

Processing and Applications of Corn syrup and High fructose corn syrup

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Introduction

Corn or maize (*Zea mays*) is one of the important cereal crops in the world. It is used for livestock feed, human consumption and fuel. Corn was discovered by Christopher Columbus, a European explorer in the year 1492, and later was introduced to Europe, China and all over the world. It contains significant amount of bioactive components providing desirable health benefits beyond its role as a major source of food. It is a third leading crop in the world after wheat and rice. It is generally used for animal feed. It is widely processed into various types of food products such as flour, corn meal, grits, snacks and breakfast cereals. Corn syrup is known as Glucose syrup is viscous sweet syrup which is produced by hydrolyzing corn starch, either by heating it with dilute acid or by combining it with enzymes. Corn syrup is classified into two types, dark and light corn syrup. Dark corn syrup is made by combining corn syrup with caramel coloring and molasses. Light corn syrup has been decolorized and it is used in baked goods and confectionary products like jellies, candies and jams compared to light corn syrup, Dark corn syrup is sweeter. There are many varieties of corn. The corn variety “yellow #2 dent corn” is used as a source of corn syrup. This review presents an overview on manufacturing and applications of corn syrup.

Processing of Corn syrup

Corn starch is converted into corn syrup through a process called Acid Hydrolysis. In this process, weak solution of Hydrochloric acid is added in wet starch and is heated under pressure. The heat and Hydrochloric acid breakdown the starch molecules and then converted into sugar. The hydrolysis can

be interrupted to produce corn syrup of different sweetness. The longer, the process is allowed to proceed; this sweetener is the resulting corn syrup. This syrup is then filtered or clarified to remove any color or flavor.



Figure1. Light corn syrup



Figure 2. Dark corn syrup

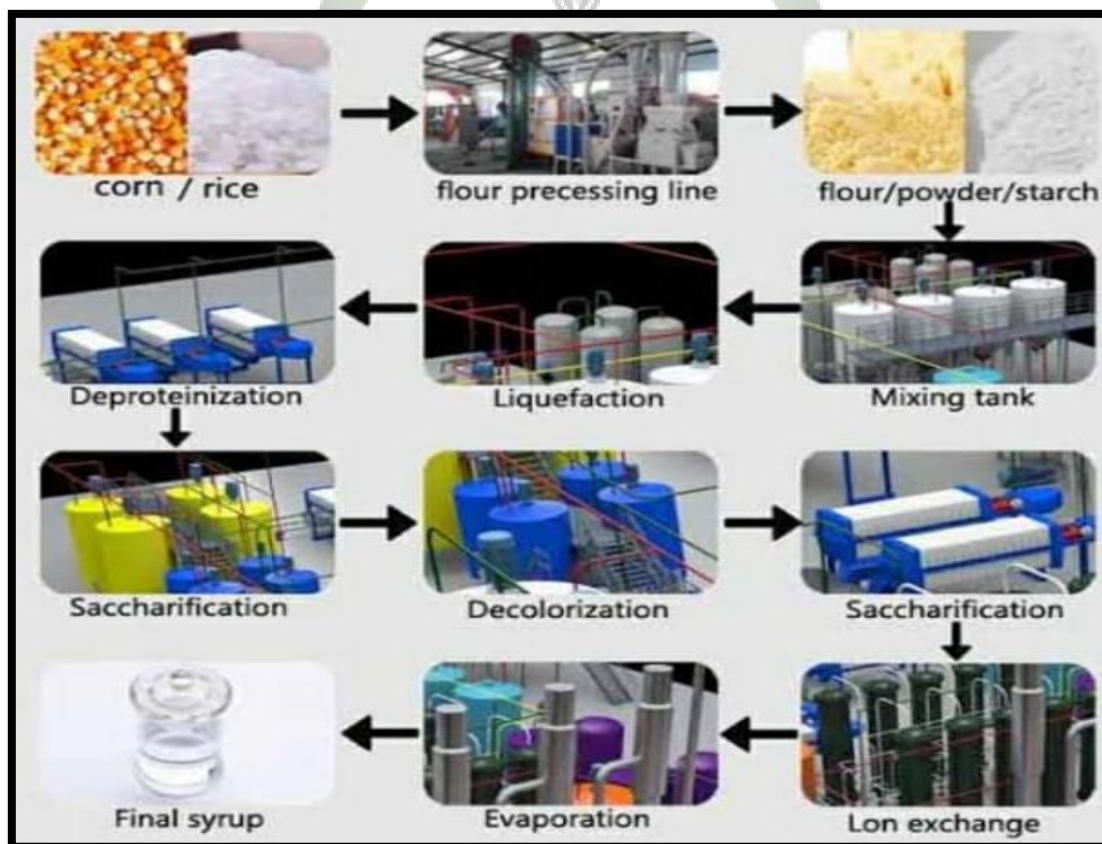


Figure 3 .Manufacturing of corn syrup

How High Fructose Corn Syrup is made?

