Amasi:

Agricultural processing brochure

South African farmers facing current economic realities are searching for new options to maintain or expand their businesses. One of the many opportunities to grow markets, turnover and profits is by adding value to farm produce. Options need to be selected carefully based on sound information and knowledge of the opportunities presenting themselves, taking into account the strengths and weaknesses of individual farms.

Introduction:

Product group: Dairy products

Dairy milk is one of the most versatile products available to the processor. Processing options include fermenting, concentrating, drying, freezing and many more methods of preservation. Processed dairy products are divided into five groups:

- Concentrated dairy products
- Cultured dairy products
- Frozen dairy products
- Liquid dairy products
- Powdered dairy products

Amasi is categorised as a *cultured dairy product*.

Product description:

Amasi (Cultured milk)

Amasi, a cultured dairy product, is cultured (sour) milk that is manufactured by inoculating pasteurised milk with a specific bacterial culture.

The end product has a firm texture, no gas bubbles and no separation of whey from the coagulum. It has a pleasant sour taste with a slight bite/prickliness on the tongue.

Amasi products are classified according to their fat content:

- Cultured high fat milk can also be named high-fat Maas and high-fat Amasi. It must contain at least 4.5 % milk fat.
- Cultured full fat milk can also be named sour milk, Maas, Amasi, cultured full milk, and cultured full-cream milk. It must contain at least 3.3 % milk fat.
- Cultured low fat milk can also be named low-fat Maas, low fat sour milk and low- fat Amasi. It must contain at least 1.5 % milk fat and not more than 2.5% milk fat.
- Cultured fat free milk can also be named cultured skim (med) milk, skim (med) sour milk, fat-free sour milk, skim (med) Maas, fat-free Maas, skim(med) Amasi, and fat-free Amasi. It must contain no more than 0.5 % milk fat.

Yield: 1kg Amasi from approximately 1 kg of whole raw milk.

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Storage of raw milk for processing

Milk is a highly perishable product that may turn sour if left at room temperature. Milk is cooled to improve its quality and stability. Milk leaves the cow at ± 37°C and must be cooled within 3 hours to 4°C. During cold storage, the milk must be stirred gently to prevent a cream layer from forming on top (cream separation by gravity).

Raw milk is thus kept in large vertical tanks at the factory or processing plant, which is fitted with one or more propeller agitator(s) until further processing starts.

Milk preparation for the manufacturing of Amasi

Clarification of milk

Clarification is the removal of solid impurities (dirt particles, white blood cells and cells of udder tissue) from milk, prior to further processing. Clarification is achieved through filtration. Milk may be filtered through a perforated strainer, fine-wire mesh or woven cloth ("melkdoek") in small dairies. Medium and large dairies use replaceable in-line filters situated before the heat exchanger.

Pre-heating of milk for separation

Prior to separation the milk is heated to 45 - 60 °C to ensure effective separation of the skim milk and cream phase. Heating also inactivates the enzyme lipase that is responsible for the development of rancidity in fats. Pre-heating guarantees the highest possible cream quality, i.e. the lowest amount of free fat in skim milk. Heating takes place in a plate heat exchanger.

Fast facts:

Fresh milk should be cooled to: **4 °C**

Prior to separation the milk is heated to: **45 - 60 °C**

Separation of milk

The cream fraction of raw milk is separated from the skim milk by passing pre-heated raw milk (45 – 60°C) through a conventional or hermetic centrifugal separator.

Standardisation of milk

Standardisation follows directly after separation and involves the adjustment of the fat content of milk to obtain a product with a defined, guaranteed fat content. Milk products are classified according to their fat content. The fat content of milk must therefore be adjusted and standardised accordingly since the fat content of raw milk varies. Standardisation is preceded by separation of the milk and cream and then re-mixing the two fractions in the desired proportions.

Take note: Fat-free Amasi is manufactured from skim milk and does not require standardisation.

Amasi process

1. **Pasteurisation of milk for Amasi**

   Pasteurisation is a mild heat treatment that destroys all vegetative pathogens and heat sensitive enzymes so that the phosphatase test gives a negative result. The added advantage of pasteurisation for Amasi is the denaturation of the whey protein and the formation of complexes between milk proteins to increase the water binding properties of the final product, thus preventing separation. This in turn increases the viscosity of Amasi. Various pasteurisation methods available, depending on the size of the processing plant:

   Batch pasteurisation: This method is suitable for small operations with less than 2500 litres of milk per day. The milk

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is pumped into an open vat or jacketed vat fitted with an agitator where it is heated. The milk is held at least 30 minutes at 85.5°C followed by cooling within 30 minutes to 43 - 45°C.

