



WHITE PAPER

Understanding ambient yoghurt – challenges and opportunities

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Introduction

Who is this booklet for?

This booklet is for dairy processing professionals who want to learn more about the opportunities in the expanding world of ambient yoghurt. Working with ambient yoghurt requires careful attention to materials and processes in order to uphold high product quality.

What is ambient yoghurt and why is everyone excited about it?

Ambient yoghurt is a type of yoghurt that has boomed in popularity in recent years. These yoghurts do not need to be chilled, and are either eaten with a spoon (often with added fruit), or else drunk directly from the package. This convenience has made it an extremely successful product, and a growth item in many markets.

What do producers need to know?

Since ambient yoghurt requires additional heat treatment and stabilizers to ensure a product that is stable over time at room temperature, this places great demands on proper dosing, mixing and heat treatment.

In the following pages, we lay out some of these challenges in more detail, offering advice and technical guidance reflecting best practices in the dairy industry.

Yoghurt takes a new turn

Consumer perspective

Ambient yoghurt is a category of yoghurt that has grown in recent years and become immensely popular. These are either eaten with a spoon (often with added fruit), or else drunk directly from the package. The essential point about ambient yoghurt is that it does not have to be chilled. This can make the drinking or eating process more convenient for consumers, and it also means that they can easily travel and take the product with them for consumption later.

The convenience and novelty of ambient yoghurt has made it into a success for manufacturers and merchants, and a popular food item for consumers.

Market perspective

Ambient yoghurt is experiencing a growth spurt in popularity. While global production volumes of most yoghurt types grew at a compound annual growth rate of 5-6% during the period 2010-2013, ambient yoghurt production grew at a CAGR of 100% in the same period. This niche product, currently rising from small volumes, is gaining attention as a convenient and healthy consumer drink.

Production perspective

Producing ambient yoghurt differs from traditional yoghurt in one principal way:

The yoghurt is **heat treated** after fermentation to kill or reduce active bacteria, yeasts, and moulds. This enables the yoghurt to be distributed and stored at ambient temperatures. They enjoy a long shelf life – 4-12 months, depending on the way they are formulated and processed. The shelf life is generally limited by aroma and colour changes or product instability

Expanded business opportunities

From a manufacturer's point of view ambient yoghurt presents many good business opportunities, when compared with chilled products.

OPPORTUNITY	HOW
Enter new geographical markets	Longer shelf life allows distribution to larger geographical areas
Facilitates transportation	Cold distribution is costly and is not available in all markets
Encourage new consumption patterns	The ambient version can be consumed on the go, as a snack and can be put in a bag for emergency hunger needs
Reach new consumer groups	For instance, by appealing to consumer who don't eat breakfast or don't like to eat cold products
Increase production efficiency through larger production batches	Chilled products have limited shelf life and are therefore produced in relatively small batches to ensure the products reach the retailer/consumer in fresh conditions

What are the key manufacturing challenges?

The additional heating required for ambient yoghurt affects a natural yoghurt in a number of ways:

- The viscosity will be reduced
- Whey will separate out from the yoghurt
- Mouthfeel, aroma and colour may change

In order to counter these changes, special ingredients are added to the yoghurt. But to achieve consistent product quality that appeals to a given group of consumers, careful attention must be paid to choosing and dosing these additives, as well as the mechanical treatment and heat treatment of the yoghurt. Getting all of this to work right in a production environment is a question of engineering optimization and food chemistry know-how.

A legal note: In some countries the definition of yoghurt requires that it must contain live yoghurt bacteria. Since a heat treatment of the yoghurt kills these bacteria, the product is not legally allowed to be called “yoghurt” in these countries.

Key process points in producing ambient yoghurt

Point-by-point, there are many considerations when designing processing lines to fit particular product recipes. This section is not an engineering discussion filled with flow diagrams, but it will give you some idea of the challenges in perfecting ambient yoghurt.

Raw material quality

The yoghurt can be made from both fresh and recombined milk, but as with any yoghurt, it should preferably have a low bacterial count and contain absolutely no antibiotics. The milk is commonly standardized and pasteurized before it enters to the yoghurt milk pasteurizer. Milk powder can be added to improve the viscosity and stability of the yoghurt, and some recipes also add milk powder.

Adding stabilizers

Different stabilizer combinations are added to the product in order to overcome the negative effects of the later heat treatment. In most cases the stabilizer can be mixed in dry. The stabilizer combination will determine the product's mouthfeel and viscosity, as well as prevent sedimentation. Common stabilizers are:

- Starch
- Pectin
- Gelatine
- Carrageenan
- Guar gum
- Xanthan

For **high-viscous yoghurt**, the stabilizer used is often based on starch, gelatine and pectin. Combined stabilizer mixtures are commercially available. For these applications, stabilizers are commonly added before fermentation.

