**Value addition products: Invert Sugars**

Invert sugar, as is generally known, owes its name to the fact that it was first observed by **Biot** in **1836** as a solution which rotates a beam of polarized light to the left, i.e., in an opposite direction from that observed in the case of its parent substance, cane sugar. The invert sugar syrups or invert sugars are chemically made up of a mixture of **glucose and fructose**. The product is **transparent** and sometimes **yellow-brown** and **sticky consistency** exhibiting greater digestibility than the common used table sugar. Due to their unique properties, invert sugar syrups have been used extensively in the food and beverage industry. The properties like providing extra sweetness, texturizing, etc. have provided an extra edge for invert syrup sugars over other natural sugars. These are the potent substitutes for honey and sucrose as well as used to keep the product moist and slow down the crystallization process that may occur.

**Production**: All inverted sugar syrups are created from hydrolyzing sucrose to glucose (dextrose) and fructose by heating a sucrose solution under milder conditions, then relying on time alone, with the catalytic properties of an acid or enzymes used to speed the reaction. Commercially prepared acid catalyzed solutions are neutralized when the desired level of inversion is reached. All constituent sugars (sucrose, glucose and fructose) support fermentation, so invert sugar solutions may be fermented as readily as sucrose solutions. The traditional method of invert sugar production from sucrose using mineral acids like H2SO4 and HCl suffers from low conversion efficiency (65-70%), high ash content and undesirable products (7-8%). Moreover, the invert sugar produced is dark in color. However, the enzymatic hydrolysis of sucrose by using immobilized invertase as a catalyst in a fixed-bed reactor is claimed to produce invert sugar syrups of high purity.

Regarding invert sugar syrup marketing, **Europe** remains one of the **top exporters** of the invert sugar syrups. **China, Indonesia and Asia Pacific** has also been an important contributor of the invert sugar syrups market. In the Asia Pacific, **India, Japan, Korea, Malaysia, Thailand and Philippines** also have significant shares in the invert sugar syrups market. India has taken a lead in developing new processes for invert sugar. The National Research and Development Corporation **(NRDC)** are marketing the enzyme process developed by **Baba Atomic Research Centre (BARC)**. Further, **IIT Kanpur** has developed a novel process based on resin technology as well.

Gehlawat., 2001

Fig: Production of value addition products: invert sugar and high fructose syrup

**Uses and Applications**: Invert sugar syrups market is segmented as **food industry, beverage industry, personal care, dietary supplements and pharmaceuticals**. In addition, it is also used in distilleries, tobacco and the feed industry. The food industry is further categorized as bakery, confectionary, frozen desserts, honey processing etc. The beverage industry is further segmented as fruit juices, energy drinks and soft drinks. The invert sugar syrups are mainly used for caramel and chocolate fillings and to enhance the quality of biscuit and cookie crusts.

* **Food and Confectionary Industry**:
1. **Bakeries and Biscuits**: It can be used for cartelization , enhancement of flavor and texture improvement
2. **Bread, Cakes and Pastries**: It improves the quality of the crust and makes the bread crumb softer. Yeast activation also becomes faster.
3. **Fruit Processing**: Invert sugar increases the shelf life due to good **humectants** properties as well as enhances taste and flavor
4. **Honey**: Due to similar chemical and physical properties as honey, invert sugar can be used for bee feeding and can be blended with honey.
5. **Herbal Cosmetics**: As invert sugar restricts bacterial activity and is a chemically purer replacement of honey, it can be used in herbal cosmetics
6. **Squashes, lemonade and instant energy drinks**: Because of the glucose and fructose content, invert sugar provides instant energy and better taste
* **Brewing Industry**: Invert syrup has a high affinity for water, so invert syrup (“humectant”) is often used to keep products moist and extend their shelf life. This additional moisture retention is especially important in low baked goods such as cakes, soft cookies and bread rolls thereby preventing quicker dryness.
* **Preservatives**: Invert sugar has a lower water activity than that of sucrose, so it provides more powerful preserving qualities (a longer shelf life) to products that use it. The shelf life of partial inverts is approximately six months, depending on storage and climatic conditions. Crystallized invert sugar solutions may be restored to their liquid state by gently heating.
* **Flavor Enhancement**: Invert sugar is added to syrups (like cough syrups) mainly for flavor enhancement. It also gives a consistent viscosity and smoothness to the solution. Invert sugar is also known for enhancing shelf life of the products it’s mixed in; therefore it is an ideal mixing solution to neutralize the bitter flavor of medical drugs.