SWEETENERS: DEXTROSE, FRUCTOSE
GLUCOSE SYRUP, SORBITOL

Typical end products
Beverage, brewing, jams, preserves, sweets, confectionery, ice-cream, liqueur, pharmaceuticals, etc.

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

Introduction
The starch sweetener industry is highly advanced and sophisticated production processes are used to meet the strict requirements for food and pharmaceutical applications. Therefore, extensive process control systems are applied throughout the entire process. The K-Patents Process Refractometer is designed for these demanding environments. For example, the K-Patents refractometer assists in compliance to tight product specifications in final syrup quality control or syrup blending. The quality of crystalline products can be improved by tighter control of the crystallization process.

All K-Patents refractometer sensor models are easy to install without the need for expensive sampling lines or by-pass arrangements. The sensors and flow adapters can be mounted on vessels, tanks and small or large process pipes. The operating costs are minimised as regular maintenance, calibration checks and re-calibrating are not required.

Dextrose
Starch is a dextrose polymer. In the production process of dextrose, the starch slurry is heated and treated with enzymes, which hydrolyses the starch into dextrose.
The first process step is liquefaction, where the starch polymer is broken down into a hydrolysate using an alpha amylase enzyme. The starch hydrolysate has a Dextrose Equivalent (DE) of 10-20. The DE value is a measure of the hydrolyzation degree. This stream is often further processed by decolorization, deionization and concentration and is sold as syrup.

In order to produce dextrose syrup, the starch hydrolysate undergoes a second process step: saccharification, in which the hydrolysis of the starch is completed and 98 DE dextrose syrup is obtained. Dextrose syrup is sold as bulk or as further processed crystalline products.

Fructose

In the production of fructose, dextrose is processed in the presence of an isomer enzyme. The enzyme converts the dextrose into fructose.

The conversion is limited and it ends at the equilibrium of the enzymatic process. In an ideal case, a 100% dextrose stream could be converted into 50% fructose (DE 50). In practice a conversion rate of about 42% is achieved. Therefore, the commercial fructose concentration is usually 42% (42 HFS = high fructose syrup or 42 HFCS = high fructose corn syrup). Before the product is ready to be sold, it undergoes further refining stages, such as the removal of colors, odors and ash.

In the case of a 55 HFS product being required, a chromatographic separation is used to concentrate the 42 HFS to 96 HFS. By blending the 96 HFS with 42 HFS, 55 HFS is obtained. 96 HFS can also be used to produce crystalline fructose.

Sorbitol

Sorbitol can be produced by a catalytic hydrogenation of the dextrose. The basic steps in the process are hydrogenation, catalyst separation, refining and evaporation to dry substance content of 70%.

<table>
<thead>
<tr>
<th>Instrumentation</th>
<th>Description</th>
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<tbody>
<tr>
<td>K-Patents Sanitary Compact Refractometer PR-23-AC</td>
<td>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.</td>
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<tr>
<td>K-Patents Sanitary Probe Refractometer PR-23-AP</td>
<td>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.</td>
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<tr>
<td>K-Patents Process Refractometer PR-23-GP</td>
<td>An industrial refractometer for large pipe sizes and tanks, cookers, crystallizers and kettles. Installation through a flange or clamp connection.</td>
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**Measurement range:** Refractive Index (nD) 1.3200 – 1.5300, corresponding to 0-100 Brix.