For **low-viscous yoghurt**, the stabilizer used is often a pectin, pure or mixed with another stabilizer. For these applications, stabilizers are commonly added after fermentation.

Deaeration

It is recommended to deaerate the milk in order to reduce the air content. This is especially important when milk powder has been added. Deaeration will minimize the risk of fouling during heat treatment, as well as minimize the fermentation time.

Homogenization

The milk is homogenized at a pressure between 50 and 200 bar at about 60-70°C, depending on stabilizer type. Most commonly a two-stage homogenizer is used for optimal running condition and flexibility. Homogenization will prevent creaming and also improve the stability and consistency of the yoghurt.

Heat treatment of yoghurt milk

The recommended heat treatment of the homogenized yoghurt milk is 90-95°C/ 5 min. The heat treatment will denature the whey proteins. These will then interact with the casein, thereby improving the water-binding ability of the coagulum. As a result, the stability of the yoghurt will improve. The heat treatment also deactivates enzymes and creates better growth conditions for the starter culture bacteria. The pre-treated milk is then cooled to fermentation temperature, typically 43°C.

Fermentation

The yoghurt milk is fed into a fermentation tank where the required amount of yoghurt culture is added in line to the milk or directly in the tank manhole. Typically, fermentation takes place for 3-5 hours, depending on the bacteria strains used. When the pH value has reached about 4.5 the product should be cooled.

Addition of stabilizers after fermentation (low-viscosity yoghurt)

The addition of a stabilizer (pectin-based) can be done in the fermentation tanks but also in the buffer tanks after cooling. The amount of pectin/kg yoghurt is often in the range 0.3-0.6% and the addition of pectin stabilizer to drinking yoghurt can be done in two different ways:

- The stabilizer in powder form, often combined with sugar, is mixed directly into the fermented milk product using a high-speed mixer.
- A concentrated solution with stabilizer and sugar in water is later added to the fermentation or buffer tank. It is also possible to arrange for continuous in-line dosage to the yoghurt stream prior to the final heat treatment. It is always of utmost importance to mix thoroughly.

Addition of aroma

Aroma can be added to low-viscosity yoghurt by mixing in an aroma concentrate. Fruit juice can also be added, but it will also reduce the product's milk solids. An alternative way of adding the aroma is to dose it aseptically and continuously prior to the aseptic packaging, using specialized dosing equipment.

Adding aromas or colours to high-viscosity ambient yoghurt can be challenging. The product is quite viscous before heat treatment and the aromas and colours are often viscous as well. Static or dynamic inline mixers must be used in order to achieve a homogenous product

Cooling

The yoghurt is now cooled in a plate heat exchanger to around 20°C and fed to an intermediate buffer tank. A fermentation tank is normally emptied within 30-45 minutes in order to maintain uniform product quality.

Heat treatment of the yoghurt

The stabilized and cooled yoghurt must now be heat-treated. The temperature/time combination used is dependent on raw milk quality, pH, composition, stabilizer type, etc. The heat treatment is designed to kill off the yoghurt culture bacteria as well as any yeast or moulds present. The heat treatment is not designed to eliminate bacterial spores from the yoghurt. They will remain in the product, but when the pH of the product is low enough they will stay in their dormant, inactive state.

For an undiluted, **high viscous yoghurt** with a pH below 4.5, treatment at 75°C for 20 seconds is often used. The ingredients used to maintain the viscosity are generally sensitive to heat and using higher temperatures would make the product sandy or grainy.

Low viscous yoghurts are often mixed with water or juice and contain no additional ingredients – or only limited amounts – for maintaining viscosity. Higher temperatures (95-110°C) are typically used for the heat treatment of these yoghurts

For **low-viscous yoghurt**, a homogenizer (150-200 bar) is included prior to the yoghurt heat treatment to improve the stabilizing effect of the pectin on the proteins. Using lower-pressure homogenization may result in early sedimentation during storage. It is important that the pectin is fully dissolved before it is homogenized together with the yoghurt. So if, for example, dry pectin has been added to the product, the homogenization temperature should be increased to around 85°C.

For **high-viscous yoghurt**, homogenization is normally not included in the final heat treatment, as homogenization would break down the starch stabilizer and reduce the viscosity.

Adding fruit – before or after heat treatment

Fruit or other food particles, such as grains, can be **added before heat treatment**.