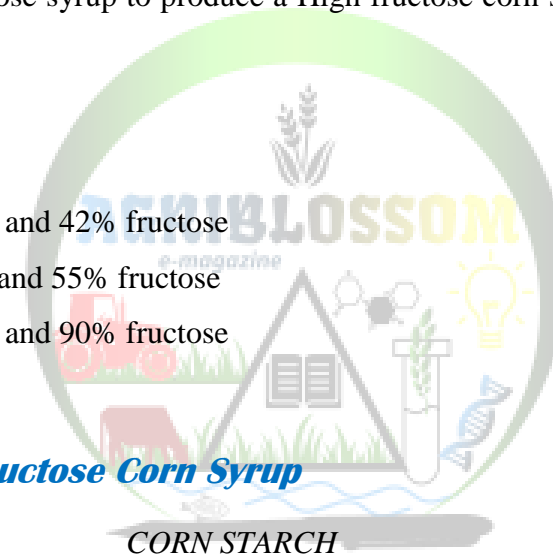
Normally, high fructose corn syrup contains dextrose sugar which is three times sweet as sucrose in sugarcane sugar. Enzyme conversion is a process used to improve the sweetness of ordinary corn syrup. In this process, the dextrose sugars in the syrup are converted into sweet fructose sugars by the action of an enzyme in a series of steps under controlled pressures, temperature and acidity. It produces a high fructose corn syrup (HFCS) with 40-45% of fructose content.

When this HFCS (40-45%) is passed through a series of fractional column, to separate and hold the fructose content. The separated portion is about 85-90% fructose and is flushed from the columns with deionized water and only a small amount of liquid sweetener is needed. The remaining liquid is blended with 40-45% fructose syrup to produce a High fructose corn syrup with 55-60% of fructose content.

Types

1. HFCS 42 : 58% glucose and 42% fructose
2. HFCS 55: 45% glucose and 55% fructose
3. HFCS 90 : 10% glucose and 90% fructose

Production of high fructose Corn Syrup



CORN STARCH



AMYLOPECTIN AND AMYLOSE



DEXTRINS AND MALTODEXTRINS



CORN SYRUP



HIGH FRUCTOSE CORN SYRUP 90



BLENDING WITH GLUCOSE



SYRUP

HIGH FRUCTOSE CORN SYRUP (55-60%) & (40-45%)



Figure 4. High fructose corn syrup

Comparison of corn syrup and high fructose corn syrup

Corn syrup	HFCS
It contains maltose	It contains fructose and glucose
Less soluble in water	More soluble in water
It is made by partial hydrolysis of corn starch	It is made by the enzymatic conversion of glucose into fructose in corn syrup.(hydrolyzed)
It can be used as a sweetener as well as thickener	It can be used as sweetener only
Composition : It contains 100% Glucose	Composition : 55% fructose , 45% glucose 42% fructose , 58% glucose

Products used in Corn syrup

Pickles and pickle products, Bakery products such as bread, biscuits , rolls, cakes, pies and cookies, Peanut Butter, Jams, Jellies , Candies , Salads, Fruit Butter, Seafood, Sauces, Cheese spread and nut spreads, Ice-creams, Chewing gum, Chocolates, Medicinal soda, Marshmallows , Sausage, infant foods, pudding powder, Infant foods, Fruit drinks and Frozen desserts.

* It is used in foods to add volume, soften texture and enhance flavor.

Applications of High fructose corn syrup

* In food industry, it is used as a replacement of table sugars in a wide variety of food products.

* It protects soft texture of canned vegetables and fruits and reduces freezer burn in frozen foods.

* It has a lower freezing point, so frozen beverage concentrates can be poured from the freezer and easier for consumers to thaw and mixed with distilled water.

* It inhibits microbial spoilage and increases the shelf life of food products.

Why does food manufactures use HFCS?

It enhances moisture control and texture and it increases the freshness of food products. It acts as a flavor enhancer for sweet as well as spicy flavors. It is cheaper than sugar. It has less manufacturing costs and easy to transport.

Products Used In HFCS

Canned and frozen fruits, salads dressing, Breakfast and cereal bars, Granola, Sauces and ketchup, Yogurt, Spaghetti sauce, Granola, Baked goods, Fruit fillings and Tomato products.

Conclusion

Corn is one of the important crops in farming industry. Although, corn products are a major food in many parts of the world, corn is inferior to other cereals in health values. Similarly to most foods, corn is neither a cure-all nor a poison. In this article, we explained the manufacturing process and role of applications of corn syrup and HFCS.