practices during butter handling

Washing hands with clean water and detergent followed by drying with a clean towel before handling butter helps to protect the product from microbial and dirt contamination. Covering hair and dressing clean gown during handling of milk and milk products are also important practices that handlers need to practice. The major sources of microbial contaminations of butter are related to unclean surfaces of the churn, storage utensils and wash water.

Regarding with storage container Plastic materials used for butter storage and transportation are not generally easy to clean, and are scratched by repeated cleaning, which provides a hiding place for microbial multiplication. Such conditions can represent potential source of microbial contamination of butter, despite washing with hot water. Therefore, replacements of plastic containers with stainless steel or aluminium containers can improve the flavour and hygienic conditions of the product considerably.

1.2.7 Maintenance of butter making equipment

- **Maintaining of butter churn**

  Durability and non-failure operation of the butter churn depends on correct maintenance according to the requirements of the present manual.

- ✓ Protect all parts of the butter churn from damage.
- ✓ Do not allow contact of the plastic parts with active solvents or the articles heated above 80 °C.
- ✓ Wash the dirty surfaces with 0.5-2 % soda solution and soap water using soft rags.

  Do not use sand, metal brushes, soap-sandy and other active cleaning agents.
- ✓ When washing, check that water does not get on the electric motor through the air holes and the hole in the electric drive cover.
- ✓ In case of long-term break in butter churn operation grease the shaft, the impeller with technical Vaseline.
- ✓ The electric motor bearings are designed for operation during the whole service life without additional lubrication.

- **Maintenance procedure of milk separator**
  - ✓ The gears must well lubricated according to manufacturer's instructions.
  - ✓ The level of the lubricant must be kept constant;
  - ✓ Observe the oil level through the sight glass.
  - ✓ The bowl must carefully balance.
  - ✓ The bowl should cleaned thoroughly as immediately after use to ensure proper functioning of the separator and for hygiene.

- **Periodic maintenance**
  - ✓ Check bushes and bearings on pivot points
  - ✓ Replace the wearing and braking parts (if it happen)

1.3 Fitting and adjusting machine components

Major types of churns are classified mainly as a batch churns and continuous butter making churns. In batch churns there are wooden and metallic churns. Presently wooden churns are obsolete and metallic batch and continuous butter making equipment's are popular. Role of churn is to agitate the cream, today's churn design is the modification of several earlier designs,

and following are the types of churn design evolved over the time. During the ancient time wooden churns were popular and in recent time metallic churn are widely adapted.

1.3.1 Bach types of butter churns

- **plunger butter churn**

Is the most historically outstanding type. It often consists of a wooden barrel and a stick that has a disc with holes attached to it. One had to pour milk or cream into the barrel and move the stick up and down inside it for a good 60-90 minutes in order to produce butter.

- **Paddle churn**

This is the most popular kind of churn and is widely used today, especially for homemade butter. Such a machine looks like a container with a couple of paddles in it. They rotate and churn cream, converting it into butter.

Paddle churns can be mechanical or electric. The first kind has a hand crank that one has to rotate manually to make the spread. The second is automatic and powered by electricity. The only thing you need to do is pour cream or milk into the container and wait

Figure.1.1 wood & metallic Bach churner (access date on11/2022)

1.3.2 Continuous Butter Making Machine

This equipment is specially used to produce cream products with the fat content of no less than 80%, and the produced cream is stable in grade and good in shape. In addition, the formation of cream, separation of buttermilk, emission of air and cream plasticizing are all finished automatically and continuously in the corresponding parts of the equipment. So this equipment is featured by simple operation, effectiveness and time-saving and high cream yield. Since the

production of cream with this equipment is carried out in a closed system, the external pollution risk for the product is extremely low.

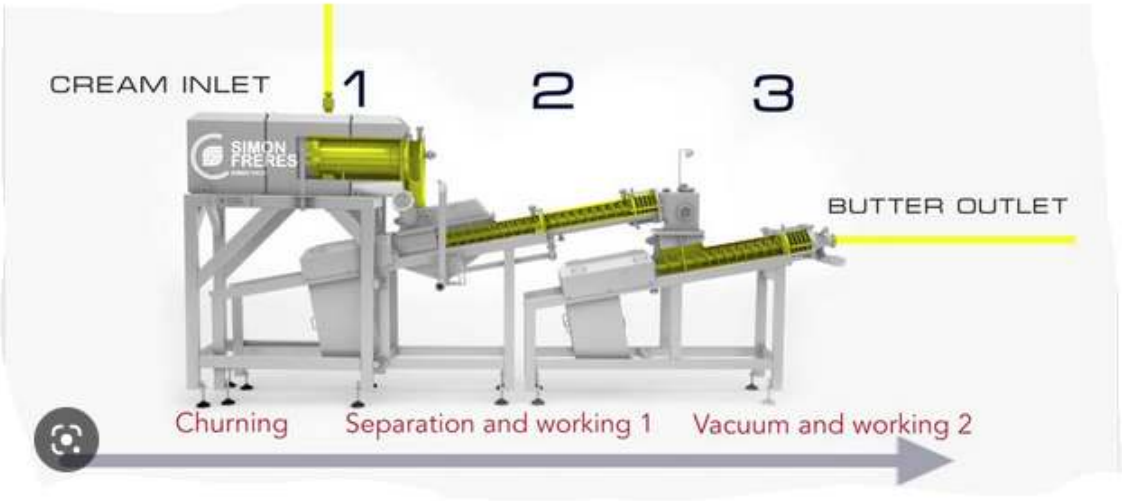


Figure.1.2 continuous butter making churner (access date 21/11/2022)

1.3.3 Main Components of butter churner

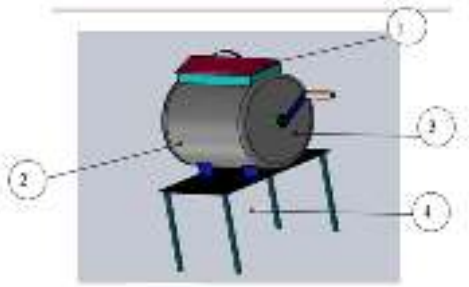
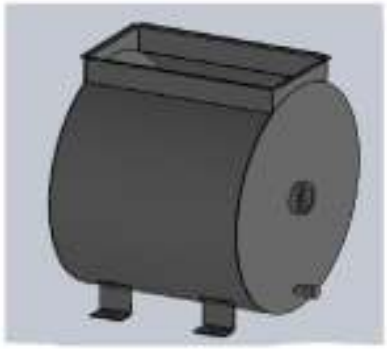
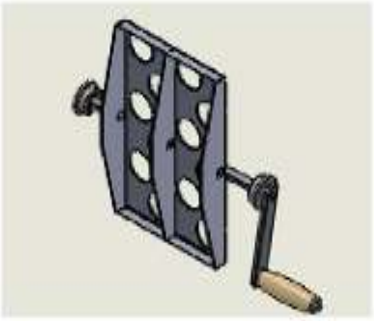


Figure.1.3 parts of butter churning machine

The machine has 4 main sub parts.

- Churning unit sub parts
  - ✓ Cover of butter churner
  - ✓ Body of butter churner
  - ✓ Agitator of butter churner
  - ✓ Frame of butter churner

Table.1.2 Main components of butter churning machine

No	Sub parts	Function	Figures
1	Cover	The cover of the butter churner is sheet of stainless steel that folds to fit the body with negligible loss of milk during churning. And also it has handle to open and close.	
2	Body	The body of the butter churner is the part which takes or carries the fresh or fermented cream. It has a drain cap on this lower end of this part which is used to drain the fluid after churning to take of the butter. It has also double bearing house to use the bearing, set also there	
3	Agitator	The agitation of the cream, caused by the mechanical motion of the device, disrupts the milk fat. The membranes that surround the fats are broken down, subsequently forming clumps known as butter grains. These butter grains, during the process of churning, fuse with each other and form larger fat globules.	

4	Frame	The frame is part which is used to hold up the machine that is fitted to operator's safety and setting stance.	

1.3.4 Adjusting Churning temperature gauge.

- The temperature of the cream during churning has great importance.
  - ✓ If too cool, butter formation delayed and the grain is small and difficult to handle.
  - ✓ If the temperature is too high, the butter yield will be low because a large proportion of the fat will remain in the buttermilk, and the butter will be spongy and of poor quality.

- Cream should churned adjusting the machine temperature gauge.
  - ✓ At 10--12°C in the hot season and
  - ✓ At 14--17°C in the cold season.
- The temperature raised by standing the vessel containing the cream in hot water, and lowered by standing the vessel in cold spring water for a few hours before the cream churned.
- The churning temperature adjusted by the water used to dilute the cream.
- In the hot season, the coldest water available should be used, preferably water that has been stored in a refrigerator.

1.3.5 Adjust Amount of cream to be churned

- The amount of cream to be churn should not exceed one-half the volumetric capacity of the churn.

- An airtight churn should ventilated frequently during the first 10 minutes of churning to release gases driven out of solution by the agitation.
- If butter is slow in forming, adding a little water which is warmer than the churning temperature, but never over 25°C, usually causes it to form more quickly. When the butter appears like wet maize meal, water (1 litre per 4 litres of cream) at 2°C below the churning temperature should added.
- It may be necessary to add water a second time to maintain butter grains of the required size.
- Churning should cease when the butter grains are the size of small wheat grains

1.3.6 Churning process flow of the Butter Churner

I. To start the machine, first inspect the machine sensitive parts such as bolts, drain cap Tightness and pins
II. Next start to load a milk on the cover part.
III. Finally manually crank the agitator by handle crank

1.3.7 Cream separation

Cream separation is a phenomenon by which the milk is separated in to cream and skim milk by centrifugal force. The centrifugal force is thousand times greater than gravitational force. The milk enters the rapidly revolving bowl of the separator.

It is then acted upon by centrifugal force. The inflow of milk is channelized to the outer wall of the bowl and fills it from outside towards the centre. The centrifugal keep on continuously and act upon to partition the serum and cream. The milk serum has higher specific gravity (1.036) than that of fat (0.9). Obviously serum is thrown towards the outer periphery and channelized to skim milk outlet, while the cream is channelized to the central core and forced out through cream outlet.

Generally the milk is preheated to 37-50 ^{o}C before separation for optimum results. This makes the process easier and more efficient as the warm milk is less viscous than the cold milk. In-flow of milk is regulated by adjusting the milk inlet valve to the separator.

As the disk stack revolves the cream moves towards the centre of the bowl and the skim milk is directed outwards periphery by the centrifugal force. Under normal conditions it produces skim milk and cream in the ratio of 90:10; variation in cream richness will vary these proportions.

