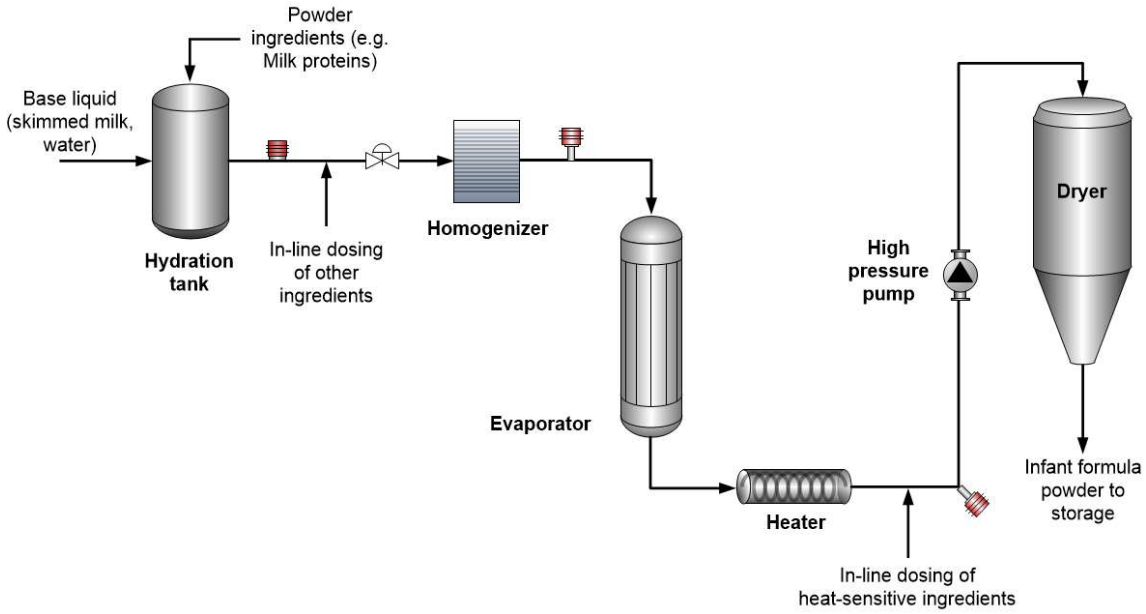
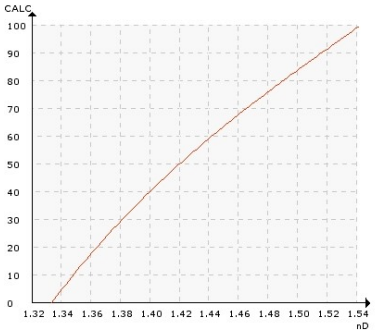


INFANT FORMULA

Typical end products

Powdered infant milk formula, powdered baby milk.

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



Introduction

Baby milk, or infant formula, is a substitute for breast milk. It is available as either a dried powder, or as a ready-to-use canned or bottled liquid. Regardless of the type, all formulas contain a protein source, a fat source, a carbohydrate source and added supplements.

Infant formula can be manufactured by a wet-mixing process where all ingredients are handled in liquid form, a dry-blend process where ingredients are blended as powders, or a combination of these processes.

Wet-mixing is the most used technology as it ensures control over the milk's composition and microbiological safety. The formula's composition should be carefully monitored in order to achieve a high-quality product that comes as close as possible to matching breast milk and that is safe for infant consumption.

Application

The wet-mixing process involves three stages: preparation of the mix, evaporation and drying. For the preparation of the mix, the base liquid can be water or skimmed milk. Other water-soluble powder ingredients are added to the base liquid (e.g. milk proteins) and the resulting mixture is stored in a large vessel for complete hydration.

A homogenization step follows to increase the uniformity and stability of the emulsion by reducing the size of the fat and oil particles in the formula.

Evaporation of the milk mixture is an essential step that enhances the spray-drying operation and increases the final product shelf life. Other ingredients, which are heat-sensitive, are added after evaporation.

Finally, the concentrated milk is typically dried in a spray-dryer system. The temperature as well as the solids content of the milk mixture are kept as high as possible for maximum efficiency. Low solid content results in small particle size, as well as poor wettability and short self-life of the final product. Excessively high dry solids content increases the milk's viscosity which results in larger particles and affects the spray-dryer capacity.

Instrumentation and Installation

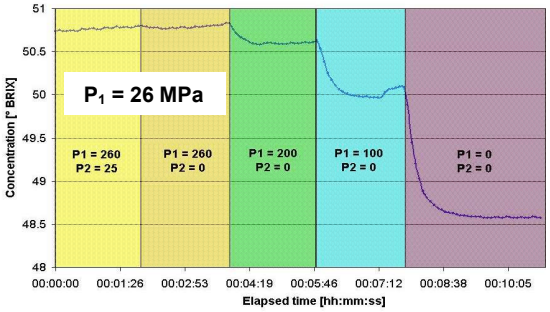
The K-Patents Sanitary Refractometer PR-43-A is the ideal in-line measurement instrument for safe, clean, sanitary and accurate manufacturing of infant formula. The refractometer is 3A Sanitary and EHEDG certified. It is designed to withstand CIP and high process temperatures. Moreover, the PR-43-A can be calibrated to measure either Brix, dry solids, or total dissolved solids (TDS).

A refractometer is installed after the hydration tank to measure TDS content. This ensures the right in-line dosing of other ingredients to meet the recipe requirements.

Another refractometer after the evaporator monitors and controls the evaporation performance to reach a specific dissolved solids content. This helps to determine the right dose of heat-sensitive ingredients and ensures that the desired concentration is fed to the dryer. Solid content prior drying is critical to optimize the spray dryer performance, energy consumption and final product quality.

A third refractometer can be installed before the evaporator for maximum evaporation performance control. When the products contain fat or oil, the refractometer should be installed after the homogenizer where the fat globules break down to a smaller size. The refractometer detects fat globules as long as they are smaller than 6 µm.

The pressure in the homogenizer can be adjusted to obtain this globule size. The higher the pressure the smaller the globule. The recommended homogenizer's **primary pressure** is P_1 = 26 MPa (260 bar).



Typically, prism wash is not required for any of these applications. However, a steam prism wash solution using Process Refractometer PR-43-AP-L42, aseptic steam ASV valve, and a side flow cell is required for low velocities or for fluids with a dry solid content above 40 %.

K-Patents PR-43-A is a stand-alone device capable of operating independently or with one of several different user interface options. It provides an Ethernet or 4-20 mA output signal for real-time process control.

The high accuracy control achieved with K-Patents precise in-line concentration measurements ensures end-product quality and safety, as well as 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 is angle mounted on the outer corner of the pipe bend directly, or in 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 or vessel through a 2.5 inch or 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.