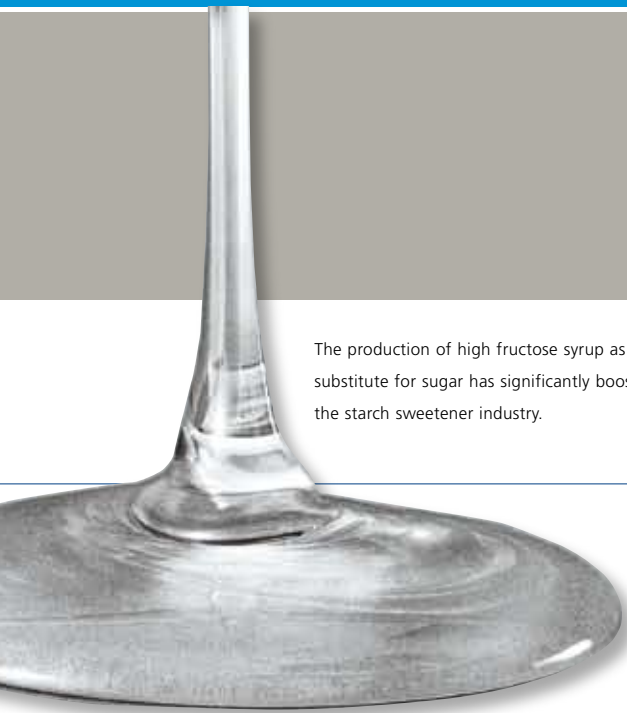


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The production of high fructose syrup as a substitute for sugar has significantly boosted the starch sweetener industry.

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5

## From acid to enzyme: how the sweetener industry was transformed

The fifth in a series of short articles about how biological solutions have driven the evolution of industry forwards.

At the beginning of the nineteenth century, the German chemist Kirchoff discovered that, by boiling starch with acid, it could be converted into a sweet-tasting substance consisting mainly of glucose. From that time on, acid was used in industry to break down starch into glucose. However, this technique had a number of drawbacks: the formation of undesirable by-products, poor flexibility, and the need for equipment capable of withstanding acid at temperatures of 140-150°C.

When industrial enzymes became available to the starch industry about 40 years ago, a transformation of starch hydrolysis technology began. The real turning point came in the early 1960s with the launch by Novozymes of an amyloglucosidase. For the first time, starch could be completely broken down into glucose. Within a few years, almost all glucose production was reorganised and enzyme hydrolysis was used instead of acid hydrolysis. The benefits were greater yield, a higher degree of purity and easier crystallisation.

The process was further improved by the introduction of a new technique for the enzymatic liquefaction of starch. A fully enzymatic starch hydrolysis was achieved when the heat-stable bacterial amylase Termamyl® was introduced by Novozymes in 1973. This enzyme could remain active at

temperatures in excess of 100°C, making it ideal for use in a jet cooker.

Later in the 1970s, the focus turned to a new type of enzyme called a glucose isomerase. This enzyme made possible the production of a syrup as sweet as sucrose – high fructose syrup. In fact, in 1975 Novozymes was the first to produce an immobilised glucose isomerase, called Sweetzyme®, which was capable of transforming dextrose into fructose. The production of high fructose syrup as a substitute for sugar has significantly boosted the starch sweetener industry in certain countries, notably the USA. High fructose corn syrup is used in many US food products and soft drinks where sugar was used previously.

The modern starch sweetener industry owes much to enzyme innovations. ●

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