Continuous pasteurisation: Large processing plants make use of a continuous High Temperature Short Time (HTST) method. Milk is heated quickly to 90 - 95°C for 15 - 40 seconds in a plate heat exchanger. This is a compact, simple, easily cleaned and economic heating device since it uses the hot pasteurised milk to pre-heat the incoming cold milk (and vice versa), i.e. makes use of energy regeneration. The pasteuriser consists of series of stainless steel plates mounted vertically, supported by cylindrical bars, and are tightly packed and sealed together. The plates have waffle-like indentations that provide a large heat transfer area and a turbulent flow of the liquids.

A rubber-seal between the plates keep them about 5 - 8 mm apart. The liquids leave the plates through holes in the corners of the plates. Open and blind holes route the liquids to the correct plate processing area. Five stages of heat exchange can be identified:

- **Regenerative heating**: The incoming milk is pumped to the regeneration section of the heat exchanger where it is heated to 55 - 65°C by heat transfer from freshly pasteurised milk. Up to 92% of required heat can be recovered in this way. Milk may leave the pasteuriser at this stage to be homogenised and return to the next section.

- **Heating:** Milk is further heated indirectly with hot water, vacuum steam or saturated steam at atmospheric pressures to the required temperature (90 - 95°C).

Fast facts: Small operations: **Batch** pasteurisation | Large operations: **Continuous** pasteurisation

- **Holding:** The hot milk is held at the required temperature in a chamber or a holding pipe for the required period of time (15 - 40 seconds). The dimensions of the holding pipe must be sufficient to ensure the required residence time and flow rate of the milk. The stainless steel holding pipe slopes upwards and excludes trapped air. The temperature at the end of the pipe is continuously monitored to ensure sufficient pasteurisation. If the required temperature is not maintained for long enough, the milk is returned to the heating and/or holding sections via the flow diversion valve.

- **Regenerative cooling:** The hot milk from the holding section goes to the regeneration section where it is cooled to 50 - 60°C by heat transfer to the incoming milk.

- **Cooling:** Milk is further cooled to 43 - 45°C, first with cold water and finally with chilled water or refrigerant (brine or polyalcohol solutions). The higher the fat content of the milk, the higher the final temperature of the cooled milk will be. This prevents the milk from thickening, resulting in clogging of pipelines and filling problems. The mechanical action involved in pumping and filling thick, cold milk could also cause damage to the fat globules.

- **Take note:** It is required by law in South Africa that processors keep thermographic recordings of the temperature of pasteurisation for at least four weeks; and that apparatus used must be calibrated monthly to ensure the correctness of the pasteurisation process.

2. Inoculation and incubation of milk for Amasi

Inoculation is the addition of starter cultures to a food substance to initiate fermentation reactions. The warm milk (at 22 - 26°C) from the pasteuriser is pumped into the fermentation vats and inoculated with a 1 - 2% Streptococcus lactis culture. The milk and starter culture mixture are agitated to ensure even dispersion of the culture in the milk.

The culture is responsible for the development of lactic acid, flavours and aroma compounds. The inoculated milk is incubated for 3 - 16 hours at 20 - 30°C to allow fermentation to take place. Fermentation is defined as the conversion of the milk sugar, lactose, into simpler substances such as acids by the action of the starter culture and enzymes. This takes place in fermentation tanks. The tanks are insulated to ensure than an even temperature is maintained throughout incubation. Fermentation is stopped when the preferred acidity is reached and the product has coagulated according to consumer preferences.