This has several advantages:

- Possibly lower investment cost
- Simple production time schedule (PTS)
- Minimized line equipment downstream after heat treatment

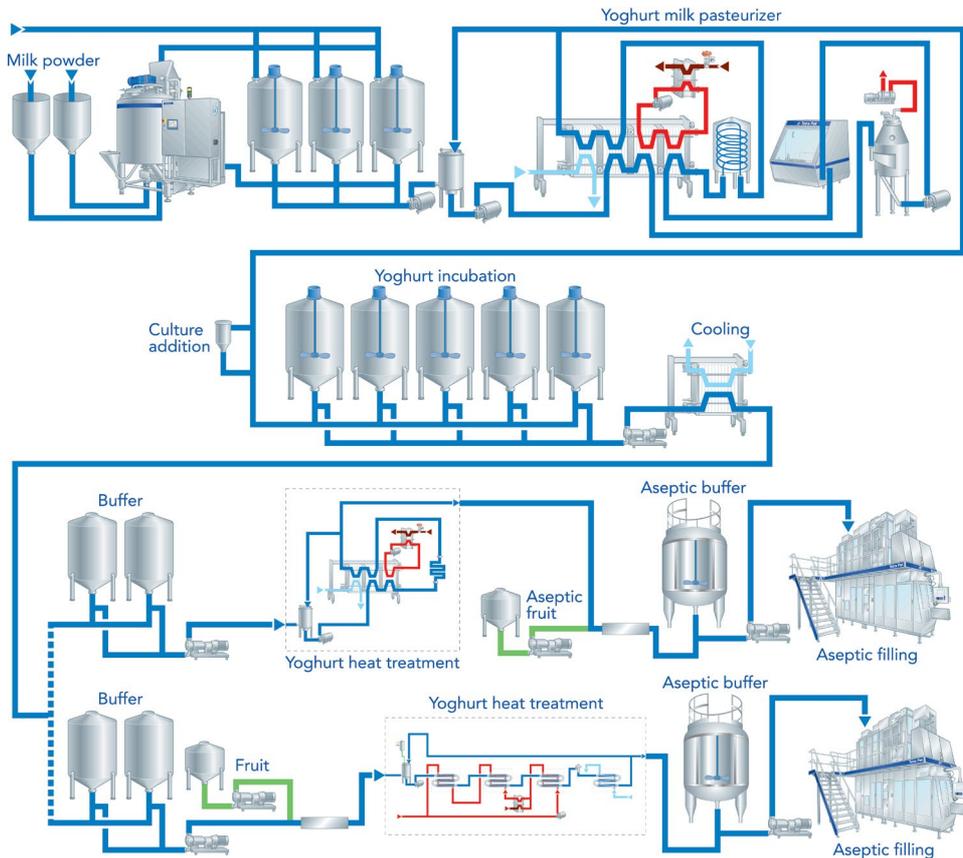
On the other hand, if particles are added before the heat treatment, it is more challenging to design the line and process to maintain particle integrity. The heat treatment is then not only dependent on pH, composition and stabilizer but also the type of particle and particle size.

This type of solution is thus always a trade-off between the lower cost and the increased processing complexity.

Another method is to **add the fruit after heat treatment** of the yoghurt. In this case the fruit itself must be high heat-treated before addition to avoid contamination of the yoghurt. Heat-treating the yoghurt separately from the fruit particles has several advantages. The separate heat treatments can be optimized for these products' specific properties, both from the perspective of heat load and mechanical treatment, which results in:

- Improved product quality in terms of particle integrity, yoghurt viscosity, etc.
- Increased production flexibility
- Lower running cost

Adding fruit after heat treatment is preferred from the standpoint of processing flexibility and product quality, but the initial equipment cost may be higher than for other solutions.



Example of process line concept for ambient yoghurt with fruit addition before or after the yoghurt heat treatment.

Best-practice production processes for ambient yoghurt

Tetra Pak has solid experience within ambient yoghurt, and has a worldwide installed base of process lines for ambient drinking yoghurt products. In fact, Tetra Pak supported the successful launch of ambient yoghurt in China.

Our customer and solution experience is based on real understanding and extensive specialist knowledge. We are able to offer customized solutions targeting your requirements, and can guide you to solution with the lowest total cost of ownership.

Tetra Pak – your dairy advisor

Tetra Pak specialists stand ready to assist you in many ways with your business and technical questions regarding milk processing, product development, and safety issues.

Your Tetra Pak representative can help you design or upgrade lines based on your specific product processing needs.

For further information on dairy processing and packaging in general, try www.tetrapak.com

You'll also find more specific information here:

<http://www.tetrapak.com/about-tetra-pak/cases/how-milk-quality-affects-your-uht-dairy-products>

<http://www.tetrapak.com/processing/dairy/fermented-dairy-products>