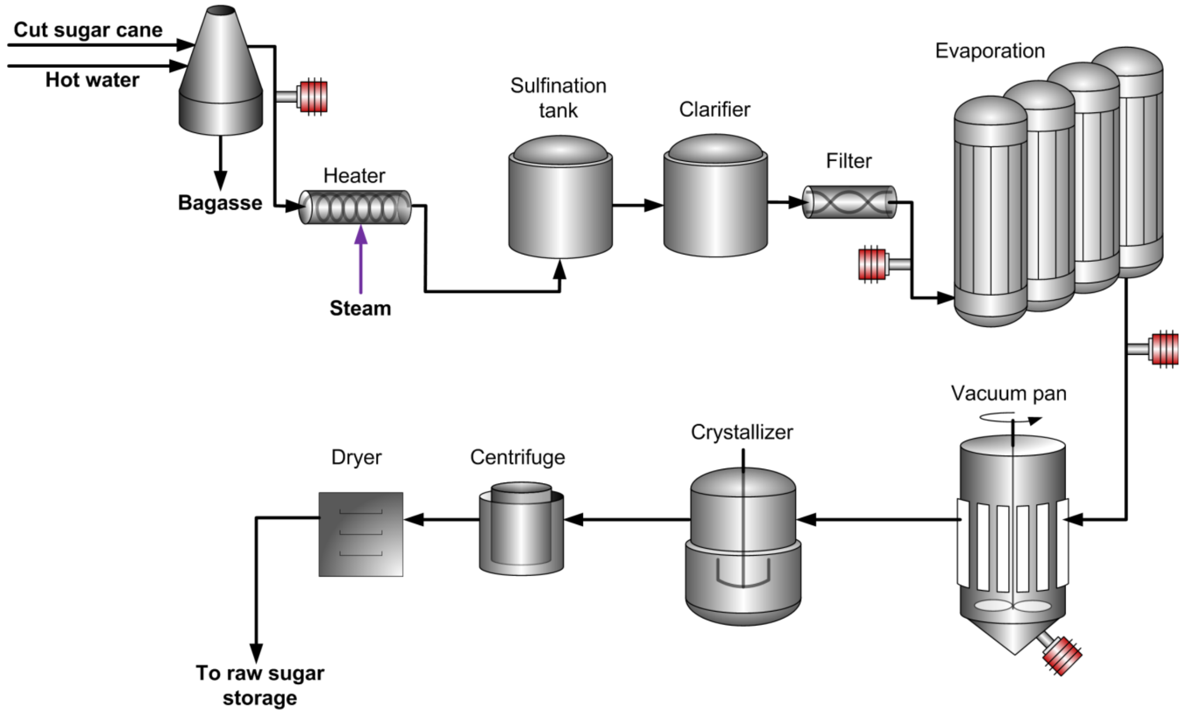
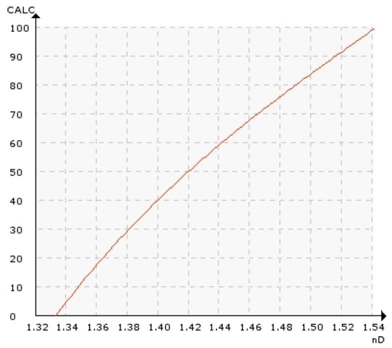


MILLED CANE SUGAR

Typical end products

Syrup, soft drinks, beer brewing, preserves, beverage, sweets, liqueurs, ethanol, etc.

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



Introduction

After sugar cane has been harvested, it must be processed in under 24 hours to avoid sugar loss by inversion to glucose and fructose. Traditionally, sugar cane processing requires two stages: 1. Milling extracts raw sugar from freshly harvested cane and sometimes bleaches it to make "mill white" sugar for local consumption. 2. Refineries, often located close to consumers in North America, Europe and Japan produce refined white sugar. These two stages are slowly merging into combined milling and refining.

