



# **Animal production Level**

## **NTQF Level -II**

### **Learning Guide 54**

**Unit of Competence: Assist in handling and Processing of Milk**

**Module Title: Assisting in handling and Processing of Milk**

**LG Code: AGR APR2 M16 L02 LG54**

**TTLM Code: AGR APR2 TTLM 0919v1**

**LO2. Process milk into different products**



<b>Instruction Sheet</b>	<b>Learning Guide 54</b>
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This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Determining types of Milk products to be processed
- Preparing whole milk and other ingredients
- Processing milk
- Preparing milk processing equipment and materials
- Identifying any OHS hazards and taking appropriate action
- Using Personal Protective Equipment (PPE)
- Observing Sanitary procedure

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Determine types of Milk products to be processed
- Prepare whole milk and other ingredients
- Process milk
- Prepare milk processing equipment and materials
- Identify OHS hazards and taking appropriate action
- Use Personal Protective Equipment (PPE)
- Observe sanitary procedure

### **Learning Instructions:**

1. Read the specific objectives of this Learning Guide 54.
2. Follow the instructions described in number 1 to 7.
3. Read the information written in the “Information Sheet (1, 2,3,4,5,6 and 7) in page **3,5,8,12, 14, 17 and 19** respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.



5. Accomplish the **“Self-check 1, Self-check 2, Self-check 3” Self-check 4, Self-check 5” Self-check 6 and Self-check 7** in page 4, 7, 11 ,13,16, 18 and 21 respectively.
6. If you earned a satisfactory evaluation proceed to “Operation Sheet 1-2 in page 22 and 3 in page 23 respectively.
7. Do the “LAP test” in page 24 (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work.



<b>Information sheet-1</b>	<b>Determining types of Milk products to be processed</b>
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Some of the common milk products that are made locally or commercially from whole milk are

- **Cream:** A portion of milk containing not less than 18% milk fat. Cream may be taken from milk by “skimming” or “separating” Skimming is the process of removing manually the cream, which rises to the surface, after milk stands in a container. The remaining part of the milk is called skimmed milk. Separating is the process of removing cream mechanically. The remaining part is called separated milk.
- **Curd/yoghurt:** The coagulated part of milk if milk is stands in a container for sometime at room temperature, it forms clots called curds which are contained in a clear liquid called whey.
- **Whey:** This is the watery part of milk after separation of the curd from the whole milk. It contains protein, lactose, minerals and salts.
- **Cheese:** This is the clotting casein of milk. Cheese is made from separated milk or whole milk. The milk curd, after being removed from the whey, is pressed into solids and through other processes and forms cheese. Genuine cheese must contain no fat other than that obtained from milk.
- **Butter:** This is the solidified milk fat or cream prepared by churning. The cream produced from milk is violently churned up and shaken so that the fat globules are broken up and closed together into pieces of mass called butter.
- **Ghee:** This is butter which has been heated and clarified. Butter is boiled over heat until the water is evaporated. It is then strained and ghee is produced.
- **Ice cream:** This is cream made by mixing milk products with other ingredients and them freezing them into a semi solid state. The principal ingredient of the cream is usually milk or cream flavoring and coloring materials, etc.



<b>Self-Check -1</b>	<b>Written Test</b>
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down common milk products that are made locally or commercially produced (6pts)

Note: Satisfactory rating – 6 points

Unsatisfactory - below 6 points

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

**Answer Sheet**

Score = \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_\_\_\_\_

Date \_\_\_\_\_

1. \_\_\_\_\_

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<b>Information sheet- 2.</b>	<b>Preparing whole milk and other ingredients for processing</b>
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Poor hygiene introduces additional bacteria that cause the milk to get spoilt very quickly. To ensure that raw milk/whole milk remains fresh for a longer time, good hygiene must be observed during milking and when handling the milk afterwards.

