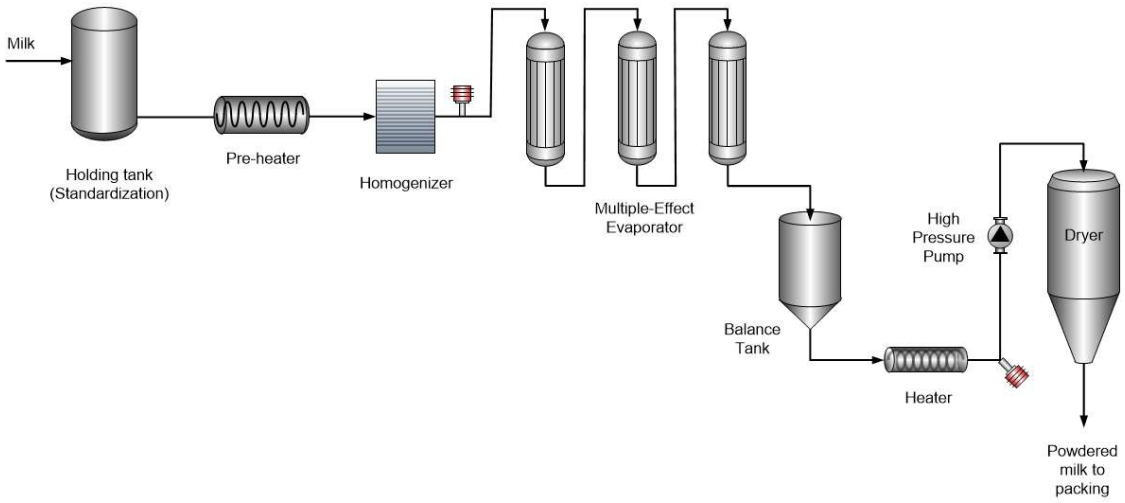
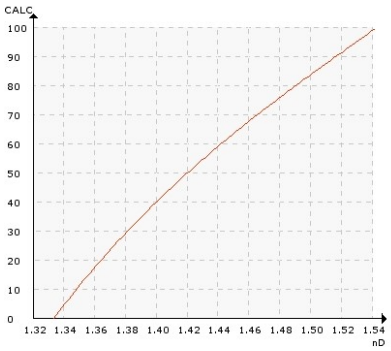


EVAPORATED OR CONCENTRATED MILK

Typical end products

Unsweetened condensed milk (evaporated milk), sweetened condensed milk and powdered milk.

Chemical curve: R.I. per BRIX at Ref. Temp. of 20˚C



Introduction

Evaporation is one of the oldest methods for preserving milk. In this operation, water is removed from the milk to obtain a concentrated dairy product.

Depending on the process, the evaporated milk may be the desired end-product, or evaporation may just be a prior step to further processing, for example, for the production of sweetened condensed milk or powdered milk.

Application

The first step in the production of unsweetened condensed milk (or evaporated milk) and powdered milk is the standardization of the fat and dry matter content of the raw material milk to the level required in the final product. This is followed by a heat treatment to destroy microorganisms and to stabilize the milk. Pre-heating the raw milk before evaporation has a significant effect on the shelf life of the final product.

The milk is then evaporated to a specific dry solid concentration. For the production of unsweetened and sweetened condensed milk, the milk is evaporated to obtain a concentration of 30 – 40 % dry solids. For the production of powdered milk, the milk is concentrated to about 40 – 50 % dry solids for a spray-dryer, and about 18 % dry solids for a roller dryer. The total dissolved solid concentration achieved in evaporation is critical as it affects the performance of subsequent operations and the quality of the final product.

After evaporation, the milk is homogenized. Homogenization reduces the mean size of the fat globules so that they are distributed uniformly in the milk and do not rise to the top creating a creamy layer. This is not a required step in the production of powdered milk, but it is applied to facilitate milk reconstitution.