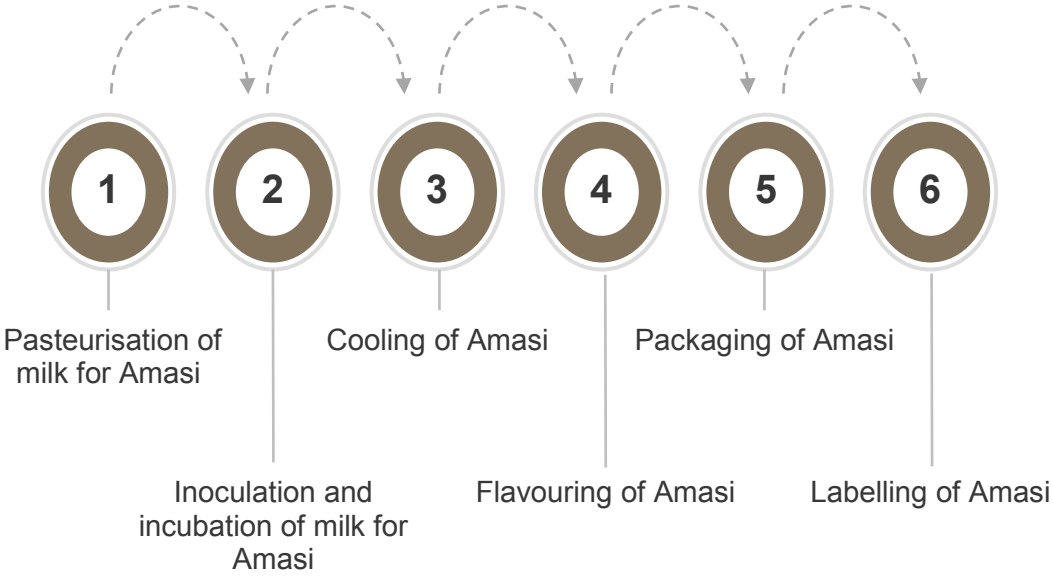
3. Cooling of Amasi

The Amasi is cooled to 15°C as soon as the required acidity is reached. Cooling retards fermentation and further acid development. Batch cooling is usually done in the fermentation tanks by replacing the heating medium with cold water. The tanks are equipped with slow speed agitators that scrape the walls of the tank to speed up heat exchange. Continuous cooling may take place in tubular coolers or plate coolers that are able to cool high viscose liquids.

4. Flavouring of Amasi (optional)

Amasi may be flavoured with pasteurised fruit or permitted fruit flavours. Mixers with a gentle stirring action are used to disperse the fruit and flavouring throughout the Amasi. All additions must be declared on the packaging/label.

Process overview



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5. Packaging of Amasi

Amasi is filled into suitable containers such as laminated cartons or plastic bottles and are hermetically sealed. Filling takes place at 15°C due to the high viscosity of the cooled product. Laminated cardboard boxes or plastic tubs with foil caps are generally used. The packaged product is placed in cold storage rooms to reduce the temperature to below 5°C.

6. Labelling of Amasi

All the containers are pre-labelled or labelled after they are filled and sealed.

Labelling of cream

Labelling in South Africa is controlled by legislation. Anyone who wants to use the information provided in this document must familiarise him/herself with all the applicable laws that apply to the producing, processing, manufacturing and storage of the products referred to in this document.

Other processing options – Cultured dairy products

Listed below are other processing options not covered in this report, but available from Eskom.

- **Cultured buttermilk** is the product obtained from milk that has been inoculated with a starter culture to produce a viscous liquid with a mild lactic flavour. It is consumed as a refreshing drink or used as an ingredient in various baked products.
- **Gouda** is a close textured, mild cheese. It is classified as semi-hard.
- **Kefir** is a smooth, viscous, fermented dairy drink with a fresh acidic taste and contains lactic acid, alcohol (± 1%) and gas (carbon dioxide).
- **Processed cheese** is made from a variety of natural cheeses that are ground and blended together with emulsifying agents. Various other additives may also be added. The mixture is heated and packaging in laminated films.
- **Ricotta** is a cheese prepared from whey. Ricotta is a low fat, soft cheese with a maximum fat in dry matter content of 10% and a minimum dry matter of 20%.
- **Set yoghurt** is prepared from high or full fat pasteurised milk inoculated with a specific starter culture. Fermentation takes place in the final retail container under controlled conditions. The yoghurt has a firm, gel-like consistency and a clean surface is apparent when the yoghurt is cut.
- **Stirred yoghurt** is a fermented milk product with a thick, smooth consistency and may or may not be flavoured. It is incubated in tanks, stirred, flavoured and cooled before packaging.
- **Cheese spread** is a blend of hard cheese with added emulsifying salts. The mixture undergoes a heat treatment that increases the shelf life. Cheese spread has a relatively high moisture content (± 55 %) and a pH of 5,7 - 6,3.
- **Cheddar cheese** is defined as the product obtained from coagulated milk from which the whey has been removed. The coagulum or curd has undergone ripening to a greater or lesser extent. Cheddar is classified as a high fat, hard cheese.
- **Drinking yoghurt** is essentially stirred yoghurt with a lower solids content and broken coagulum. It may be pasteurised and/or aseptically packaged to extend the keeping quality.
- **Feta** is a pickled cheese with a clean, acidic salty taste. It is packaged in a brine solution to prevent drying out and to preserve the cheese.
- **Cottage cheese** is the product obtained from coagulating milk. It is a soft, unripened cheese containing about 80 % moisture.

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- Understanding their energy needs
- Understanding their electrical systems and processes
- Investigating the latest technology and process developments, including electric infrared heating and drying systems
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Call 08600 37566, leave your name and number and request that an Energy Advisor in your region contacts you. Alternatively, e-mail an enquiry to **advisoryservice@eskom.co.za.**

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Five alternative funding product offerings are available to help reduce your investment costs for new agro-processing or agro-beneficiation business or expand/improve an existing agro-processing or agro-beneficiation business.

For more info visit: http://www.eskom.co.za/sites/idm/Business/Pages/Alternativefunding.aspx

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