The following factors are important in various milk-harvesting practices to prevent bacterial contamination of milk such as:

1. Health and personal hygiene
2. Environmental hygiene
3. Milking procedures and milk handling
4. Post-milking.

#### **Addition of milk ingredients**

Most of the time milk ingredients are added to the whole milk to keep the flavor/ odor and aroma of milk. The most common milk ingredients are:

Salt, garlic, flavoring spices like “Besobila” etc



Table.1.Key factors and on-farm practices to undertake to produce clean milk on small holder farms

Table 14.1. Key factors and on-farm practices to undertake to produce clean milk on small holder farms	
Key factors to produce clean milk	On-farm practices
Prepare the shed	Repair any holes in floor, clean the floor and wash with disinfectant
Personal hygiene	Use clean clothes, carefully wash hands; don't milk if you are sick
Prepare for milking	Have ready the udder cloths, buckets, stool, basket (for dirty udder cloths), strip cup, muslin cloth and milk can to save time; place milk can outside shed
Pre-milking cleanliness	Do not use milk containers for any other purpose, all equipment must be clean, sanitised and dry
Cow comfort	Gentle handling of cows, maybe offer some concentrate, but not roughage
Cow cleanliness	Brush cow to remove dust, wash udder and teats, and dry teats
Cow disinfection	Use one cleaning cloth per cow soaked in hypochlorite (1 teaspoon/5 L water)
Reduce disease transfer	Use one cloth per cow; put used udder cloths into separate basket; don't let milk drip/spill onto floor
Water quality	Only use good-quality water for washing cows and containers
Pre-milk each teat	Strip milk each teat into cup to check for mastitis and remove initial milk
Hand milking	Use fast steady speed, use 'hand squeeze' not 'hand strip' technique; don't use oil, water, milk or spittle as lubricant; use hand cream if necessary
Machine milking	Routinely replace rubber linings, sanitise after use; follow correct maintenance schedule; open tops of milk cans in cooling unit to facilitate heat dissipation
Timeliness of milking	Start milking within 30 seconds of washing udder, cow's let-down lasts 5–7 min
Teat dip	Dip each teat into iodine solution; can use all in cup if solution is still clean
Bulking milk	Quickly strain into milk can through muslin to remove contaminants; put lid on can
Cooling milk	Take milk to a milk collection centre for cooling as soon as possible; handle can gently
Post-milking cleanliness	Rinse all milking utensils in cold water, wash them with detergent and brush in hot water, rinse again in cold water, then rinse in disinfection or very hot water and place upside to drain
Reusing disinfectant	Do not reuse rinsing disinfectant solution for next milking
Drying of equipment	Leave utensils to drain on racks in a well-ventilated, clean, tidy place
Disease treatment	Use indicator paper or California mastitis test to detect sub-clinical mastitis; treat on same day as detected
Clinical mastitis treatment	Empty inflamed teat out every 2 hr, leave antibiotic in teat for 8 hr



<b>Self-Check -2</b>	<b>Written Test</b>
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

2. List down the common milk ingredients (6pts)

Note: Satisfactory rating – 6 points

Unsatisfactory - below 6 points

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

**Answer Sheet**

Score = _____
Rating: _____

Name: \_\_\_\_\_

Date \_\_\_\_\_

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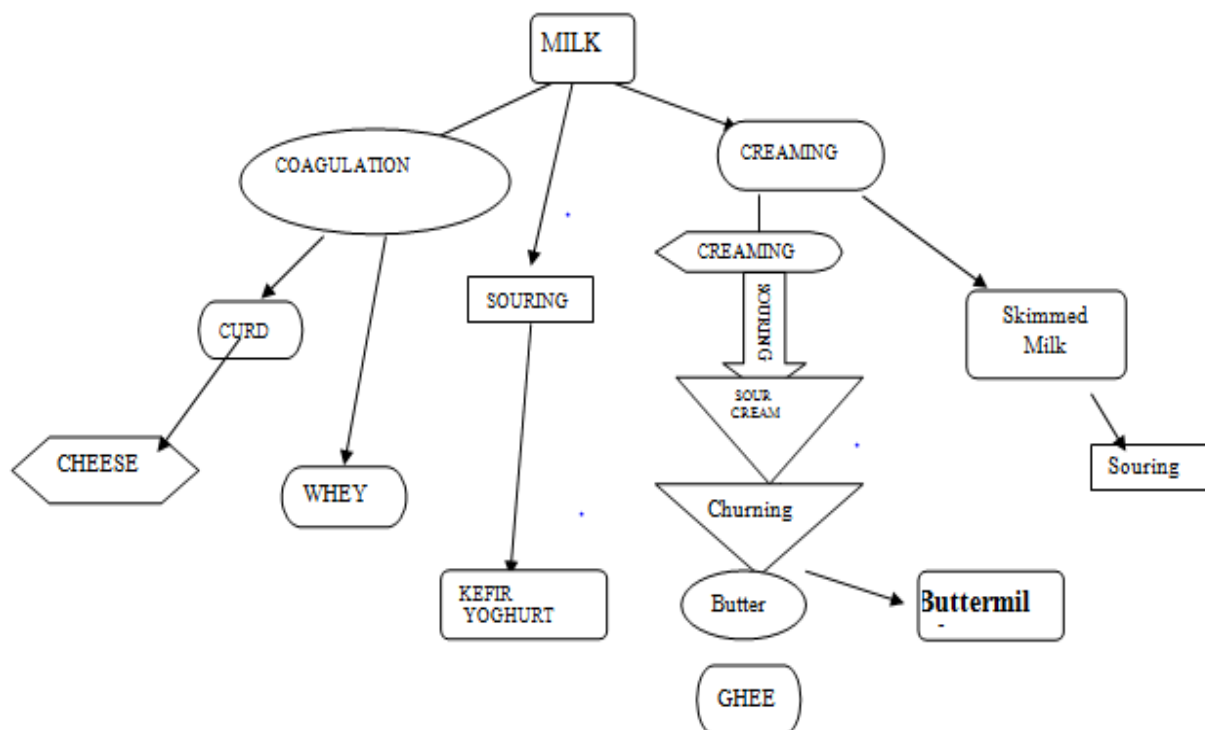


