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*Dextrose*

The Intelligent  
Sweetener

> Sweeteners



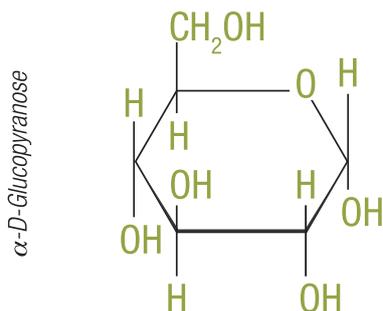
DEXTROSE

**Cargill**<sup>®</sup>

# Dextrose

The development of high quality foods and beverages is a continuous process of improvement and creativity to support health, convenience and well being. Cargill's dextrose has become an essential ingredient in a wide range of food and beverage applications, for its functional, sensorial as well as nutritional properties.

## Dextrose chemistry



If ever a sweetener could be considered ubiquitous, it would be dextrose, often referred to as “grape sugar” or “blood sugar”. It is a sugar occurring widely in nature - in honey and many fruits for example. As a constituent of cellulose, starch and glycogen, it is found in all plants and animals.

Just like sugar, dextrose consists of carbon, oxygen and hydrogen. However, no further comparison is possible, since several features differentiate dextrose from sugar. A number of important differences are, in large part, due to their different molecular weights (sucrose: 342; dextrose: 180). Dextrose is a synonym of D-glucose and refers to the pure, crystalline monosaccharide obtained after a total hydrolysis of starch. It exists in 2 forms, dextrose monohydrate which contains one molecule crystal water in contrast to anhydrous dextrose, which contains none.

## Production

Cargill's Sorini plant produces dextrose monohydrate through enzymatic process. Before treating with converting enzyme, starch is diluted using process water to change the solid phase to slurry. Later on the long chain of polysaccharides are hydrolyzed to form simple saccharides.

The final conversion takes place after pH and temperature adjustment. The converted syrup is then double filtered to remove small residue of protein, fat, unconverted starch, and other un-dissolved matter. The solution is concentrated and crystallization process is controlled by seeding, stirring and cooling so that all monohydrate is obtained.

## Functional properties

### Reducing sugar

Dextrose is a reducing sugar. The reducing power of a sugar is measured by its ability to reduce solutions of alkaline copper sulphate (Fehling's solution) to cuprous oxide. The dextrose equivalent (DE) of pure dextrose is defined as 100. Expressed as a percentage of the reducing value of pure dextrose and calculated on a dry weight basis, the total reducing value of a starch hydrolysate is referred to as its DE.

### Maillard reaction

The classic browning in food systems is due to the interaction of reducing sugars and acidified protein compounds. Due to its active aldehyde groups, dextrose is a powerful reducing sugar and promotes rapid buildup of browning.

### Crystal form

At temperatures below 55 °C (131°F) dextrose crystallises from aqueous concentrated solutions in the monohydrate form, in which each dextrose crystal contains 1 molecule crystal water per molecule dextrose (Dx-Monohydrate).

### Sweetness control

With its pleasant, clean and sweet, cooling taste, dextrose has been used for years as a natural sweetener in a wide range of food applications. Dextrose is one of the sweetest of the starch derived sugars. On a scale on which sucrose is assigned a sweetness value of 100, dextrose is rated at 75.

Its sweetness is influenced by a variety of factors such as temperature, acidity, salts, flavouring materials, sweetener concentration and the nature of other sugars present. Contrary to sucrose, dextrose is not subject to the process known as inversion and, therefore its degree of sweetness does not change.

Dextrose and sucrose are often used together to control and balance sweetness and total solids. When dextrose and sucrose are combined, they exhibit a synergy: at a 40% replacement level, for example, the apparent relative sweetness of dextrose could be as high as 90.

### Heat of solution

The heat of solution of dextrose monohydrate (-105.5 J/g) differ greatly from that of sucrose (-16.1 J/g). Hence, the heat required to dissolve dextrose is approximately 10 times greater than for sucrose. Consequently, when eating food containing dextrose in crystalline state, there is a distinct cooling sensation in the mouth.

## DEXTRROSE

The perception of sweetness is shortened and flavour enhancement is improved.

### Solubility

Crystalline dextrose is readily soluble in water but only slightly in ethanol and hardly soluble in other organic solvents. At temperatures higher than 55°C (131°F), dextrose is more soluble than sucrose.

In addition, at any given specific temperature, there is an optimum sucrose-dextrose saturation ratio that raises total solubility above that of the individual components.

### Freezing point

Dextrose, because of its low molecular weight, has the capacity to decrease the freezing point. At a 30% concentration, the freezing point of a dextrose solution is 2°C lower than that of a comparable sucrose solution - crucial in the production and consumption of ice-cream.

The freezing point depression factor (FPDF) is typically used for calculations in the ice-cream industry. The FPDF factor for sucrose is 1.00 compared to 1.90 for dextrose.

### Osmotic pressure

The difference in molecular weight between dextrose (180) and sucrose (342) significantly affects the osmotic pressure. At equal weights, dextrose provides almost twice the number of molecules in solution. A dextrose solution therefore exerts a much higher osmotic pressure providing a more powerful preserving action against microbiological spoilage.

### Fermentability

Because it is a monosaccharide, dextrose is the ideal carbohydrate source for yeast fermentation in baking and brewing. The fermentation begins immediately and proceeds rapidly. Dextrose provides energy to the cell to produce many by-products in addition to carbon dioxide and ethanol. Also, dextrose is used in lactic acid fermentation processes in the pickling and the meat industry.

### Flavour

Dextrose is often used in combination with sugar or other sweeteners. It acts to shorten the sweetness perception and enhance the original food flavour.

### Stability

Dextrose is a reducing sugar and improves, in comparison with sucrose, the inhibition of oxidative degradation, thus increasing colour stabilisation. This can help to extend the shelf life of food products.

### Bulking agent

Dextrose monohydrate is available in a variety of particle size distributions and granulometry to provide ease and stability of blending. Coarse dextrose products are perfect in relation to flowability and dust minimalisation.

## Applications

### Confectionery

- > Toffees, caramels, fudge
- > Marshmallows
- > Candy filling
- > Chewing gum
- > Tablets
- > Panning
- > Chocolate

### Beverages

- > Soft drinks
- > Energy drinks
- > Alcoholic beverages
  - Light Beers
  - Specialty Beers
  - Ciders
  - Wines

### Bakery

- > Fermented products
- > Biscuits & Wafers
- > Cakes
- > Icings and Glazes
- > Creams and Fillings
- > Breakfast Cereals
- > Dried fruits

### Dairy and Ice-Cream

- > Frozen desserts
- > Desserts
- > Fermented Desserts
- > Milk drinks

### Convenience Food

- > Food and beverage powders
- > Dressings and condiments
- > Pickled products
- > Instant teas
- > Vending powders
- > Meat curing
- > Fermented meat
- > Fish products and marinades

### Food Ingredients

- > Spices and seasonings
- > Hydrocolloid mixes
- > Batters and coatings



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