- **Parts of Cream separator**

The modern centrifugal cream separator consists of the following main parts:

- ✓ A bowl which can be rotated at a high speed (5000-6000 rpm) by means of suitable gears and power transmission mechanism.
- ✓ Arrangement for supplying milk to the bowl.
- ✓ Removing the cream and skim milk.
- ✓ Driving the machine.

- **Fitting and Adjusting (Assembling) Cream separator**
  - ✓ Put the bowl cover pin assembly back to gather
  - ✓ Sure the bowl fit base notch
  - ✓ Tighten the bowl nut well
  - ✓ Place the milk contact parts over the spindle
  - ✓ Starting with milk spout.
  - ✓ Next place the bowl assembly making sure it seats properly on the tapered head of the spindle shaft.
  - ✓ Put the cream spout on the next place the float chamber
  - ✓ Next to float chamber put the milk tank “ON” the float chamber
  - ✓ Make sure the milk tank is placed with on label at the front
  - ✓ Tighten the tank tap handle put the tap in “OFF” position

Watch this video https://www.youtube.com/watch?v=OtwuzujBvRw accessed date 21/11/2022

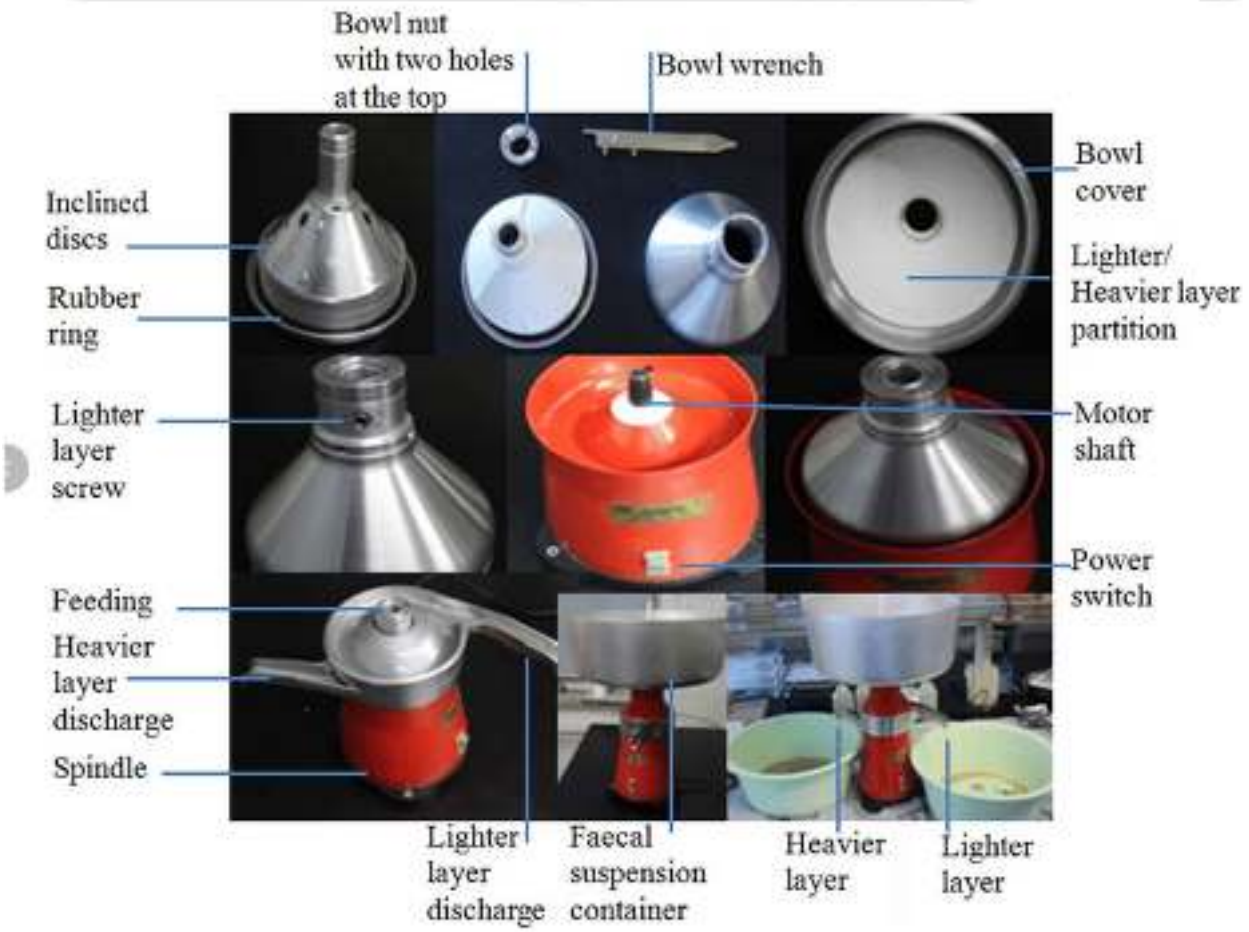


Figure 1.4 parts of cream separator

1.4 Enter processing/operating parameters

- **Milk preparation and operation**
  - ✓ Milk must be strained to remove any dirt or particle
  - ✓ Milk must not be cold, homogenized or Sour
  - ✓ For best results, separate milk right out of the cow. If that is not possible rewarm the milk to approximate cow body temperature 100^0F(38^0C)
  - ✓ It is very important that the milk is warm and stays warn though out the separating process
  - ✓ Pre warm the separator as follow
    - Heat approximately 8 quarters (7liter) of hot water to 150^0F (66^0C)
    - Pour about 4 quarter of hot water into the tank.

- ✓ Place the containers under the spout to catch the water
- ✓ Open the tap and turn the machine on. Therefore, the hot water flows through the separator, and warms all the milk contact parts and close the tap.
- ✓ Now pour 6 quarter (6lit) of warm milk in the tank.
- ✓ Make sure you have in place adequately sized containers to receive the cream and skimmed milk, which, will come out of the spout

1.5 Checking and adjusting equipment performance

1.5.1 Adjust Butter churning performance

A variety of methods and devices have been developed to produce butter on a small and large scale. Butter churns have varied over time as technology and materials have changed. The first butter churns had a wooden container and a plunger to agitate the cream until butter formed, then, butter churns consisted of a container made from wood, ceramics or galvanized iron that contained paddles.

Later centrifugal type butter churns were introduced for butter making. Instead of having spinning paddles, the paddles are fixed and the container spins. This allows better separation of butter from butter milk. The most suitable treatment for the uniform butter consistency is mechanical treatment of butter.

During this process, cream undergoes a phase inversion as fat globule membranes are disrupted, globules coalesce and oil leaks out to form a continuous phase. Many physical and chemical factors are involved in achieving desired consistency and yield of butter. Churning of 40 % cream yields almost equal amount of butter and butter milk. Optimized and evaluated the traditional butter making methods for getting good quality and yield of butter by standardizing cream fat levels and altering churning temperatures during butter making.

A high temperature during the churning process reduces the butter yield, as some of the butter fat liquefies and is lost with the buttermilk. A number of interrelated variables are involved in efficient operation of butter churn machine, such as fat level, cream acidity, and churning temperature and churn speed.

Preliminary test was carried out at different churn speed and churning temperature. Many parameters were recorded during the test which includes the amount of soar/fermented milk used, acidity level of yogurt, purity of soar, starting time of churning, ending time of churning, time taken to churn and butter yield were collected. The efficiency of improved butter churner was 64% higher (82g/liter) than the local churner (50g/ liter). This implies the possibility of extracting 32 gram extra butter from one litter of milk by using improved churner.

Figure 1.5 Electric churner access date 22/11/2022

This Electric Butter Churn machine eliminates the hard manual work, as the motor rotates the churning blades to produce butter.

- You only need to press the button and watch as the machine converts the cream into butter and buttermilk.
- It comes fitted with three-propeller turbulence system that does the work of converting cream to butter.
- The system is easy to work with since the propellers can be easily dismantled, and cleaned by hand.

- Inner parts are made of food grade stainless steel for hygiene and ease of handling.

1.5.2 Separation performance of centrifugal Cream separator

Factors influencing the separation performance of cream separator

- **Position of the cream screw**
  - ✓ Cream screw/outlet consists of a small, threaded, hollow screw pierced by a circular orifice through which the cream emerges.
  - ✓ The screw can be driven IN or OUT, bringing it nearer to or away from the centre of rotation.
  - ✓ Skim milk screw/outlet is for the removal of skim milk.
  - ✓ By altering the position of the cream screw, the ratio of skim milk to cream changes.
  - ✓ Cream screw is moved IN towards the axis of rotation, higher fat percentage in cream obtained and vice versa.

- **Fat percentage in milk**
  - ✓ Higher the fat % in milk, higher % fat in cream and vice versa.
  - ✓ High-fat milk has a higher fat content than low-fat milk.

- **Speed of the bowl**
  - ✓ Velocity of fat globule is proportional to square of the rotational speed so an increase in bowl speed has major effect on separation efficiency.
  - ✓ Higher the speed of bowl, greater will be the centrifugal force and more rapidly the skim milk leaves the bowl with higher fat % in cream.

- **Temperature of milk**
  - ✓ Increase in temperature of milk leads to both an increase in density difference between milk fat and skim milk leading to lower separation efficiency.
  - ✓ Higher temperature leads to disruption of fat globule which will result in heavy fat losses in skim milk. Fat losses are higher at 70°C

- **Factors affecting fat losses in skim milk**

Temperature of milk	Speed of the separator bowl	Rate of milk in-flow	Position of cream screw
Mechanical condition of the machine	Amount of separator slime in the bowl	Size of the fat globules	Degree and temperature of separation
	Presence of air in milk	Acidity of Milk	

Figure 1.6 cream separator access date 21/11/202

1.5.3 Butter homogenization/reworked

Milk is commonly homogenized by flat valves. To investigated, if milk can be produced more Efficient, we homogenized common full cream milk with a fat content of M = 3.5 vol.-% with the different disruption system by homogenization pressures up to 1000 bar. In all disruption systems the droplet size decreases with increasing homogenization pressure, which indicates that the process is dominated by disruption process.

Butter homogenizer machines is intended for mechanical processing of blocks of butter, animal fat, margarine and other fats, without prior defrosting. Butter homogenizer is used to homogenize bulk butter before re-packing. The design of the operating parts homogenizer helps to increase product plasticity and ensure even distribution of moisture, which provide long-term product storage, preservation of organoleptic properties. Homogenization is performed in order to improve the consistency of the butter.