<b>Information sheet-3.</b>	<b>Processing milk and processing methods</b>
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### 1.1. Milk processing

Milk is processed in a number of milk products in the form of concentrated, cultured and dried products, to be reconstituted in to milk as required or mixed with other ingredients to provide mixes such as solid cheeses of various flavors and types, and in condensed or evaporated forms for convenient transportation and longer shelf life.

Basically milk is processed to increase deliciousness of milk products and their shelf life. It is processed in different ways in to different products; traditional or industrially. The types of products to be processed are determined based on the enterprise requirements. Raw milk can be processed in to the following products include: Cream, yoghurt, butter, cheese, Whey and other special products.



**Diagram. 1. Different products of milk**



## 1.2. Milk processing method

### Cream separation method

#### 1. Gravitational separation :Gravity separation is slow and inefficient

Cream can be separated from milk by allowing the milk to stand in a setting pan in a cool place. This can be done in either of two ways

➤ **Shallow pan method-** Milk, preferably fresh from the cow, is poured into a shallow pan 40 to 60 cm in diameter and about 10 cm deep. The pan should be in a cool place. After 36 hours practically all of the fat capable of rising by this method will have come to the surface, and the cream is skimmed off with a spoon or ladle. The skim milk usually contains about 0.5 to 0.6% butter fat.

➤ **Deep setting methods –** Milk preferably fresh from the cow, is poured into a deep can of small diameter. The can is placed in cold water and kept as cool as possible. After 24 hours the separation is usually as complete as it is possible to secure by this method. The skim milk is removed through a tap at the bottom of the can.

**2. Centrifugal separation –** Centrifugal separation is quicker and more efficient leaving less than 0.1% fat in the separated milk compared with 0.5--0.6% after gravity separation. It also allowed removal of cream and recovery of the skim milk in a fresh state.

Factors affecting efficiency of cream separation:

- Mechanical condition of machine
- Temperature of the milk
- Los speed of bowl
- High rate of inflow
- Clogging of bowl Acidity of the milk

**Churning:** is the process of shaking up whole milk or cream to make butter. Butter production (changing whole milk to butter) is a process of transforming a fat-in-water emulsion (milk) to a water-in-fat emulsion (butter).The process can be summarized in 3 steps:

- Churning physically agitates the cream until it ruptures the fragile membranes surrounding the milk fat. Once broken, the fat droplets can join with each other and form clumps of fat, or butter grains.



- As churning continues, larger clusters of fat collect until they begin to form a network with the air bubbles that are generated by the churning; this traps the liquid and produces foam.
- The cream separates into butter and buttermilk. The buttermilk is drained off, and the remaining butter is needed to form a network of fat crystals that becomes the continuous phase, or dispersion medium, of a water-in-fat emulsion.