Preparation and Extraction

The mill washes, chops and shreds the cane mechanically. Shredded cane is repeatedly mixed with water and crushed between rollers. The collected juices contain 10–15 Brix and the remaining fibrous solids, called bagasse, are burned for fuel. About 93% of the juice is extracted. Water and weak juice from the last mill is added to help soften the cane and to aid in the extraction. The surplus bagasse can be used in animal feed, paper manufacturing or as a fuel for commercial electricity generation.

Heating

The juice is sent to multiple heaters, where the sugar content is increased to 16-17 Brix.

Sulfitation and Clarification

Sulfur dioxide is added to the juice to remove impurities and to decolorize it. After that, lime is added to precipitate impurities and to help remove coloring matter, organic acids and other suspended materials. The limed juice is sent to clarification to settle. The clear juice goes to the evaporation plant.

Rotary filters are generally used to recover the sugar from the settled-out mud.

Evaporation

The clarified juice is concentrated in a multiple-effect evaporator to make syrup at about 60 Brix.

Crystallization

The thick juice syrup is further concentrated under vacuum until it becomes supersaturated and is then seeded with crystalline sugar. On cooling, more sugar crystallizes from the syrup.

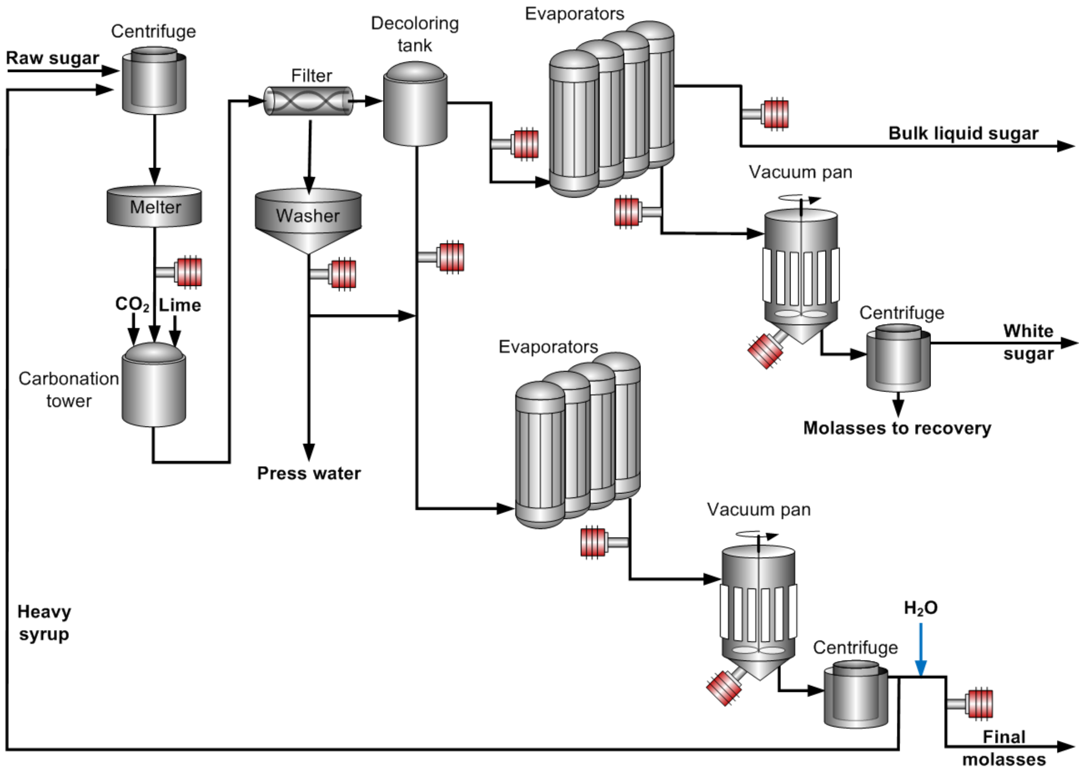
Centrifuging and Drying

A centrifuge separates the sugar from the molasses. Additional crystallizations extract more sugar and the final residue is called blackstrap. After drying the crystals, the color of the raw sugar varies from yellow to brown. Bubbling sulfur dioxide, through the cane juice before evaporation, bleaches most color-forming impurities into colorless ones. This *sulfitation* produces sugar known as "mill white", "plantation white" and "crystal sugar". Such sugar is the most commonly consumed in sugar cane -producing countries.