The evaporated, homogenized milk then moves on to cooling, sterilization and packing for a canned evaporated milk, or to drying for a powdered milk product.

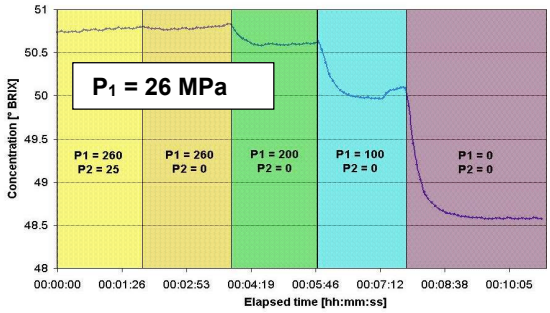
Instrumentation and Installation

K-Patents Sanitary Process Refractometer PR-43-A provides real-time and accurate Total Dissolved Solids (TDS) measurements for better control and monitoring of the milk evaporation process. The refractometer

can be calibrated to read TDS or another scale preferred by the manufacturer, e.g. Brix.

The PR-43-A is used for standardization after the holding tank to achieve the precise solids content in the milk as indicated by legal standards.

If a homogenization step is performed, a refractometer is installed after the homogenizer to include the fat content in the measurement. The K-Patents refractometer detects fat globules as long as they are smaller than 6 µm. This globule size can be achieved by adjusting the pressure of the homogenizer. The recommended homogenizer's primary pressure is P_1 = 26 MPa (260 bar).



An additional refractometer between the evaporator and the high-pressure pump to the dryer allows for continuous control of the evaporation performance through dry solids concentration levels.

Accurate TDS measurement after evaporation is important in order to achieve the desired quality of the evaporated milk product and to enhance the drying operation. If the dry solids content exceeds the targeted level, the viscosity of the milk increases and creates problems with atomization during drying. Low solids content increases the energy requirements at the drying stage.

Thanks to its self-cleaning design, a prism wash system is usually not required. However, for fluids with a dry solids content above 40 % or a flow velocity below 1.5 m/s, a steam prism wash solution consisting of the PR-43-AP-L42 with an aseptic steam valve ASV and side flow cell is required.

K-Patents PR-43-A provides Ethernet and mA output signals for real-time process control. The refractometer is 3A and EHEDG certified, which ensures high standards of hygiene and safety for food production applications.

The control achieved with K-Patents precise and accurate in-line concentration measurements helps to improve end-product quality and to reduce operating costs.

Instrumentation	Description
	K-Patents Sanitary Compact Refractometer PR-43-AC for hygienic installations in small pipe line sizes of 2.5 inch and smaller. The PR-43-AC refractometer is installed in the pipe bend. It can be directly mounted on the pipe, or by a flow cell using a 3A Sanitary clamp or Varivent® connection. The user interface of the refractometer can be installed locally in the field, remotely in the control room or in both locations by connecting several user interfaces in a network.
	K-Patents Sanitary Probe Refractometer PR-43-AP for hygienic installations in large pipes, tanks, cookers, crystallizers and kettles and for higher temperatures up to 150°C (300 °F). The PR-43-AP refractometer is installed in the pipe line through side flow cell SFC 2.5 inch or a vessel through 4-inch Sanitary clamp. The user interface of the refractometer can be installed locally in the field, remotely in the control room or in both locations by connecting several user interfaces in a network.
Automatic prism wash:	Prism wash with aseptic steam: The components of a steam wash system are refractometer PR-43-AP-L42 with insertion length of 42 mm, Side flow cell SFC-HHSS-H10/15/20/25, Aseptic steam valve ASV-H/ESS-H05, and Multichannel user interface MI for automatic prism wash diagnostics and control. The wash is used in applications where flow velocity is below 1.5 m/s (5 ft/s) or where dry solids exceed 40 %.
Measurement range:	Refractive Index (nD) 1.3200 – 1.5300, corresponding to 0-100 Brix.