### **Factors affecting butter churning**

- Milk acidity
- Churning temperature
- Degree of agitation, and
- Extent of filling the churn



<b>Self-Check - 3</b>	<b>Written Test</b>
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define churning? (3 points)
2. What are the factors that affect butter churning ? (7 points)

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

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

**Answer Sheet**

Score = \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_\_\_\_\_

Date \_\_\_\_\_

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<b>Information sheet-4</b>	<b>preparing milk processing equipment and materials</b>
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After collecting whole milk from different sources, the milk should pass through different steps for processing. In each step different materials and equipment are required. The materials and equipments must be cleaned and disinfected properly. The following are materials and equipment used for the processing of milk.

Cream separator	Churner	churner
Milk cooling tanks		Milking machine

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Bucket</li> <li>2. Ladle /Spoon</li> <li>3. Sieve/filter</li> <li>4. Milk jars</li> <li>5. Milking can</li> <li>6. Lactometer</li> </ol> | <ol style="list-style-type: none"> <li>7. Refrigerator</li> <li>8. Weighing scale</li> <li>9. Cooking dish</li> <li>10. Homogenizer</li> <li>11. Pasteurizer and the others should be prepared accordingly</li> </ol> |
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<b>Self-Check -4</b>	<b>Written Test</b>
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down the five materials, tools and equipment used in milk processing (5pts)

**Note: Satisfactory rating – 5 points**

**Unsatisfactory - below 5 points**

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

**Answer Sheet**

Score = \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_\_\_\_\_

Date \_\_\_\_\_

1

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<b>Information sheet-5</b>	<b>Identifying any OHS hazards and taking appropriate action</b>
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According to the International Labor Organization (ILO) OHS Hazard can be categorized into physical, chemical or biological nature. Proper management is needed to avoid accidents and to keep the staff motivated.

### **Physical**

- Exposure to high levels of noise.
- Injuries of teats, udder
- Long-time exposure to heat and cold.
- Skeletal problems resulting from lifting and moving of animals, feed bins (bags)

### **Chemical**

- Respiratory problems resulting from exposure to dust, which is composed of feathers, dander, micro-organisms, etc.
- Respiratory, skin, and eye diseases due to exposure to gaseous chemicals.(e.g. NH<sub>3</sub>, H<sub>2</sub>S, CO<sub>2</sub>, CO, and CH<sub>4</sub>).
- Exposure to disinfectants, detergents, formaldehyde and pesticides.

### **Biological**

- Zoonotic infections. These diseases are transmitted between animals and humans & they also are transmitted from animals to humans and include bacterial, viral, fungal, and parasitic diseases. tuberculosis,

### **OHS requirements**

Work task is provided according to Occupational Health and Safety (OHS) requirements. This may include:

- Using of relevant protective clothing and equipment,
- Use of tooling and equipment,
- Creating conducive working environment and safety handling of material,



- Using First aid kit to provide aid services
- Hazard control and hazardous materials and substances.etc,
- Following Occupational health and safety procedure designated for the task
- Checking and fulfilling required safety devices before starting operation





<b>Self-Check -5</b>	<b>Written Test</b>
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

2. List down the three types of hazards (3pts)
3. Write the Occupational Health and Safety (OHS) requirements in work place. (7pts)

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

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

**Answer Sheet**

Score = _____
Rating: _____

Name: \_\_\_\_\_

Date \_\_\_\_\_

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<b>Information sheet-6</b>	<b>Using personal protective equipment (PPE)</b>
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**Select suitable personal protective equipment.**

There are different types of materials, tools and equipments and supplies to perform different activities in milk handling. Therefore, identifying, selecting, using and preparing facilities, supplies according to the working activity are very important aspect in work.

Personal protective equipment include

- Overalls
- Gloves
- plastic boots/shoes
- Respiratory musk
- Aprons,
- Hair cover

Protective clothing should be selected to prevent skin contact with contaminated materials or environments. Consideration should be given to the type of work being performed by the worker when selecting personal protective clothing.



<b>Self-Check -6</b>	<b>Written Test</b>
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down PPE used in processing of milk (6pts)

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

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

**Answer Sheet**

Score = _____
Rating: _____

Name: \_\_\_\_\_

Date \_\_\_\_\_

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<b>Information sheet-7</b>	<b>Observing Sanitary procedure</b>
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When all cows have been milked, the shed and all milking equipment must be thoroughly cleaned. There are many dairy detergents and chemical sterilizers available, but misuse could lead to ineffective cleaning and sterilizing, or residues appearing in milk.