Benefits

The digital technology of the K-Patents Process Refractometer, combined with the sturdy design results in highly accurate and reliable measurements gives improved control over the complete process.

Instrumentation	Description
	K-Patents Sanitary Compact Refractometer PR-23-AC for small pipe line sizes of 2.5 inch and smaller. The PR-23-AC sensor is installed in the pipe bend. It is angle mounted on the outer corner of the pipe bend directly, or by a flow cell using a 3A Sanitary clamp or Varivent® connection.
	K-Patents Sanitary Probe Refractometer PR-23-GP for installations in large pipes, tanks, cookers, crystallizers and kettles, and for higher temperatures up to 150°C (300 °F). Installation through a 3A Sanitary clamp.
	K-Patents Process Refractometer PR-23-GP is an industrial refractometer for large pipe sizes and tanks, cookers, crystallizers and kettles. Installation through a flange or clamp connection.
Measurement range:	Refractive Index (nD) 1.3200 – 1.5300, corresponding to 0-100 Brix

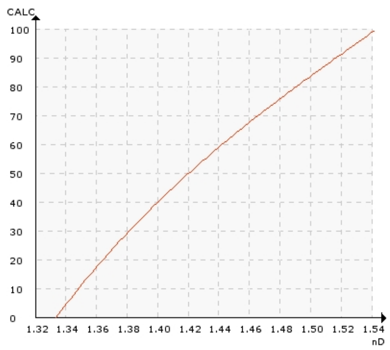


REFINED CANE SUGAR

Typical end products

Syrup, soft drinks, beer brewing, preserves, beverage, sweets, liqueurs, ethanol, etc.

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



Introduction

The raw sugar received by a refinery contains 96,5 to 98,5% sucrose and therefore 1,5 to 3,5% impurities which comprise organic matter, inorganic compounds, water and micro-organisms. The raw sugar is also highly colored.

Refining Process

The first step in refining is called affination, wherein the raw sugar crystals are treated with heavy syrup (typically 60-80 Brix) in order to remove the film of adhering molasses. This strong syrup dissolves little or none of the sugar but softens or dissolves the coating impurities. The mixture, called magma, is spun in centrifuges and washed with hot water to remove the adhering molasses film.

The washed raw sugar crystals are then dissolved in water and diluted to about 70 Brix.

During carbonation the syrup is mixed with milk of lime and reacted with carbon dioxide to produce a precipitate of calcium carbonate (chalk). The chalk precipitate entraps organic non-sucrose and inorganic impurities.

Pressure filters are used to remove the chalk precipitates and to produce clear, light brown syrup.

The brown syrup is then passed over a series of acrylic and styrene resin columns and granular activated carbon columns. The resulting low coloured syrup (fine liquor) is used for crystallisation of white sugar or for the production of bulk liquid sugar.

The fine liquor, after reduction of its water content by multiple effect evaporation, is fed to vacuum boiling pans. Crystallization is initiated by seeding the concentrated liquor with slurry. The process is continued until the crystals reach the desired size. The resultant mixture of crystals and mother liquor is fed in centrifuges and the sugar crystals are washed with hot water to remove any adhering syrup.

The K-Patents' Process Refractometers are used at several stages in the refining process. The measurements taken, are unaffected by entrapped air bubbles, undissolved components or color variations in the product. This results in a consistent product quality.

Reliable monitoring is particularly important for the control of the pans. It ensures consistency in crystal size and better yield. Furthermore, the growth of false grain can be avoided which reduces the need for product screening.

Instrumentation	Description
	K-Patents Sanitary Compact Refractometer PR-23-AC for small pipe line sizes of 2.5 inch and smaller. The PR-23-AC sensor is installed in the pipe bend. It is angle mounted on the outer corner of the pipe bend directly, or by a flow cell using a 3A Sanitary clamp or Varivent® connection.
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Measurement range:	Refractive Index (nD) 1.3200 – 1.5300, corresponding to 0-100 Brix.