Figure 1.7 butter homogenizer

1.5.4 Milk Tanks

- The milk tanks are prime components associated with milk production in processing type of business.
- There are various uses of milk tank in the dairy business.
- It used for store-standardized types of milk, skimmed milk or cream.

- The pre stack tanks, interim tank, milk tanks and mixing tanks will always give you good quantity of milk with all necessary characteristics.

Figure 1.8 milk tankers access date 21/11/2022

1.6 Carrying out pre-start up checks

Before starting any processing activity check the parts of the equipment whether it is good or not. Tools and equipment entering, Critical and should be cleaned, sanitized and inspected before entry. Alternatively, a captive tool program can be put in place to ensure that these areas have a designated set of tools required for any task required in that operation.

It is important to ensure that those tools and equipment are kept locked, clean, and part of a master sanitation schedule. New equipment should be evaluated to ensure it isn't a source of contamination before being used when receiving new or used equipment, precautions must be taken to prevent introducing contamination**.**

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All equipment new to the facility must be cleaned and sanitized before it enters any production zone. Cleanliness and microbiological condition of the equipment should be confirmed by taking indicator and/or pathogen swabs. The equipment may need to be re-cleaned, sanitized, and

checked before being placed into service. A best practice is to have a policy and standard operation procedure (SOP) to handle new equipment entering the plant and commissioning of the equipment.

- Similar precautions should be taken when used or existing equipment is moved to different areas.
- Used and/or repurposed equipment presents a greater risk because its history may be unknown and older designs tend to be less cleanable. Additional precautions are prudent.
- New stainless steel equipment must be passivized for corrosion resistance and to enable cleaning.

As a responsible operator, running a pre-start check the equipment before to start the day activity.

- Undertaking a pre-start check the equipment before you start a day's work, happens in three stages.

  Step 1 - Visual inspections of important features prior to starting the equipment

  Step 2 - Visual & function tests while the equipment is turned on but stationary

  Step 3 - Testing the machine's functions during a short drive within each of these steps there are activities that are common to all pre-start checks

- **Pre-start checking (inspecting) for dairy machine**
  - ✓ Check bolts and other loosen parts and tighten it before operation will start.
  - ✓ When maintaining, inspecting, attaching and detaching parts, park the machine at flat and safe place
  - ✓ Use proper tools to maintain the machine and check working area is safe during Operating
  - ✓ Only allow responsible person, who are familiar with the instructions, to operate the machine
  - ✓ Use only the machine for recommended work in the manual
  - ✓ Take care when loading or unloading the machine
  - ✓ Maintain the proper working speed.

- **After operation**
  - ✓ Remove remaining objects and wash in Agitating part, Body part and Drain Cap part.
  - ✓ Fasten the loosen bolts and nuts after operation

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Test I: Choose the best answer (7pts)

1_____is dairy product made by churning fresh or fermented cream or milk.

A. Cheese B. yogurt C. Butter D. milk

2._____ is refers to the adjustment of the fat level in cream to the desired percentage, confirming to standard requirements.

A. Cream neutralization B) standardization of cream C) pasteurization D) none

3. Which one is the component of butter churn?

A. Cover B) agitator C) frame D) all are the answer

4. Durability and non-failure operation of the butter churn depends on_____

A. Wash the dirty surfaces with 0.5-2 % soda solution and soap water using soft rags.

B. Protect all parts of the butter churn from damage.

C. A&B

D. None

5. What is the importance adjusting the cream temperature during churning?

A. To increase the butter quality

B. To increase the butter quantity

C. To increase the butter quantity in the buttermilk

D. A&B are answer

6. What is the function of milk tank?

A. holding milk B. mixing milk C. heating milk D. A&B

7._____ Machine used in achieving the different variety of product, improves the taste, texture and viscosity of juice based drink or cream and prevents a sedimentation and cream line in the milk products.

A. Homogenizer B. Pasteurizer C. Separator D) Churner

Test 1: Give short answer for the following questions (3pts).

1. Write the stage of cleaning
2. Write types of butter churner
3. List at list three parts of cream separator

Note: Satisfactory rating 10 points Unsatisfactory – below 10points

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

Score = _____

Answer Sheet

NAME_____ **Date**_____

Operation Sheet 1

1.1 Methods of adjusting cream separator machine

A. Tools and equipment' needed to adjust cream separator

- ✓ Personal protective equipment
- ✓ milkCream centrifugal separator spare part
- ✓ Top wrench
- ✓ Oil for cream separator gear
- ✓ Cleaning reagent
- ✓ Two bucket
- ✓ Table
- ✓ Electric power
- ✓ Electric cable

B. Procedures of assembling cream separator

Step 1 put the bowl cover pin assembly back to gather

Step 2 Sure the bowl fit base notch

Step 3 Tighten the bowl nut well

Step 4 Place the milk contact parts over the spindle

Step 5 Start with milk spout. Next place the bowl assembly making sure it seats properly on the tapered head of the spindle shaft.

Step 6 put the cream spout on the next place the float chamber

Step 7 put the milk tank "ON" the float chamber

Step 8 Make sure the milk tank is placed with on label at the front

Step 9 Tighten the tank tap handle put the tap in "OFF" position

Step 10 taste the machine as it is functional by adding milk

Step 11 apply cleaning procedure of cream separator

LAP Test 1

Name……. ID……..

Date…….

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **1** hours. The project is expected from each student to do it.

Task 1: Perform adjusting cream separator machine

LG #37 LO #2- Operate and monitor the butter churning and the butter oil process operation

Instruction sheet

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

- Starting and operating the process
- Monitoring equipment in operation
- Identifying and maintaining variation of equipment
- Monitoring production stage
- Identifying, rectifying and reporting out-of-specification product/process out comes
- Maintaining work area
- Conducting work with environmental guidelines
- Maintaining workplace information

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:

- Start and operate the process
- Monitor equipment in operation
- Identify and maintain variation of equipment
- Monitor production stage
- Identify, rectify and report out-of-specification product/process out comes
- Maintain work area
- Conduct work with environmental guidelines
- Maintain workplace information

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.

3.Read the information written in the information Sheets
4.Accomplish the Self-checks
5.Perform Operation Sheets
6.Do the “LAP test”

Information Sheet 2

2.1 Starting and operating the process

Butter is a product obtained by the mechanical processing of milk fat. It should be emphasized that milk does not contain butter, but fat. So, butter is essentially an industrial product produced after processing the fat. Traditionally, butter is defined as a plastic product derived from cream, inverted to a water-in-oil emulsion (W/O) with minimum 80% fat.

The continuous fat phase in the butter is a complex matrix of liquid butter oil and fat crystals forming a network which entraps the water droplets and to a limited extent small air bubbles.

The composition of the butter is approximately the following: fat 81.5% -82.4%, water 16.5-17.5%, while the dry matter that does not contain fat is 0.6-1.6%. The dry matter contains a small percentage of protein, milk sugar and salt that has been added during the processing of fat and its conversion into butter.

The colour of the butter depends on the type of milk we use. Cow's milk gives a slightly yellow butter, which is due to the fat content of the milk in β-carotene. Unlike cow, goat butter is white and this is because the goat converts the β-carotene it receives in its food to vitamin A, which is colourless.

2.1.1 There are four types of butter making processes

Traditional batch churning from 25- 35% milk fat (mf) cream Traditional Ethiopian butter (kibe) is always made from soured milk (irgo); cream is not used. The sour milk is placed in a clay churn or a bottle gourd (calabash). Churns are usually spherical, with a neck 10 cm in diameter at the narrowest point and a vent 0.5 cm in diameter near the neck.

The churn may have previously been smoked with Olive Africana. Besides imparting a distinct flavour to the butter, this practice has a bacteriostatic effect, and may reduce processing time by heating the churn. After filling, the churn is stoppered with a plug, a false banana leaf, or a piece of skin. Wach video:- https://www.youtube.com/watch?v=lcLTiHAvt9k

- https://www.youtube.com/watch?v=dVt-6NJ71kQ access date (27/11/2022

Step of homemade butter making

Figure 2.1 collect cream from boiling milk

Figure 2.2 Make Curd With Leftover Milk

Figure 2.3 Equipment Required

Figure 2.4 Making Butter from Cream

Figure2.5 Making Butter from Curd

Figure 2.6 Use a Spoon to Drain out Milk / Whey from the Butter

Figure 2.7 homemade butter

- **Continuous flotation churning** from 30-50% mf cream;

There are two methods of continuous butter making: one involving the accelerated churning of normal cream and the other the utilization of re separated high-fat cream.

Stage 1 First fed the cream into a churning cylinder fitted with beaters that are driven by a variable speed motor. Rapid conversion takes place in the cylinder and, when finished, the butter grains and buttermilk pass on to a draining section. The first washing of the butter grains sometimes takes place in route - either with water or recirculated chilled buttermilk.

Stage 2 on leaving the working section the butter passes through a conical channel to remove any remaining buttermilk. The butter may be given its second washing, this time by two rows of adjustable high-pressure nozzles. The water pressure is so high that the ribbon of butter is broken down into grains and consequently any residual milk solids are effectively removed. Following this stage, salt may be added through a high-pressure injector.

Stage 3 The third section in the working cylinder is connected to a vacuum pump. Here it is possible to reduce the air content of the butter to the same level as conventionally churned butter.

Stage 4 in the final or mixing section the butter passes a series of perforated disks and star wheels. There is also an injector for final adjustment of the water content. Once regulated, the water content of the butter deviates less than +/- 0.1%, provided the characteristics of the cream remain the same.

Stage 5 The finished butter is discharged in a continuous ribbon from the end nozzle of the machine and then into the packaging unit.

