UNIVERSITY OF COPENHAGEN
FACULTY OF SCIENCE

Dairy Product Technology 1
NFOK21005U

Notes taken during the course, including lectures, exercises, curriculum, and practicals

Lucas Daniel Paz Zuleta, TZS159
MSc student at the University of Copenhagen

Last compiled: 26-05-2025
Link to Git repo.: https://github.com/DanishUnicorn/dpt1_notes

Course Description

Content

The course deals with the product technologies of a range of non-fermented dairy products, e.g. fluid milk products, concentrated and dried dairy products, butter and spreads, as well as ice cream. Plant-based dairy analogues will also be introduced.
Furthermore, the course deals with unit operations and equipment applied in the production of dairy products as well as technological innovations, developments, optimizations and trends within well-established technologies, e.g. for improvement of environmental impact.

Learning Outcome

The overall aim of the course is to provide students with in-depth knowledge of the technologies used for processing of non-fermented dairy products.

After completing the course the student should be able to:
Knowledge

- Discuss the major factors influencing the quality of dairy products and relevant manufacturing processes.
- Identify and critically examine the principle(s) underpinning unit operations needed for the production of selected dairy products.

Skills:

- Apply principles of colloid science to processing of dairy products.
- Apply obtained knowledge of dairy technology to pilot plant practicals and analyses on dairy products.
- Analyse data obtained for characterization of processing effects on physical and chemical properties of dairy products.
- Reflect and critically examine the effect of various unit operations on dairy product quality.
- Reflect and critically examine how colloidal interactions can be controlled in order to produce stable dairy products.

Competences:

- Discuss how the technology behind manufacture of dairy products affects final product quality.
- Discuss the contribution of different unit operations to product properties, and the value of different product streams in production of selected dairy products.
- Work effectively in a group for both theoretical and practical assignments.

Litterature

See Absalon for a list of course literature. The curriculum will include lecture notes and scientific papers in addition to parts of textbooks.

Recommended Academic Qualifications

Qualifications corresponding to having completed the Dairy Internship are recommended.
Academic qualifications equivalent to a BSc degree is recommended .

Teaching and Learning Methods

Lectures, project work in the dairy pilot plant and laboratory and half/one-day excursions.
Minor costs for one-day excursions (e.g. transportation) are paid by the students.

Workload

Table 1: *A table with an overview over the workload for the course.*

Category	**Hours**
Lectures	30
Preparation	88
Practical exercises	12
Excursions	8
Project work	55
Guidance	12
Exam	1
Total	206

Contents

1 Lecture Notes **1**

2 Literature résumés **2**

1 1st Reading Material from the Curriculum 2

1.1 Milk for Liquid Consumption 2

1.2 Sterilized Milk 3

1.2.1 Description 3

1.3 Reconstituted Milk 3

Chapter 1
Lecture Notes

Chapter 2
Literature résumés

This section of the course notes is designed to streamline access to the key findings from each reading material (RM), providing a concise and accessible overview of essential information. Created through experimentation with various AI platforms, this chapter also serves to enhance prompt engineering skills, exploring diverse methods of note-taking for maximum efficiency and clarity. The procedures for creating these summaries have varied, but all methods share a common approach: each RM has been fully read, with summaries and notes prepared after completing each respective subsection. By using these AI-co-op'ed approaches, these notes aim to be both a reliable reference and a resource for continuous improvement in capturing complex microbiology concepts.

1 1st Reading Material from the Curriculum

1.1 Milk for Liquid Consumption

Liquid milk is treated by **pasteurization** or **sterilization** to ensure **safety**, extend **shelf life**, and retain **flavour**. Raw milk is considered unsafe and is restricted in many countries. **Pasteurized milk** retains better flavour, while **sterilized milk** offers longer shelf life, especially valued in cooking. **Fat content** is usually standardized, but **low-fat** and **skim milks** are also common. Some products are **fortified** or processed via **ultrafiltration** for consistent protein content, although this may be legally restricted. Quality attributes vary by use, and packaging is essential for hygiene [1].

Manufacture

Thermalization reduces lipase activity and psychrotrophic growth, aiding shelf life. **Homogenization** prevents creaming but increases **lipolysis risk**, requiring higher heat (e.g., 20 s at 75 °C). **Low pasteurization** (15 s at 72 °C) kills pathogens while preserving **natural inhibitors**, though heat-sensitive compounds like **agglutinins** and **immunoglobulins** are degraded in **high-pasteurized milk**. **Packaging hygiene** is crucial to prevent recontamination and preserve shelf life [1].

Shel Life

Shelf life is influenced by **bacterial growth**, **enzymatic activity**, and **chemical/physical changes**. Key factors include **storage temperature**, **recontamination**, and **Bacillus cereus** spore levels. Below 7 °C, psychrotrophs dominate spoilage. Hygiene in **packaging** is essential; **rapid tests** help detect recontamination [1].

Extended-Shelf-Life Milk

ESL milk combines long shelf life with near-fresh flavour. One method applies **short-time direct UHT treatment** (e.g., 2 s at 140 °C) with **aseptic packaging**; enzymes like **plasmin** may still affect taste after weeks. The second method involves **microbial removal** via **microfiltration** or **bactofugation**, often followed by partial **UHT sterilization** of retentate and cream. Aseptic packaging is essential. **Cooked flavour** is minimized by limiting heat to fat-rich fractions [1].

1.2 Sterilized Milk

1.2.1 Description

Sterilized milk must be microbe-free, shelf-stable at ambient temperature, and retain **acceptable flavour** and **nutritional value**. **UHT sterilization** (e.g., 1 s at 145 °C) minimizes **browning**, **off-flavours**, and **vitamin loss**. To prevent spoilage, packaging must be **aseptic**, and milk free from heat-resistant enzymes. **Homogenization** avoids creaming and coalescence. **Lactulose** content is used to identify UHT-treated milk [1].

Manufacture

Sterilized milk is made via **in-bottle**, **mild in-bottle**, or **flow-through UHT** processes. **Psychrotroph enzymes** (esp. from *Pseudomonas*) are heat-resistant, so raw milk must be fresh. **UHT heating** (>140 °C) ensures safety but risks **casein aggregation**, off-flavors, and **vitamin loss**. **Aseptic homogenization** and **deaeration** are crucial to prevent oxidized flavor. **Oxygen- and light-tight packaging** prolongs shelf life [1].

Shelf Life

Spoilage of **in-bottle sterilized milk** may result from surviving **spores** (e.g., *B. subtilis*, *B. stearothermophilus*) or **leaky packaging**. **UHT milk** mainly deteriorates via **recontamination** or residual **heat-resistant enzymes**, causing **gelation**, **off-flavors**, or **plasmin-induced bitterness**. **Nonenzymatic spoilage** includes **oxidation**, **Maillard reactions**, and **light effects**. Shelf life is tested via **incubation**, **oxygen pressure**, or **ATP bioluminescence** [1].

1.3 Reconstituted Milk

Reconstituted milk is made by dissolving milk powder in water; **recombined milk** adds **anhydrous milk fat** to reconstituted skim milk. It mimics whole milk but lacks **natural fat globule membrane** components. **Filled milk** uses **vegetable oil** instead of milk fat. **Toned milk** blends **buffalo milk** with skim milk to reduce fat content [1].

Bibliography

[1] P. Walstra, J.T.M. Wouters, and T.J. Geurts. *Dairy Science and Technology*. 2nd ed. CRC Press, 2005. DOI: 10.1201/9781420028010. URL: https://doi-org.ep.fjernadgang.kb.dk/10.1201/9781420028010.