Abstract for High Fructose Syrup Production

Ensymm abstract for enzymatic high fructose syrup production.

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INTRODUCTION

The food and beverage industry depends heavily on enzymes. Enzymes produced by yeast have been used for thousands of years in brewing and baking.

High fructose syrup (HFS) contains fructose and glucose in roughly equal proportions. The high fructose syrup has a greater demand than pure glucose as food and drink sweeteners, because fructose is sweeter than glucose. Therefore, if glucose can be converted into fructose, its commercial value is increased greatly. High Fructose Syrup (HFS) is a concentrated solution containing fructose and dextrose with lesser quantities of higher molecular weight saccharide. It is extremely sweet and clear syrup, refined by carbon and ion exchange systems to assure highest food standards in terms of color, clarity, composition, flavor and ash. Therefore, it is rapidly developing as an alternative to cane sugar particularly in the case where it is dissolved and filtered before added to the formulation. High fructose corn syrup is a relatively new product, production of which started in 1966 in Japan, but popularized after 1971 when the USA started its production. As the product is new to the market, its applications are not yet fully developed. Main consumers of HFS are the baking, beverages, canning, confectionery, dairy industries. In addition, high fructose syrup is used in many other processed foods like jams and jellies.

Manufacturers of HFS expect to supply it in the next couple of years to the confectionery, fruit canning, processed foods and dairy products industry. Fructose, also known as fruit sugar, is the sweetest natural sugar and is found in fruits, vegetables, and honey.

The body responds to fructose in a different way than to glucose and sucrose. Fructose is more satiating, and it is up to 1.8 times sweeter than sucrose, making it useful in foods and beverages for the health conscious. Fructose is also ideal for use in diabetic foods as it has very little effect on blood glucose and only a negligible effect on the secretion of insulin.

INTRODUCTION

High Fructose Syrup Production Pathway

As mentioned before, the principal use of glucose isomerase is the production of high fructose syrups from glucose syrups (which are usually derived from maize or corn starch or pure Glucose or Molasses).
Enzymatic treatments are a major way of producing sweeteners including syrups derived from sucrose or starch that contain mixtures of glucose, maltose, fructose, and other sugars. High fructose syrup (HFS) from maize starch has now eclipsed sucrose as the major sweetener used in US food industry.

For the production of HFS three production processes are known. They have a similar technology and pathway but three different source materials:

1. Starch (the industrial sources is maize or other corns)
2. Molasses (from sugar cane or sugar beet)
3. Cellulose (it is in Pilot scale but successful Development)

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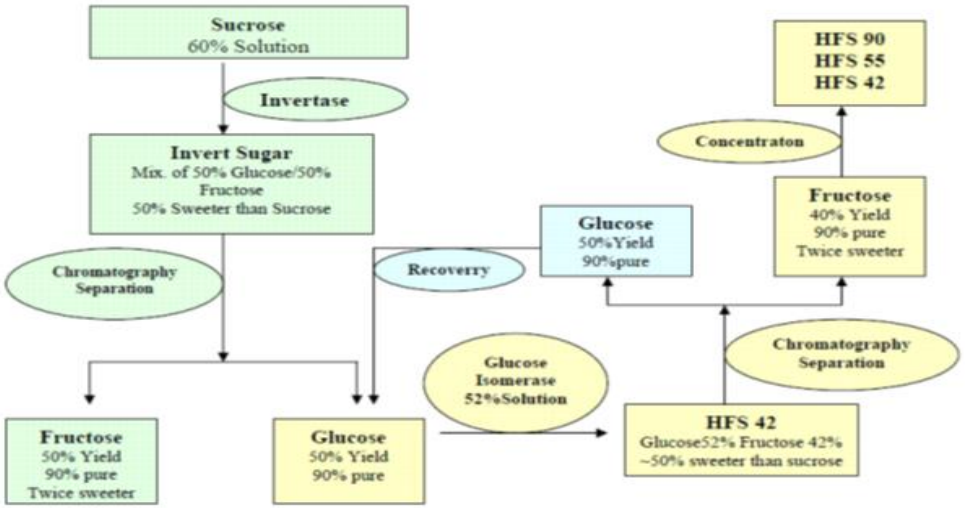
Economical Data

Glucose has 70-75% the sweetening strength of beet sugar (sucrose), but fructose is twice as sweet as sucrose. Thus, processes for the manufacture of fructose are of considerable value. The commercial process for production of fructose from glucose became feasible only when procedures for immo-bilization of the enzyme were developed, so that the same batch of enzymes could be used repeatedly. Since glucose isomerase is formed intracellular in most strains, many commercial processes are carried out with immobilized cells or by the addition of partly broken cells.

ECONOMICAL DATA

Syrup refineries produce a multitude of products by processing starch. The focus of this discussion is high fructose syrups that are used as sweeteners for a variety of products. These syrups have been used as sweeteners in the beverage industry for years. The soft drink industry represents the largest consumer of these products. Sucrose is sweeter than dextrose, but less sweet than fructose. Ideally, a mixture of half fructose and half dextrose would most closely mimic sugar. However, a blend of 55% fructose and 45% dextrose will most closely duplicate the flavor and mouth feel of the traditional beet and cane sugar.

Processing Lines



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FEASIBILITY, OPERATING COSTS AND OPTIMIZATION

Feasibility

The investment is split into the following parts: This is the part which will be one content of our possible quotation after the decision to produce fructose with an enzymatic process. Ensymm Company has the knowledge and qualified suppliers for the enzymatic part, chromatography and turn-key plants. All partners are German companies. Please pay attention to the following calculation to get an overview on the investment difference between imported sugar and HFS from molasses (30% or 40% sucrose).

Operating costs

These are broken down in the raw materials, utilities and chemical consumption per ton of produced HFS as dry substance. The bulk of the operating costs are in the molasses costs which typically represents the major part of the total operating costs (heavily depends on sucrose weight in %).

In addition to this, there are the chemical process costs with about 20% of the overall costs. This includes resins, enzymes and other processing chemicals.

The main chemicals consists of regeneration chemicals for ion exchange (hydrochloric acid and sodium hydroxide) and powdered carbon. Utilities represent approximately 6% of the total operating costs. The product is typically loaded up to either rail cars or tank trucks. This is a consumption figure per ton of produced HFS 55.

Optimization

- Using cheap molasses instead of import of expensive sugar
- All immobilized enzymes and chromatographic columns are for usage in multiple processing line and not in batch processing.

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For further inquiries and quotes, please contact:

ensymm UG & Co.KG
Life Science Center Dusseldorf
Merowingerplatz 1
40225 Dusseldorf
Germany

Tel: 0049 2113367527
Project_assistant@ensymm.com
www.ensymm.com