Wach this video:- https://www.youtube.com/watch?v=CleAHnW7_rg access date 27/11/2022

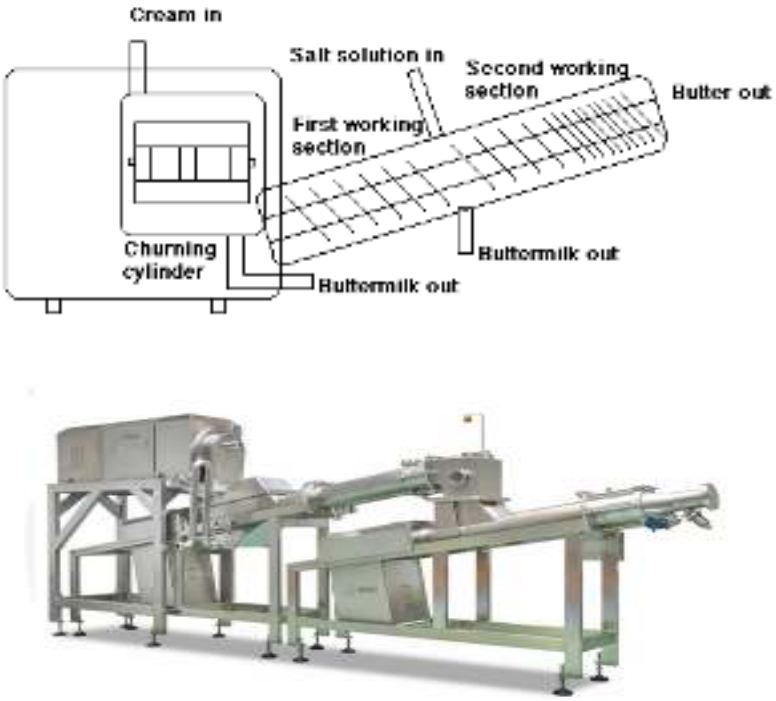

Figure 2.8 continuous butter churning machine

- **The concentration process**, whereby "plastic" cream at 82% mf is separated from 35% mf cream at 55°C and then this oil-in-water emulsion cream is inverted to a water-in-oil emulsion butter with no further draining of buttermilk.
  - ✓ 30% fat cream pasteurized at 90 °C

- ✓ degassed in a vacuum
- ✓ cooled to 45 - 70 °C
- ✓ separated to 82% fat ("plastic" cream)
- ✓ the concentrate, still an O/W emulsion, is cooled to 8 - 13 °C
- ✓ fat crystals forming in the tightly packed globules perforate the membranes, cause liquid fat leakage and rapid phase inversion
- ✓ contrast to mayonnaise, also a o/w emulsion at 82% fat but is winterized to prevent crystallization
- ✓ butter from this method contains all membrane material, therefore, more phospholipids
- ✓ no butter milk produced After phase inversion the butter is worked and salted

- **The anhydrous milk fat process**, whereby water, solid non-fat (SNF), and salt are emulsified into butter oil in a process very similar to margarine manufacture.

Phase Separation

- **Step of Butter processing from anhydrous milk fat:**

  - ✓ prepare "plastic" cream (>80% fat)
  - ✓ heat with agitation to destabilize emulsion
  - ✓ separate oil from aqueous phase: 82 to 98% butter fat
  - ✓ this butter oil is then blended with water, salt and milk solids in an emulsion pump and transferred to scraped surface heat exchanger for cooling and to initiate crystallization
  - ✓ further worked to develop crystal structure and texture
  - ✓ process similar to margarine manufacture
  - ✓ margarine has advantage of fat composition control to modify physical properties
  - ✓ Butter produced by phase separation contains few phospholipids.

The processes for the production of anhydrous milk fat (butter oil), using cream as the raw material, are based on the emulsion splitting principle. In brief, the processes consist of the cream first being concentrated and the fat globules then being broken down mechanically, so that

the fat is liberated. This forms a continuous fat phase containing dispersed water droplets which can be separated from the fat phase. Wach this video:- https://www.youtube.com/watch?v=QlXGsMx6YU4

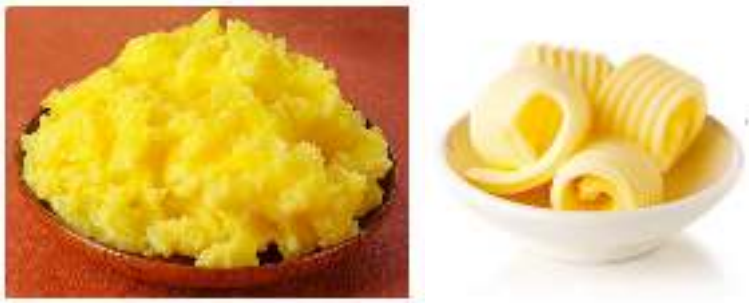

Figure 2.9 anhydrous milk fat

An optimum churning temperature must be determined for each type of process but is mainly dependent on the Mean melting point and melting range of the lipids, 7-10^{o}C in summer and 10 - 13^{o}C in winter.

If churning temperature is too warm or if the thermal cream aging cycle permits too much liquid fat, then a soft greasy (oily) texture results If too cold or too much solid fat, then butter becomes too brittle (hard). The best temperature to turn cream into butter is 13-15℃. However, you can work with room temperature as well. Cold cream just out of the fridge will take longer to get churned into butter

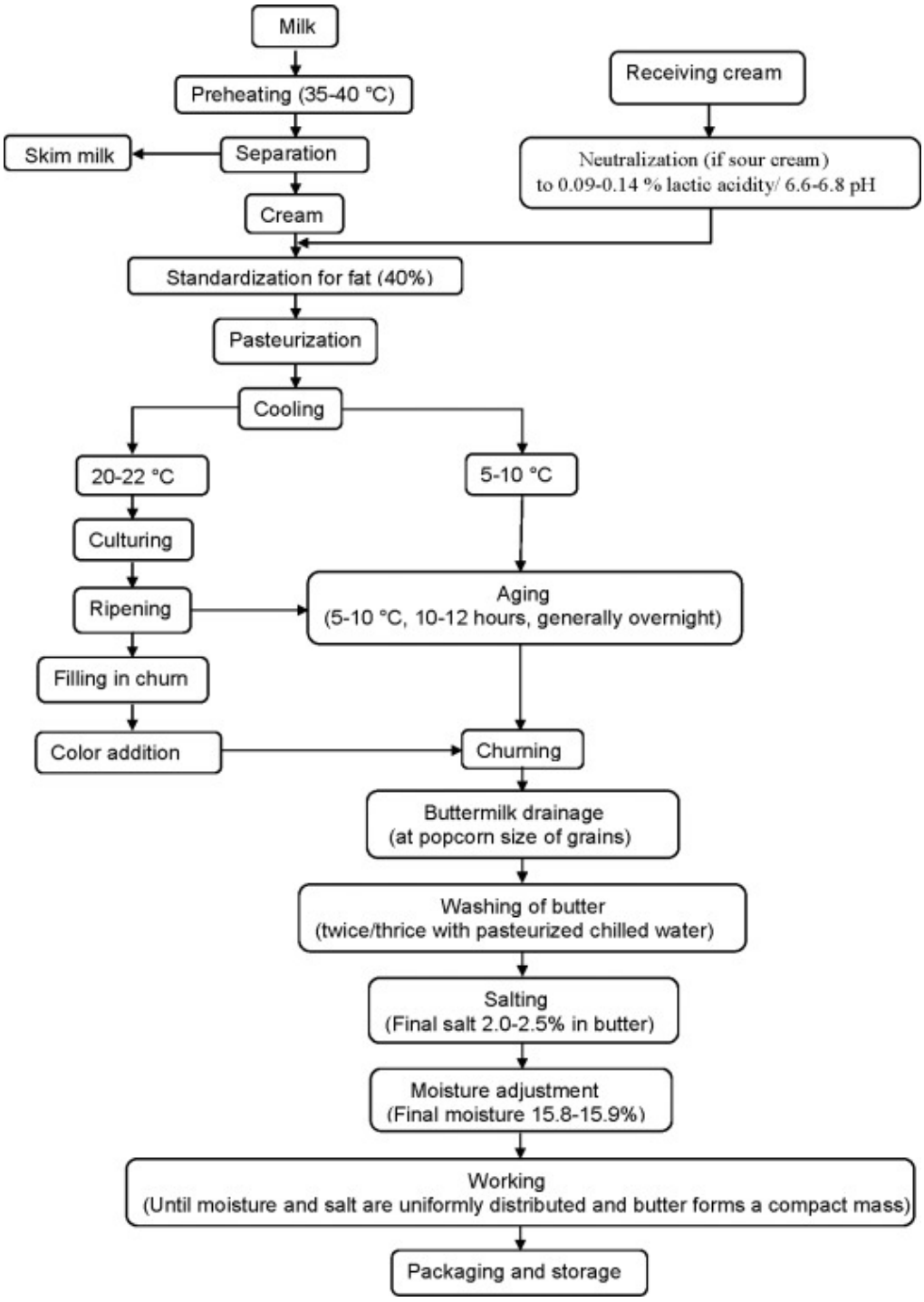

Figure 2.10 flow diagram of butter processing

2.1.2 There are different types of Butter

- **Unsalted Butter**

Unsalted butter is a mildly sweet butter that's best for baking. Because it is not salted, you're left with the pure taste and flavours of the churned cream, the fat, water content, and salt levels in a butter can affect the overall outcome of a product.

- **Salted Butter**

Salted butter has salt added of butter. Even though it seems like a small amount, it really does make a difference in taste. The extra salt helps the flavours for the product and increase the shelf life of the butter.

- **Sweet Cream Butter**

Sweet cream butter is made from just that: sweet cream, otherwise known as pasteurized fresh cream. Some types of butter are made with cultured or sour cream and have a vastly different flavour than the milder sweet cream butter. Sweet cream butter can be sold in salted or unsalted.

- **Cultured Butter**

Cultured butter, otherwise known as artisan butter, is a type of butter that is handcrafted. After the pasteurization process, live bacterial cultures are added to the cream and left to ferment before the churning process begins. Cultured butter is produced in a very similar way to yogurt or sour cream, resulting in the same kind of tangy and acidic flavour that's both creamy and filled with a lactic acid flavour.

- **Clarified Butter / Ghee**

Clarifying butter is the process of skimming the milk solids off of melted butter while the extra water evaporates during the melting process. Once the skimming and evaporating are complete, you're left with pure butterfat that has a higher smoke point and a richer, fuller flavour.

- **Organic Butter**

Organic butter's milk comes from cows who were only given feed that was grown without pesticides or synthetic fertilizers. The cows themselves were also raised naturally, and are free of any injected growth hormones that unnaturally manipulate the size and growth rate of the cows.

- **Whipped Butter**

Whipped butter is softened butter that has nitrogen gas whipped into it to give it the irresistibly fluffy and airy texture that spreads delicately on toasted bread. Nitrogen gas is used instead of air because the addition of air would cause oxidation in the butter, making it go bad quickly.

Figure 2.11 whipped butter

2.2 Monitoring equipment in operation

An optimum churning temperature must be determined for each type of process but is mainly dependent on the mean melting point and melting range of the lipids, as discussed above, i.e., 7-10 °C in summer and 10 - 13 °C in winter. If churning temperature is too warm or if thermal cycle permits to much liquid fat than a soft greasy texture results; if too cold or too much solid fat than butter too brittle and sticky.