Good cleaning practice includes:

- Dry clean and remove all loose dirt and debris from the shade and yards
- Rinse or wet the surface, using cold or warm (not hot) water
- Hot wash using a detergent solution that holds contaminants (or soils) in suspension for a short time
- Rinse with cold water and drain
- Apply sanitizer to contact surfaces and allow to dry.

### **7.1. Milking barn or cowshed**

Everything within the milking barn, stable or cowshed should be kept clean and tidy. These rooms should be free of dirt and animal droppings. They should be kept free of dust and the floor should be dry, clean and fly and rodent proof. The interior and the surroundings of the barn, stable or cowshed should be kept clean and tidy. The walls, ceilings, windows and equipment should be free of filth, litter and vermin. Animal droppings and manure should be collected and disposed of properly.

### **7.2. Utensils and Equipment**

General guide lines used to clean milk utensils and equipment should include:

- Be cleaned after each usage
- Be washed thoroughly after each usage
- Be sanitized before each usage
- Be protected from contamination and mishandling prior its usage
- Be stored free from flies and other vermin when not in use.



### 7.3. Milk handlers

- Keeping the milk handler level of personal hygiene high
- Washing of hands with detergents before handling milk
- The milk handler should always wear clean garments (PPE) while milking, transporting, storing and processing milk.



<b>Self-Check -7</b>	<b>Written Test</b>
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**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down the general guide used in cleaning of milk equipment (5pts)

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

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

**Answer Sheet**

Score = \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_\_\_\_\_

Date \_\_\_\_\_

i. \_\_\_\_\_

ii. \_\_\_\_\_

iii. \_\_\_\_\_

iv. \_\_\_\_\_



<b>Operation sheet -1</b>	<b>Cream separation</b>
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### **Procedure**

1. Set bowl, fit the skim milk spout and the cream spout.
2. Fit the regulating chamber on top of the bowl.
3. Put the float in the regulating chamber.
4. Put the supply can in position, making sure that the tap is directly above and at the centre of the float.
5. Pour warm (body temperature) water into the supply can.
6. Turn the crank handle, increasing speed slowly until the operating speed is reached.
7. Open the tap and allow warm water to flow into the bowl.
8. Pour warm milk (37--40°C) into the supply can. Repeat steps 6 and 7 above and collect the skim milk and cream separately.
9. When all the milk is used up and the flow of cream stops, pour about 3 liters of the separated milk in to the supply can to recover residual cream trapped between the discs.
10. Continue turning the crank handle and flush the separator with warm water.

<b>Operation sheet -2</b>	<b>Butter making</b>
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### **Procedure**

1. Clarify or filtrates the milk as soon as it is milked & cool it.
2. Wash & dry the charner.
3. Sour the cream 2-3 days or add sweet cream to the churn after measuring the volume of cream to churn. The ideal volume of cream to be churned should not exceed one half the volumetric capacity of the churn.
4. Churn the cream in cool temperature (morning or evening).
5. When the butter grains appear, it may be necessary to add water ( $2c^0$  below the churning temperature) to maintain butter grain butter grain of required size.
6. Churning should cease when the butter grains & are the size of small wheat grains.
7. Drain off the buttermilk or collect the butter grains & wash the butter with water several times. Adding only as much water as is needed to float butter in the container or churn does each washing.

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8. Add dry & evenly ground & of best quality salt available at a rate of 16 salts per kg of butter or according to the test & wash it.
9. Roll out the 8 to 10 times or ridge with spatulas to remove excessive moisture.
10. Take weight & pack it in container.

<b>Operation sheet -3</b>	<b>Cheese making</b>
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## PROCEDURE

1. Standardized the milk
2. Heat to 83 c<sup>0</sup>for 20 minutes
3. Acid is added example Lemon juice or Lactic acids Acetic acid or Acid whey
4. Stirring for 2minutes
5. Coagulation to casein in denatured serum proteins, fat is incorporated
6. Precipitation to settle the curd 15min
7. Filtering
8. Adding of salt 3-10g/l used milk
9. Cooling
10. Filling packs/ moulds & pressing
11. Wrapping





<b>LAP Test</b>	<b>Practical Demonstration</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 5 hours.

Task 1. Cream separation

Task 2. Butter making

Task 3. Cheese making

