

NOTES FOR COOPERATIVES

INTRODUCTION TO BASIC DAIRY TECHNOLOGY (MQ02)

What is milk?

- Milk is produced by mammals (e.g. cows, sheep, goats, buffalos).
- The majority of milk produced and marketed in Zambia for human consumption is from cows, but milk from other domesticated mammals such as sheep and goats can also be consumed.
- By volume, milk is mainly composed of water with other major constituents being protein, fat and sugar (lactose as a form of carbohydrate)

Components of cow's milk	Percentages by mass
Water	87%
Protein	3.5%
Fat	3.9%
Lactose (carbohydrate)	4.7%
Ash (minerals, calcium and magnesium)	0.8%

Why should we process milk?

- Raw milk can contain bacteria that are harmful to human health. The number of these bacteria increase over time if milk is not chilled at about 4°C. Without cooling milk will naturally get sour over time and unfit for further processing.
- Correct processing/heating of milk removes harmful bacteria and means that milk is safe for human consumption and keeps good quality for days or weeks (depends on the process used).

How can we ensure processed milk is of good quality?

- To ensure the best quality of processed milk, we need to ensure the quality of raw milk from the time it leaves the cow to the time of processing.
- Therefore, it is important that farmers and storage facilities (e.g. MCCs) **cool milk** and follow good **hygiene, transport, storage** and **cleaning** procedures.





NOTES FOR COOPERATIVES (MO2)

Procedures associated with milk processing:

1. Pasteurising
2. Sterilising
3. Homogenising
4. Standardising

(1) Pasteurising

Milk pasteurising is the process of heating milk (or milk product) to a predetermined temperature for a specified period to ensure all microbes are killed. Pasteurisation can be categorized as **batch** or **continuous** processing.

Batch processing assumes heating milk at 63°C for 30 minutes in a closed vessel, while **continuous** processing assumes heating at 73°C for 15 seconds and cooled to 4°C using a high heat plate exchanger at a specified flow rate.

Reasons for pasteurising milk:

- (i) Naturally milk is a good medium for bacterial growth. It can also harbour disease-causing bacteria, such as bacteria that cause Tuberculosis (TB), Brucellosis, or Typhoid.
- (ii) Pasteurisation destroys all the disease-causing (or pathogenic) bacteria. The only bacteria to remain after pasteurisation are the spoilage bacteria i.e. Sour causing bacteria.
- (iii) Pasteurization improves the shelf life of milk as long as the milk is stored at not more than 4°C. A good refrigerator will achieve this temperature.

! REMEMBER that pasteurised milk can still spoil if it becomes contaminated with bacteria after pasteurisation or is not kept chilled and stored properly.

(2) Sterilising (long life or UHT milk)

Ultra-high temperature process (UHT sterilisation) implies very rapid heating of the product (milk) to a temperature of 135°C for 3 seconds and rapid cooling to packing temperature of around room temperature.

The goal of UHT treatment is to obtain a commercially sterile product through a closed antiseptic process line with no risk for contamination during packaging. That is a product with extended shelf-life at room temperature without any need for refrigeration.

Reasons for sterilising milk:

- (i) Keeps product (milk) fresh for long periods of up to a year without the need for cooling – easy to store and saves energy in local markets.
- (ii) It kills vegetative pathogenic and spoilage bacteria as well as denaturing serum protein. This explains the slightly different taste from raw and pasteurised milk.

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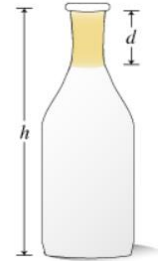
(3) Homogenising

Homogenisation is a physical process of breaking down milk fat globules into tiny droplets to discourage cream separation. These tiny droplets of fat do not rise in a milk container/bottle/package but stay suspended within it. *(See diagram on right)*

Homogenised milk



Non-homogenised milk



Reasons for homogenising milk:

- (i) Smaller fat globules in milk lead to no cream line formation because all the fat remains evenly distributed in the milk. If milk is not homogenized, separation will occur after some time and you have to shake the bottle to mix the milk again.
- (ii) Whiter and more appetizing colour.
- (iii) Better stability of cultured products.
- (iv) Preferred by some consumers (e.g. cleaner taste, better mouth feel).

Disadvantages of homogenisation include:

- (i) Homogenised milk cannot be efficiently separated.
- (ii) Increased sensitivity to light (sunlight and fluorescent) which can change the taste.
- (iii) Costly process.

(4) Standardising

Standardising means regulating the composition of milk solids (fat) to meet legal standards or customer demand. E.g. fat free, low fat (2.0%), full fat (3.2%). This is done by using cream separators, and/or blending milk of lower fat with cream. Lactose free milk is a new product for consumers with lactose-intolerance. An enzyme (lactase) is added to break down lactose to tolerated elements.

(5) Distribution and sale to the public

Part III of the Food Safety Act 2019 prohibits the "sale of poisonous, unfit or adulterated food". Milk must meet the following food safety regulations before selling to the general public:

1. Milk should give a **negative phosphatase test** immediately after processing. (Assesses the effectiveness of heat treatment)
2. Microbiological limits for pasteurized milk (cfu = colony forming unit)

Micro-organism	Maximum level (cfu/ml)
Total plate count	25,000
Total coliforms count	5
Escherichia coli	absent

Source: ZS 337:2014 ZABS standard

The ZDTP is focused on supporting dairy farmers to improve their productivity, milk quality and linkages to urban markets. The views expressed in this publication are those of the implementers of the programme and do not necessarily reflect those of the New Zealand Government. For further information, please contact ZDTP Country Manager Tania Thomson on tania@primeconsultants.net or +260 96 456 4206