2.2.1 Churning operation

- Churning of cream consists of agitation at a suitable temperature until the fat globules adhere forming larger and larger masses, and until a relatively complete separation of fat and serum occurs.
- In the churning process, the cream is violently agitated for 5-10 min to break down the fat globules, causing the fat to coagulate into butter grains, while the fat content of the remaining liquid (buttermilk) decreases.
- Optimum churning temperature: 9-11°C.
- From the aging tank, the cream is pumped to the churn or continuous butter maker via a plate heat exchanger, which brings it to the requisite temperature.

2.2.2 The effect of temperature on the churning efficiency

- High cooling and ageing temperature requires less churning period, yield large fat losses in butter milk. Butter gets a soft greasy texture.
- Improper cooling and ageing of the cream does not allow the fat to be sufficiently solid, and the fat loss in buttermilk will be excessive, and the butter obtained will have an unsatisfactory, weak body.
- Low cooling and ageing temperature prolongs the churning period, decrease fat losses, produce a firm body that has a satisfactory standing up capacity.
- Cooling to abnormally low temperatures, and ageing near that temperature causes the fat globules to become so firm that they bond together during churning only with difficulty, thus, he churning process is prolonged. Butter becomes too brittle.

- **Churning efficiency (Ec). I**t represents fat separated from cream (for butter).

$$E_c = 1 - f_{bm}/f_c$$

fbm = buttermilk fat as per cent w/w

fc = cream fat as per cent w/w

✓ Maximum acceptable fat loss in buttermilk is about 0.7% of churned fat corresponding to a churning efficiency of 99.3% of cream fat recovered in the butter.

✓ Churning efficiency is highest in the winter months and lowest in the summer months.

✓ Fat losses are higher in ripened butter due to a restructuring of possibly involving crystallization of high melting triglycerides on the surface of the globules.

✓ If churning temperature is too high, churning occurs more quickly, but fat loss in buttermilk increases.

✓ For continuous churns, assuming 45% cream, churning efficiency should be 99.61-99.42%.

2.2.3 Milk Separator Operation

The milk separator is one of the most important pieces of equipment in a dairy factory and its impact on dairy profitability and skimmed milk powder specifications and process losses is often underestimated by dairy manufacturers. The dairy separator is a high speed centrifuge which needs to be properly operated, maintained and serviced to give reliable and efficient service.

A milk separator can contribute up to 25% of your waste water load and milk solids losses, increasing the cost of dairy waste water treatment and disposal. A well maintained efficient milk separator will give skim fats of 0.07% consistently resulting in a good cream yield**.**

Separation efficiency (Es). It represents fat separated from milk (for cream**).**

$$E_s = 1 - f_s / f_m$$

fs = skim fat as per cent w/w

fm = milk fat as per cent w/w

Es depends on initial milk fat content and residual fat in the skim.

Assuming optimum operation of the separator, the principal determining factor of fat loss to the skim is fat globule size. Modern separators should achieve a skim fat content of 0.04 - 0.07 per cent.

Churn overrun. It represents the extra yield of materials obtained in butter after churning.

$$\%\text{churn over run} = \frac{(\text{Kg butter made} - \text{kg fat churned})}{\text{kg fat churned}} \text{x}100$$

- **Overrun** the difference between the number of kilograms of butterfat churned and the number of kilograms of butter made This difference is due to the fact butter contains non-fatty constituents such as
  - ✓ Moisture
  - ✓ Salt

- ✓ Curd
- ✓ Small amounts of lactic acid
- ✓ Ash in addition to butterfat.

The overrun is financially important to the milk processor and constitutes the margin between the purchase price of butterfat and the sale price of butter. The dairy unit depends largely on overrun to cover manufacturing costs and to defray expenses incurred in the purchase of milk.

- . **Other factors affecting yield**
  - ✓ Shrinkage due to leaky butter (improperly worked).
  - ✓ Shrinkage due to moisture loss; avoided by aluminum wrap.
  - ✓ Loss of butter remnants on processing equipment; % loss minimal in large scale continuous processing.

- **Plant Overrun**

Plant efficiency or plant overrun is the sum of separation, churning, composition overrun and package fill efficiencies. In summary the theoretical maximum efficiency values are:

- ✓ Separation Efficiency 98.85
- ✓ Churning Efficiency 99.60
- ✓ Package overfill 0.20

These values can be used to predict the expected yield of butter per kg of milk or kg of milk fat received.

2.3 Identifying and maintaining variation of equipment

The best way to manage variations is to understand them first. This means understanding what causes them, why they happen, and how to predict and control them. Once you understand the process well enough, you can take steps to prevent them from happening. The common cause variation cannot be controlled easily. But we can reduce its impact on our processing by using good quality raw materials and equipment, maintaining the equipment properly, and controlling the environmental conditions.

- **Cause of process variation in butter production**

  - ✓ Change in machine setting
  - ✓ Use un appropriate personal protective equipment
  - ✓ Operator mistake
  - ✓ Machine failure
  - ✓ Calibration issue
  - ✓ Overloading
  - ✓ Improper maintenance

Once you identify the special cause, you can take corrective actions to eliminate it.

In addition to eliminating the causes, you can also plan for future changes.

- **Preparing maintenance schedules and procedures**

  Prepared maintenance schedules and procedures effectively communicated to staff and suppliers to minimize negative impacts on production and costs the manufacturer's instructions should referred in the development of maintenance and repair programs.

Maintenance and repair programs should specify:

- Where servicing is required;
- The extent of servicing required;
- The nature of the servicing required;
- The frequency of servicing;
- Report to supervisor/manager any problems around machines and guards

2.4 Monitoring production stage

The collected raw milk from farm in the milk container or truck, having passed the preliminary analytical tests, proceeds to whole milk intake bays and the milk hoses are connected up by the driver.

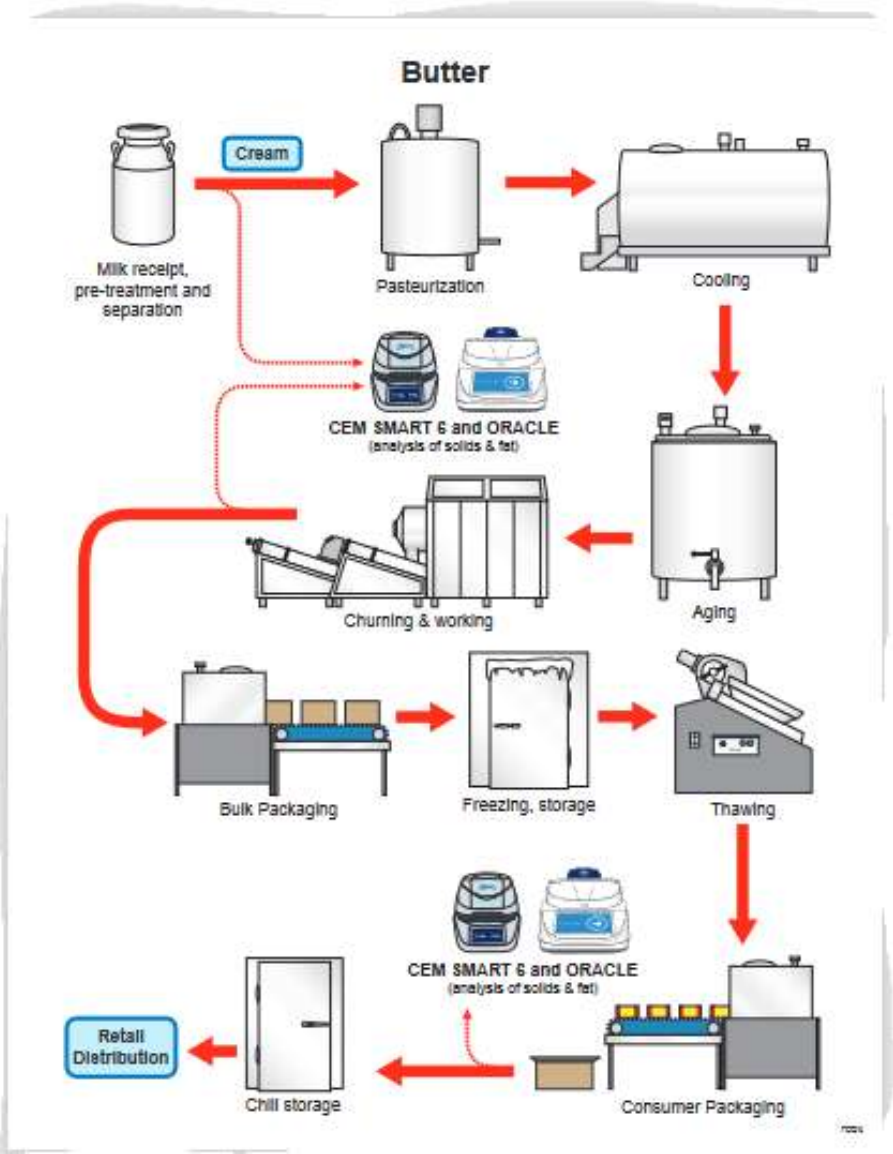

Figure 2.12 butter production line

- **Preparation of Cream**

Commercial butter can be produced from both sweets as well as cultured cream. Cultured butter is an important product. However, most creamery prefer to produce butter from sweet cream as it result in sweet butter milk which has better economic value than sour butter-milk that results when sour/cultured cream is churned.

- **Neutralization of cream**

Sour cream must be neutralized to make butter of good keeping quality. It is under stood that by neutralization of cream acidity of cream is reduced. Churning of High acid cream may cause high fat loss which can be prevented by neutralization. In pasteurization of sour cream, the casein curdles, by entrapping fat globules, as the bulk of curd goes in butter milk, causing high fat loss.

- **Objectives of neutralization**
  - ✓ to reduce the acidity of cream which permits pasteurization without risk of curdling,
  - ✓ to produce butter which keeps well in cold storage
  - ✓ To avoid excess loss of fat which result from the churning cream i.e. excessively sour.
  - ✓ To guard against undesirable flavors which may result when a cream of high acid which is subjected for pasteurization at higher temperatures.
  - ✓ To improve the keeping quality of butter from high acid cream. Salted-acid-butter develops a fish flavor during commercial storage at -23 to -29

- **Factors affecting neutralization**

Accurate neutralization of sour cream is important to get a desired quality product. Neutralization is influenced by several factors such as:

- ✓ Accuracy in sampling.
- ✓ Accuracy in testing.
- ✓ Accuracy in estimation of amounts of cream and neutralizer.

- ✓ Careful weighing the quantity of neutralizer.

