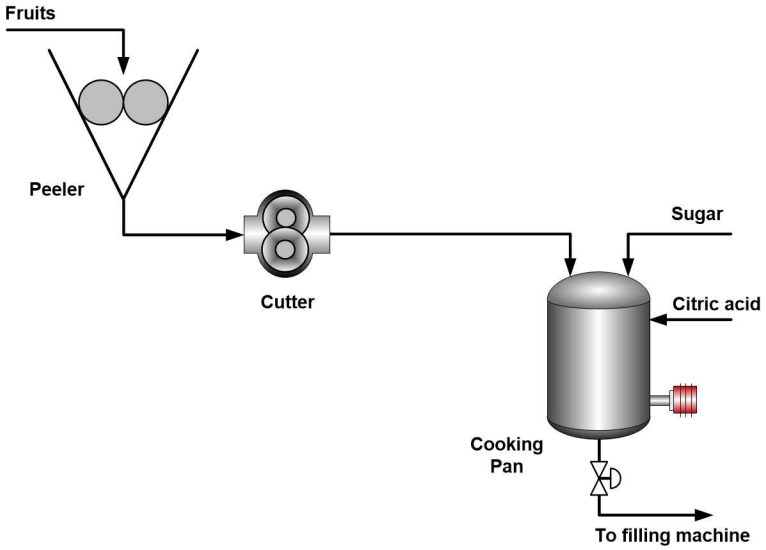
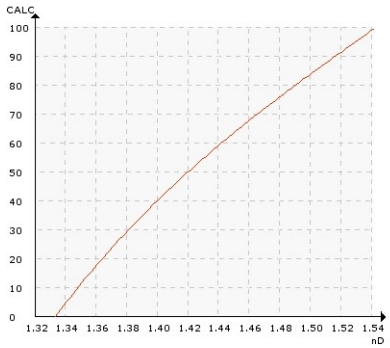


JAM, JELLY, MARMALADE

Typical end products

Jams, jellies, marmalades, and similar fruit preserves.

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



Introduction

Jam-making is an industry that converts fruits into a spread mixture. Fruits in the form of purée, pulp or juice are dissolved in water in the presence of a syrup, concentrated to a high dissolved material content by cooking, and cooled rapidly to obtain a mass with the appropriate gel consistency.

Application

Jam cooking is usually performed in batches of 500 to 3000 kg (1100 to 6600 lbs). Each batch takes 1-3 hours and consists of four main phases:

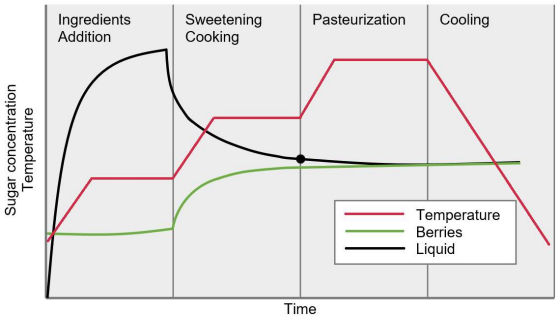
1. Ingredients Addition: Berries, fruits, pectin and sugar are mixed with water. Frozen berries thaw as temperature slowly increases.

2. Sweetening Cooking: In this phase, berries and fruits absorb sugar from the liquid until equilibrium is achieved. The temperature of this process is below 90°C (194-°F). This phase is not required if there are no solid substances present in the medium.

3. Pasteurization: Cooking temperature is raised up to 100-150°C (212-302°F) for 10-20 minutes to destroy any bacteria.

4. Cooling: The jam is cooled down to 20-40°C (68-104°F) before the vessel is discharged. Aromas are often added during this phase.

Changes in the sugar content, temperature and liquid at different cooking phases are illustrated below:



Installation and instrumentation

K-Patents Sanitary Probe Refractometers PR-43-AP/APT provide accurate and in-line Brix measurements for continuous monitoring of the cooking process to ensure consistent product quality and to optimize the process.

K-Patents refractometers can be installed in any type of cooker to monitor the batch progress and final product quality. The refractometers have a measurement range of 0-100 Brix and provide

Ethernet or 4-20 mA output signals for real-time control. The refractometer's signal can be used to set quality control functions to take immediate corrective actions if the batch reaches unusually low or high Brix levels.

K-Patents refractometers eliminate the need for batch sampling and off-line analyzing, improves product consistency and quality, and optimizes sugar usage. Typical measurement range is 10-70 Brix (jam cooking) and 50-85 Brix (marmalade cooking), and the process temperature is about 70-90ºC (158-194ºF).

Open boiling pan

The open boiling pan is a traditional cooker type in which the jam is steam heated from the bottom. A scraper or agitator prevents the jam burning from the contact with the hot pan.

K-Patents Sanitary Probe Refractometer PR-43-AP sensor is installed in a pipe line or vessel using a 2.5 inch or 4 inch Sanitary clamp. The Flush Mounted K-Patents Sanitary Refractometer PR-43-APT sensor is designed for vessels containing scrapers and mixers. These sensors are installed on an APV Tank Bottom Flange and can also be installed through steam jackets.

Vertical vacuum cooker

The vertical vacuum cooker is more efficient than the open pan type. During heating and pasteurization, the high pressure prevents overcooking and the berries remain unbroken.

The PR-43-APT refractometer is installed in the vessel bottom, where it is in continuous contact with the jam and where the cooling effect from the vessel is at its best.

Horizontal vacuum cooker

An Ala vacuum cooker is horizontally mounted and has double the capacity of vertical pans. These cookers are fitted with a heat exchanging agitator/scraper. They also contain a spiral coil heater, which enables faster heating and cooling either under overpressure or under vacuum.

The PR-43-AP/APT sensor can be installed either via the steam jacket or at the end of the pan (avoiding having to cut an opening through the steam jacket).

Pipe cooker

The pipe cooker is a continuous flow cooker, where the whole cooking process takes place. Berries, fruit, sugar pectin and other ingredients are mixed and preheated, and then pumped through the cooking tubes for further heating. After cooking, the product is passed through cooling pipes before packaging. The flow velocity is 0.1 m/s for the whole process.

The PR-43-AP sensor is installed after the cooking phase to read the end-product concentration, since the sweetening of the berries occurs during heating. At this point, the temperature is at its highest and the risk for prism coating due to low product flow rate is avoided. The K-Patents refractometer can also be installed in the feeder tank to estimate the product concentration and to determine the additives quantities to be introduced during cooking, thus optimizing cooking time.

Prism coating is rarely an issue because the batch processing times and CIP cleaning intervals are short.

Instrumentation	Description
	K-Patents Sanitary Probe Refractometer PR-43-AP for installations in large pipes, tanks, cookers, crystallizers and kettles, and for higher temperatures up to 150°C (300 °F). Graphical user interface is freely selectable between a rugged, multichannel, industrial computer or a compact light-weight or a web-based user interface. The refractometer is also a stand-alone device capable of operating independently. Installation through a 2.5 inch or 4 inch Sanitary clamp.
	K-Patents Sanitary Flush Mounted Refractometer PR-43-APT for hygienic flush mounting installations in cookers, cooling crystallizers and other vessels that have scrapers or mixers. Graphical user interface is freely selectable between a rugged, multichannel, industrial computer or a compact light-weight or a web-based user interface. The refractometer is also a stand-alone device capable of operating independently. Installation through an APV Tank bottom flange.
Measurement range:	Refractive Index (nD) 1.3200 – 1.5300, corresponding to 0-100 Brix.
Pressure range:	-1…5 bar