- **Method of neutralization of cream**

There are five essential steps to follow for cream neutralization. These are:

- ✓ Adoption of definite standard of churning acidity
- ✓ Correct estimation of acidity
- ✓ Calculating the amount of neutralizer to be added
- ✓ Adding neutralizer in the correct manner
- ✓ Checking results by re-testing acidity

Acidity of cream at churning time controls the flavor and keeping quality of the butter. Therefore, it is important to decide that at what acidity the cream shall be churned. Churning acidity should be kept up to that maximum acidity where freedom from chemical deterioration of butter (fishy flavor) with age can be ensured.

For cream of average richness (about 30%), fishy flavor can be prevented by keeping the churning acidity to 0.3% maximum. The safe maximum limit of churning acidity varies with the richness of the cream. Since the acidity of cream is chiefly contained in the cream serum, cream serum acidity adjustment would give better results.

- **Standardization of cream**

It refers to adjustment of fat to desired level. It is done by adding calculated quantity of skim milk or butter milk. Desired level of fat in cream for butter making is 33 to 40%. Standardization to both higher and lower level leads to higher fat loss in butter milk. Reduction of fat by adding water should be avoided as it interferes ripening of cream and also results in butter with flat or washed off flavor.

- **Pasteurization of cream**

It refers to adjustment every particle of cream to a temperature not less that 71ºC and holding it at that temperature for at least 20 min or any suitable temperature-time combination using properly operated equipment's**.**

✓ **The main objectives of pasteurization are**:

- It destroys pathogenic microorganisms in cream so as to make it, and the resultant butter, safe for human consumption.
- It also destroys bacteria, yeast, mould, enzymes and other biochemical agents that may lower keeping quality.
- It also eliminates some of the gaseous and training substances.

- **Ripening of cream**

Ripening refers to the process of fermentation of cream with the help of suitable starter culture. This step can be eliminated if sweet-cream butter is desired.

The main object of cream ripening is to produce butter with higher di acetyl content. Ripening improves the keeping quality of salted butter but it reduces the keeping quality of a unsalted butter. Starter culture consisting of a mixture of both acid producing (*Streptococcus lactis, S.cremories*) and flavour producing (*S.diacetylactis, Leuconostoc citrovorum* and/or *Leuc. dextranicum*) organisms is added.

Amount of starter added depends on several factors and usually ranges between 0.5-2% of the weight of the cream. After being thoroughly mixed, the cream is incubated at about 21^{o}C till desired an acidity is reached. Cream is subsequently cooled to 5-10^{o}C to arrest further acid development.

- **Effect of Cream Ripening**
  - Loss Keeping quality of the resulting butter
  - Loss of flavor and aroma

- **Cooling and ageing**

Cooling and ageing are processes which prepare the cream for subsequent operation of churning. When cream leaves the pasteurizer, the fat in the globule is in liquid form. When cream is cooled, fat crystallization starts, cream will not churn unless the butter fat is at least partially crystallized.

Rate of cooling has an important influence on the body and texture of butter. The temperature to which cream is cooled is chosen is such a way that the butter produced is of optimum consistency and cream churns to butter in a responsible time of about 35-45 minutes.

Churning at too high temperature may give butter with greasy body which may work up too quickly and become sticky. Generally cooling temperature in summer should be 7-9ºC and that if in winter (10ºC-13ºC).

- **Churning of Cream**

It is during the churning process that cream is converted into butter. Here the fat globules are disrupted under controlled conditions to destabilize oil in water (o/w) emulsion and bring about agglomeration of milk fat. The sequence of events that occur during churning is as follows:

- ✓ Churning is initiated by agitation of cream causing incorporation of numerous air bubbles into the cream.
- ✓ With incorporation of air there is increase in the volume of cream and air plasma interface.
- ✓ Surface active (such as frictional, impact, concussion etc.) causes partial disruption of fat globule membrane
- ✓ The fat film, thus formed, serve as a foam depressant causing the air bubble to burst.
- ✓ The liquid fat also serves as cementing material causing fat globules to clump together and eventually butter grains are formed which floats in plasma i.e. butter milk.

- **Initial working**

- ✓ Working of butter is essentially a kneading process in which butter granules are formed into a compact mass. During this operation, any excess moisture or buttermilk is removed. However, the emulsion (w/o) at this stage is not fully stable.

- **Salting of butter**

In conventional process, butter may be salted by adding salt to butter churn after initial working of butter. Salt to be added must be high quality and the grain should be fine. It should be 99.5 to 99.8% sodium chloride. Salt sets up osmotic gradient which draws water from the butter grains. This can lead butter to be leaky. Salted butter should therefore, must be thoroughly worked. Salt may be added either in dry form or as saturated brine solution.

- **Adjustment of moisture**

After the addition of salt, the moisture content in butter is adjusted by adding calculated amount of additional water. In most countries, maximum limits of 16% is placed on the level of moisture.

- **Final working of butter**

The objective of working butter is to incorporate moisture and uniformly distribute added moisture and salt in butter. During this process remaining fat globules also break up and form a continuous phase, and moisture is finally distributed to retard bacterial growth in butter. It is safer to slightly over-work butter than to under-work. Under-worked butter may be leaky in body with large visible water droplets and may develop mottles on standing.

Watch this video **https://www.youtube.com/watch?v=qwb2uZLSLhw access date 28/11 /2022**

- **Packing & storage**:

The butter is finally patted into shape and then wrapped in waxed paper, and then stored in a cool place. As it cools, the butterfat crystallizes, and the butter becomes firm. Watch this video

https://www.youtube.com/watch?v=719pGT9hJPs access date 30/11/22

2.4.2 Butter-Oil Processing

Butter-oil processing involves taking cream from separation (40 to 43 % fat) and passing it through two more separators until the fat content is 98 to 99.5%. This is then passed through a vacuum chamber to remove the remaining moisture. The final product is 100 % butter fat (99.99%).

Ghee or Clarified Butter is the purest form of milk fat. It is obtained by heating cow/buffalo milk with unsalted butter/cream in a slow cooking process to evaporate nearly all the moisture and solid, not fat giving the product a typical physical structure, aroma, and taste.

Butter oil and ghee products are prepared by melting butter in the temperature range **50–80 or 110–140 °C**, respectively. **Butter oil has a bland flavor, whereas ghee has a pleasing flavor**. Ghee has less moisture, contains more protein solids, and differs in fatty acid and phospholipid as compared to butter oil. Butter oil is prepared by melting butter at a temperature not exceeding 80°C, whereas ghee is manufactured at 100–140°C.

- **production of butter oil from cream**

Raw cream of 35 – 40% fat content is pasteurized through plat heat exchanger or tubular heat exchanger. Then it passes through cream concentrator (essentially cream separator) to achieve a fat percent level of around 75%. Here we can store the cream as intermediary storage.

Cream is then fed to homogenizer for phase inversion (it breaks the fat globule membrane to release the fat). After phase inversion product again pass through centrifugal concentrator where the cream fat level is rise to 99.5%. Heating will be done at 95 to 98°C in a plate heat exchanger. Reduce the moisture content of the product to 0.1% in vacuum chamber followed cooling to ambient temperature through PHE.

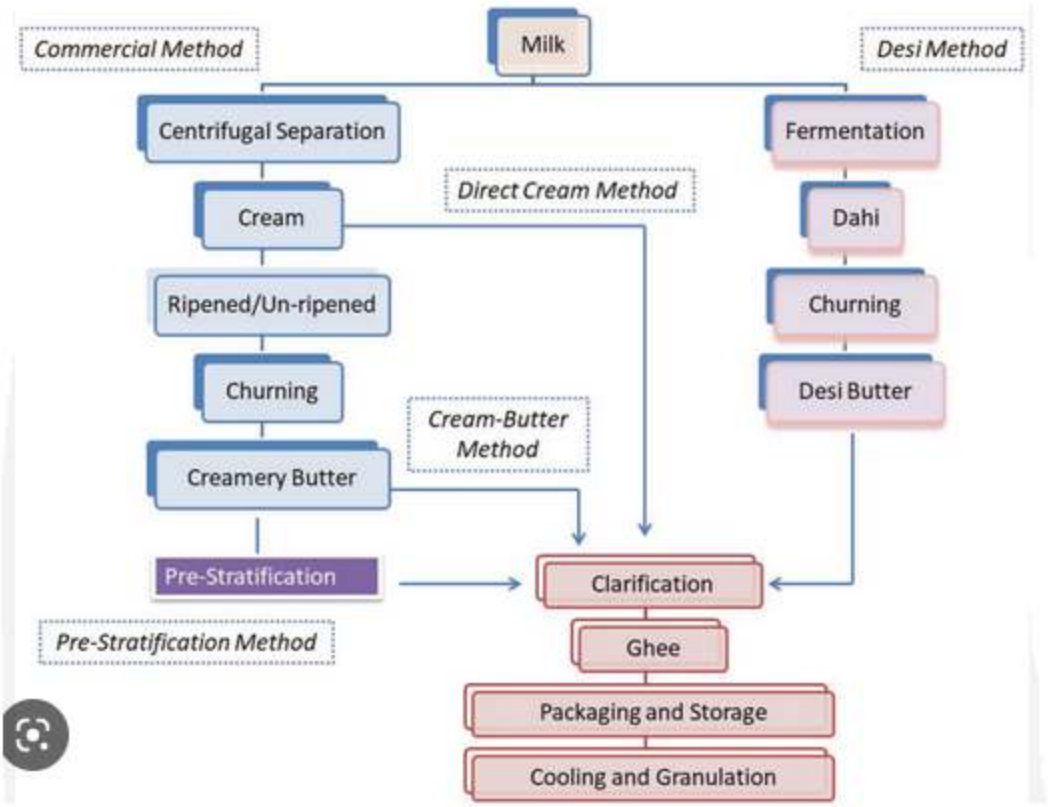

Figure 2.13 processing step of butter oil production

2.5 Identifying, rectifying and reporting out-of-specification product/process out comes

Identification of product/processes outcomes used to check either the products or processes are out of specification or not because every products or processes have their own specifications and have effects on the outcome after processing.

Main objective of Identifying and rectifying out-of-specification product/process outcomes in order to take corrective action in response to out-of-specification results.

2.5.1 Specification of product/processes

The specifications of cream and butter product have their own specification. Identifying and rectifying the processes and the products outcomes take place throughout the process and take actions when they occur, the processes or products will be out-of-specifications.

2.5.2 Factors affecting churn ability of cream:

- **Chemical composition of fats:** Increase in proportion of short fat shortens the churning period, diminishes the firmness of butter and increases fat loss in butter milk.
- **Size of fat globules:** Higher the proportion of small-sized fat globules, longer the churning time and greater the fat loss in buttermilk.
- **Force of surface tension:** Disturbance in this force is required for butter making because it maintains individuality of fat globules.
- **Phenomenon of adsorption:** Surface layer of fat globules contain adsorbed phospholipid protein complex which resists de-emulsion.
- **Electric charge:** Fat globules have negative charge and repel each other. The charge decreases as acidity of cream increases.
- **Viscosity:** Increased viscosity retards churning.
- **Concentration of fat globule in cream:** It promotes rapid aggregation.
- **Temperature of cream:** Optimum churning temp. Is 9-11˚C. Higher churning temp, Causes short churning time.
- **Fat percentage of cream:** Higher percentage of cream lowers churning period.
- **Acidity of cream:** Acid cream churns more rapidly than sweet cream.
- **Load of churn**: Overloading prolongs churning time.
- **Nature of agitation:** Agitation influenced by size, type and rpm of churn affecting churning period.

Table 2.1 out of specification of product

No	Color Defects	Reason	Corrective action
1	Mottled	Improper washing, salting and working	Proper washing, salting and working
2	Streaky and Wavy	Improper working	Proper working
3	Dull or pale	Over working	Proper working

Table 2.2 flavor defect of butter

No	Flavor Defects	Reason	Corrective action
1	Acid or Sour	Use of acid and under neutralized cream	Use of sweet and well neutralized cream
2	Alkaline	Over neutralization of cream	Well neutralization
3	Bitter	Action of lipase and photolytic bacteria on cream	Proper testing of cream
4	Cheesy	Casein breakdown by photolytic bacteria	Storage of cream at or below 5˚C
5	Cooked	Over pasteurization	Proper pasteurization
6	Fishy	Storage of high acid salted butter in presence of copper or iron	Proper storage
7	Flat	Low di acetyl content, low salt and excessing washing of butter	Adequate ripening of cream before churning, correct salt treatment and proper washing
8	Rancid	Fat hydrolysis by lipase	Inactivation of lipase by proper pasteurization
9	Oxidized	Fat oxidation by sunlight in presence of copper or iron	Proper pasteurization and vacuum pasteurization of cream
10	Stale	Improper storage of cream and butter	Proper storage of cream and butte

Table 2.3 Body and texture defects of butter

No	Defects	Reason	Corrective action
1	Crumbly	Change in fat composition and abrupt chilling of butter	Controlled cooling, ageing, churning and washing
2	Greasy	Overworking and high washing temp.	Use of app. Washing temp.
3	Gummy	Presence of high melting point fat	Selective feeding and proper working

4	Leaky	Over churning, improper cooling and washing with high temp. water	Churning, cooling and use of washing water of adequate temp.
5	Grainy	Incorrect neutralization of acid cream and oiling off fat during butter manufacturing	Correct neutralization of cream and avoiding of oiling off
6	Spongy	High churning temp. and use of low melting point fats	Proper churning temp. and fat combination
7	Sticky	Overworking	Proper working
8	Gritty	Improper salting	Proper salting

2.5.3 anhydrous milk fat and butter oil

Products consisting of more or less pure milk fat. Although they are modern industrial products, they have ancient traditional roots in some cultures. Ghee, a milk fat product with more protein and a more pronounced flavor than AMF, has been known in India and Arab countries for centuries.

Defined by Codex Aliment Arius standard CODEX STAN 280-1973, anhydrous milk fat, milk fat, anhydrous butter oil and butter oil are fatty products derived exclusively from milk and/or products obtained from milk by means of processes which result in almost total removal of water and non-fat solids.

Ghee is a product exclusively obtained from milk, cream or butter, by means of processes which result in almost total removal of water and non-fat solids, with an especially developed flavor and physical structure.

- Anhydrous milk fat must contain at least 99.8 % milk fat and be made from fresh cream or butter. No additives are allowed, e.g. for neutralization of free fatty acids.
- Anhydrous butter oil must contain at least 99.8 % milk fat, but can be made from cream or butter of different ages. Use of alkali to neutralize free fatty acids is permitted.

- Butter oil must contain 99.3 % milk fat. Raw material and processing specifications are the same as for anhydrous butter oil.

2.6 Maintaining work area

Workplace housekeeping may be defined as activities undertaken to create or maintain an orderly, clean, tidy and safe working environment. Effective housekeeping can eliminate many workplace hazards and help get work done safely and properly.

- **Good housekeeping can result in**:
  - ✓ More effective use of space;
  - ✓ Better inventory control of tools and equipment;
  - ✓ More efficient clean up and maintenance;
  - ✓ More hygienic workplace conditions; and
  - ✓ Improved look and feel of the work environment.

- Untidy workplaces may lead to injuries e.g. slips and trips, therefore good housekeeping practices are essential for all workplaces. For example:
  - ✓ spills on floors should be cleaned up immediately
  - ✓ walkways should be kept clear of obstructions
  - ✓ work materials should be neatly stored
  - ✓ any waste should be regularly removed
  - ✓ Suitable containers for waste should be conveniently located and regularly emptied.

2.6.1 Safety before operation

- Short term training is necessary for the operators
- Become familiar with the safe operation of the equipment, operator must know the machine working principle and operation
- All operators should trained. The owner of the machine is responsible for training the users.
- Check bolts and other loosen parts and tighten it before operation will start.

- When maintaining, inspecting, attaching and detaching parts, park the machine at flat and safe place.
- Use proper tools to maintain the machine and check working area is safe. During Operating
- Only allow responsible person, who are familiar with the instructions, to operate the machine

2.6.2 Maintaining working area. with equipment

- Shutdown the machinery and equipment
- Identify all energy sources and other hazards
- Identify all isolation points
- Isolate all energy sources
- De-energize all stored energies
- Lockout all isolation points
- Tag machinery controls, energy sources and other hazards

2.7 Conducting work with environmental guidelines

Having a safe and healthy physical work environment, including amenities and facilities, is critical
to eliminating and controlling risk in the workplace. This includes ensuring the work environment,
facilities and amenities are compliant with legislative and other identified requirements.

The work environment, facilities and amenities are required to be maintained in a safe and healthy condition, and need to be hygienic, secure and in a serviceable condition. This includes replenishment of consumables, repair of broken or damaged furnishings and equipment and ensuing cleanliness of these areas.

When the requirements of the standards' met, employees understand the role their work

- Plays, in maintaining quality output

- Motivated work force supports management in detecting, solving, correcting and preventing problems in the production area.
- Identification of the required resource
- Doing any work related with modern dairy production system we have to allocate the necessary resources which, proper and suitable to undertake the general work activities.

It is usually done within routines methods and procedures where some discretion and judgment is required in the selection of equipment and materials, organization of work, services, and actions to achieve outcomes within time and budgetary constraints should be properly allocated.

The resource, which allocated used to achieve the work. Some of the resources are, materials, tools and equipment, financials, labours, machinery, personal protective equipment, etc, have to be allocated so as to run the work properly

2.7.1 Managing West material from dairy products processing like

- Effluent from
- Tanker washing,
- Cleaning milk splits
- Cheese whey
- Air emission gases
- Out of date products
- Milk powder dust
- Refrigerant gases odour
- Solid Waste
- Damaged product

2.8 Maintaining workplace information

2.8.1 Standard operational procedure(SOP)

SOPs are used across all industries, and many organizations use dozens of them to ensure consistently high-quality work across the entire team. SOPs can consist of a simple bulleted list of action items, but effective employee on boarding and training benefits from the introduction of visual elements. A set of step-by-step instructions for completing a task. Example of SOPs Maintenance checklist, Performance review, HR checklist, Safety procedure .etc.

2.8.2 specification

Often refers to a set of documented requirements to be satisfied by a material, design, product, or service. A specification is often a type of technical standard is an established norm or requirement for a repeatable technical task which is applied to a common and repeated use of rules, conditions, guidelines or characteristics for products or related processes and production methods.

- **A technical standard includes**
  - ✓ definition of terms;
  - ✓ classification of components;
  - ✓ delineation of procedures;
  - ✓ specification of dimensions, materials, performance, designs, or operations;
  - ✓ measurement of quality and quantity in describing materials, processes, products, systems, services, or practices;
  - ✓ test methods and sampling procedures; or descriptions of fit and measurements of size or strength

2.8.3 Work place procedure and instruction

In working environment, the employees should understand a

- ✓ set of work place procedures
- ✓ Policies and instructions to address the designed goal in the organization.
- ✓ Set of policies and procedures in working environment.

- work place procedure
  - ✓ Systematically description of how some job function is to be done.
  - ✓ It is most useful if written in clear language
  - ✓ Readily available to those who perform that function.
- . Policies and procedures are
  - ✓ Set of rules and guidelines that are to be followed to achieve goals.
  - ✓ The policy sets out the overall course of action and what it aims to achieve
  - ✓ The procedures are the guidelines to be followed to achieve the aims of the policy.
- Workplace environmental procedures might include such things as:

- ✓ Measure for identifying, avoiding or minimizing environmental hazards
- ✓ Guidelines for reporting environmental hazards or incidents
- ✓ Guidelines about what to do it spills or accidents occur
- ✓ Contingency plans to cover emergencies
- ✓ Commitment that environmental considerations are included in planning and Operations

- **Workplace environmental procedures are written procedures or work instructions for**
  - ✓ Environmental hazard
  - ✓ Risk identification
  - ✓ Avoiding or minimizing environmental risks
  - ✓ Improving environmental performance
  - ✓ Waste minimization and segregation
  - ✓ Environmental monitoring,
  - ✓ Signs and labels (e.g. chemical labels),
  - ✓ Emergency procedures,
  - ✓ Hazard and incident recording and reporting procedures
  - ✓ Environmental data recording and reporting procedures where applicable.
  - ✓ Verbal instructions from persons with responsibility related to environmental work practices are also included in this definition
- . **Preparing procedures**

To write effective procedures you should convert accepted policies from your organization in to a series of coordinated activities and tasks which:

- ✓ Set out clearly what people need to do
- ✓ Assist in identifying competencies which individuals require
- ✓ Form the basis for measuring performance of the individual , group or organization

Self-check 2	**Written test**

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Choose the best answer

1. The composition of butter_____
   A. 81.5%_82.5% fat
   B. 16.5%_17% water
   C. 0.6%_1.6% the dairy matter not contain fat
   D. All
2. The colour of cow milk butter is slightly yellow because of what?
   A. Because of adding the colorant
   B. The fat content of the milk have β-carotene
   C. The milk fat content les β-carotene
   D. None
3. Which one is the types of butter processing equipment
   A. Cream separator
   B. Churner
   C. Agitator
   D. All
4. What is the average fat content of anhydrous milk fat
   A. 35% milk fat
   B. 50% milk fat
   C. 99.99%
   D. 82%
5. _____is a types of butter is the process of skimming the milk solids off of melted butter while the extra water evaporates during the melting process.
   A. Un salted butter
   B. Salted butter
   C. Sweet cream butter
   D. Clarified butter/ghee

6. What is the objective of neutralization

A. To reduce the acidity of cream

B. To produce butter which keeps well in cold storage

C. To avoid excess loss of fat

D. All are answer

7._____ Machine used heat treatment to reduce enzymatic activity and kill pathogenic bacteria of milk.

A. Homogenizer B. Pasteurizer C. Separator D. Churner

8. What are the product of raw milk after passed through centrifugal separation?

A. Butter and buttermilk C. Buttermilk and Cream

B. Cream and skimmed milk D. All

Test I: Short Answer Questions

1. Write the types of butter making process
2. Write the process variation of in butter production
3. Write the effect of cream ripening
4. List body and texture defects of butter
5. Write the benefit of good housekeeping

Note: Satisfactory rating 15points Unsatisfactory – below 15 points

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

Operation Sheet -2

2.1 Procedure of Butter making from fermented milk or sour Cream

A. Tools and equipment's

- personal protective equipment (PPE)
- Manual local available churner/ holding capacity 14liter
- 7liter local available whole milk
- Two bucket one for water holding and another to wash butter
- Salt
- Thermometer

B. Procedure

- ✓ Step 1 Start with Fresh Cow's Milk, non-pasteurized or Homogenized, Raw Cow Milk
- ✓ Step 2 ferment the milk in 3-4 days for fresh milk in the fridge to sour and clabber
- ✓ Step 3 Fill Your Churn
- ✓ Step 4 Churn the milk (it may take 30minutes-1hrs or long)
- ✓ Step 5 See butter in your Churn
- ✓ Step 6 Take Strainer and Put Butter from Milk in Bowl
- ✓ Step 7 Drain Sour Milk & Wash Butter Thoroughly
- ✓ Step 8 Last Step add salt, nutmeg or your choice of butter spices
- ✓ Step 9 apply cleaning procedure of churner

2.2 Procedures of Butter making by Concentration Method

A. Tools and equipment

- Personal protective equipment (PPE)
- Pasteurizer
- Electrical churner(holding capacity 20 litter, model:-LABEQ)
- Cooling material (refrigerator)
- Oven dry (vacuum)
- Plastic churner
- Cream separator
- Two bucket one for water holding and another to wash butter)
- Thermometer
- pH meter
- cow milk

B. Procedure of butter making by concentration method

Step 1 30% fat cream pasteurized at 90oC

Step 2 Degassed in a vacuum

Step 3 Cool cream at 45-70oC

Step 4 Separate to 82% fat ("plastic" cream)

Step 5 cool the concentrate, still an Oil in Water emulsion is to 8-13^{o}C

Step6 pack crystals forming fat in the tightly

Step7 winterize a 82% fat to prevent crystallization

Step 8 churn and add salt after phase inversion

Step 9 apply cleaning procedure of butter churner

2.3 Procedures:- anhydrous milk fat/ butter oil processing from direct milk fat

B. Tools and equipment

- Personal protective equipment (PPE)
- Pasteurizer
- homogenizer
- Cooling material (refrigerator)
- Oven dry (vacuum)
- Plastic churner
- Cream separator
- Two bucket
- Thermometer
- pH meter
- milk fat
- Heat exchanger plate
- Moisture analyser

C. Procedures

Step-1 heat cream (35-40%) up 58oC up to cream concentration 70% to 75%

Step-2 separate by centrifugal separator and homogenised

Step-3 wash and pass the cream fat through centrifugal concentrator where the fat level rise to 99.5%

Step-4 heat the fat cream at 95to 98^{o}C in plat heat exchanger to remove the residual moisture

Step-5 cool at room temperature

LAP TEST-2	Performance Test

Name……. ID……..

Date…….

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 6 hours.

The project is expected from each student to do it.

Task-1 butter making from fermented milk

Task-2 butter making by concentration method

Task-3 produce anhydrous milk fat/butter oil direct from milk fat

LG #38	LO #3- Shut down the butter churning and butter oil process operation

Instruction sheet

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

- Identifying appropriate shutdown procedure
- Shutting down procedures of the process
- Identifying and reporting maintenance requirements

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Identify appropriate shutdown procedure
- Shut down procedures of the process
- Identify and report maintenance requirements

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
2. Read the information written in the information Sheets

3. Accomplish the Self-checks

Information Sheet 3

3.1 Identifying appropriate shutdown procedure

- Appropriate shutdown procedure for Dairy equipment
  - ✓ Never use any machine you have not trained to use.
  - ✓ Pull plug or throw switch to off position before cleaning or adjusting any machine.
  - ✓ Keep fingers, hands, spoons

- ✓ Away from moving parts.
- ✓ Wait until machine stops before moving cream or butter (any milk product).
- ✓ Check all switches to see that they are off before plugging into the outlet

- **When using electric cream separator and Churner**
  - ✓ Turn off motor before you scrape down the sides of the bowl.
  - ✓ Use a wooden or plastic plunger rather than your hands or spoons to push Cream or Butter into cream or Butter collection centre (material)
  - ✓ Keep your hands to the front of the revolving bowl when operating electric cream separator or churner. This is one of the most dangerous place of equipment in the commercial milk processing.
  - ✓ Never start a machine until you are sure all parts are in their proper places. If a machine that operates with gears, check the gear position.
  - ✓ You must be aware of the lockout procedures that are to be followed before repairing or cleaning any machine
  - ✓ Lock-out procedures must be clearly posted by management near each machine
  - ✓ When using electrical power equipment, always follow the manufacturer's instructions and recommendations.

3.2 Shutting down procedures of the process

- Shut off electric cream separator and churner at stop/start switch.
- Shut off at/ disconnect electric cable if possible

- Attempt to start machine, reset or return switch to “off” position.
- Complete work on dairy product processing machine
- Ensure electric machine or equipment are clear of loose pieces, tools,
- Remove lock. If it is operated by lock key
- Restart and run up to operating speed.

3.2.1 The shutting down procedure of electric Cream separator and churner machine

- Turn the machine on and allow about 1 full minute to let the machine get up to the proper speed
- Turn the tap to the “ON” position.
- Observe the process until all of the milk has passed out of the milk tank
- Let the cream and milk drip for another moment , then remove the containers
- Put another container in place to catch the rinse water then immediately pour about 4 quarters (3lits) of hot water (150^0F) in to milk tank. This will clean the cream from the disks.
- When the water has run out of the milk tank, turn off the machine and allow the machine to come a complete stop.

3.2.2 Cleaning of milk Contact parts of cream separator

- The bottom Wrench should bolted to your worktable for ease of disassembly of the bowl.

- Disassembly the bowl
- Wash all parts in soap and warm ware until thorough clean.
- Rinse well and wipe dry
- All another milk contact parts except the body , should be washed the same way in soap and warm water including
  - ✓ Milk tank
  - ✓ Floater
  - ✓ The two spouts
- Rinse well and wipe dry.
- This dismantling and washing procedure must followed before first use and after every use.

3.3 Identifying and reporting maintenance requirements

Within the process industry, the term maintenance primarily refers to repairs and maintenance directly or indirectly related to the processes involved in the production, e.g. repairs and maintenance of technical installations, churner, cream separator, pasteurizer, homogenizer, compressors, etc. This involves a wide spectrum of tasks which however all have one prime objective in common, guaranteeing and further optimising the operational reliability and continuity of the production processes.

- During recent years much attention has been given to the execution of preventive maintenance in the process industry, i.e. intelligent approaches to preventing technical faults and unexpected stoppages.

- Rapid technological developments have resulted in the deployment of a range of complementary maintenance concepts like
  - ✓ TPM (total productive maintenance),
  - ✓ risk-based maintenance(RBM)
  - ✓ Reliability- centred maintenance (RCM) which in turn bring a dramatic increase in professionalization to the field of maintenance.

3.3.1 Maintenance of basic butter products processing equipment

- **Butter churn maintenance**

✓ The churn and butter making equipment should washed as soon as possible, preferably while the wood is still damp in the case of wooden churns.

✓ Wash the inside of the churn thoroughly with hot water. Invert the churn with the lid on in order to clean the ventilator; this should be pressed a few times with the back of a scrubbing brush to allow water to pass though ventilator should be dismantled occasionally for complete cleansing.

✓ Remove the rubber seal from the lid and scrub the groove. Scald the inside of the churn with boiling water or steam. Invert and leave to dry.

✓ Dry the outside and treat metal parts with food grade grease or Vaseline to prevent rusting

✓ The rubber seal should place in boiling water or dipping in warm water with disinfectant is enough.

- **Preventive Maintenance of cream separator**

Inspection Service Recommended every 6 months or 4000 running hours:

- ✓ Inspection of separator bowl
- ✓ Inspection of inlet/outlet
- ✓ Inspection of operating water system
- ✓ Replacement of seals and gaskets
- ✓ Lubrication oil change
- ✓ Recording of equipment deterioration to identify worn parts that require replacement or repair before they cause system failure
- ✓ The bowl should cleaned thoroughly immediately after use to ensure proper functioning of the separator and for hygiene.

3.3.2 Setting up of Machinery

In setting machinery, the equipment should be located, if possible in a lighted dry place with plenty of room to work around it for cleaning and repairs. The arrangement should be that the minimum amount of sanitary piping used, consistent with efficient operation. Related equipment may be grouped together to facilitate supervision. Straight-line flow of product is usually desirable. If possible, allow space for unit machine to add later when the business grows.

Machines especially the heavy ones, are set directly on the floor or on concrete base and grated in thoroughly with a rich cement mixture and sufficient water.

For improved sanitation, use is made of the ball foot mounting with equipment such as tanks, freezers, fillers etc, on a pipe legs 6-12 inches long having a round foot. Where machinery bolted down, it is customary to see bolts in the concrete

Self-check 3	**Written test**

Name…… ID…… Date……. **Directions:** Answer all the questions listed below.

Test I: Multiple choice

1. Preventive maintenance of cream separator
   - **A.** Inspection of separator bowl
   - B. Inspection of inlet/outlet
   - C. Lubrication oil change
   - D. All

2. When using electric butter Churner

   A. Turn off motor before you scrape down the sides of the bowl.
   B. You start the operation
   C. Use hand to push the cream
   D. None

Short answer

1. Write the appropriate shutdown procedure of butter processing equipment
2. List down the specification of maintenance and repair programs**.**
3. Mention butter processing equipment that need scheduled maintenance

Note: Satisfactory rating 8 points Unsatisfactory – below 8 points

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