

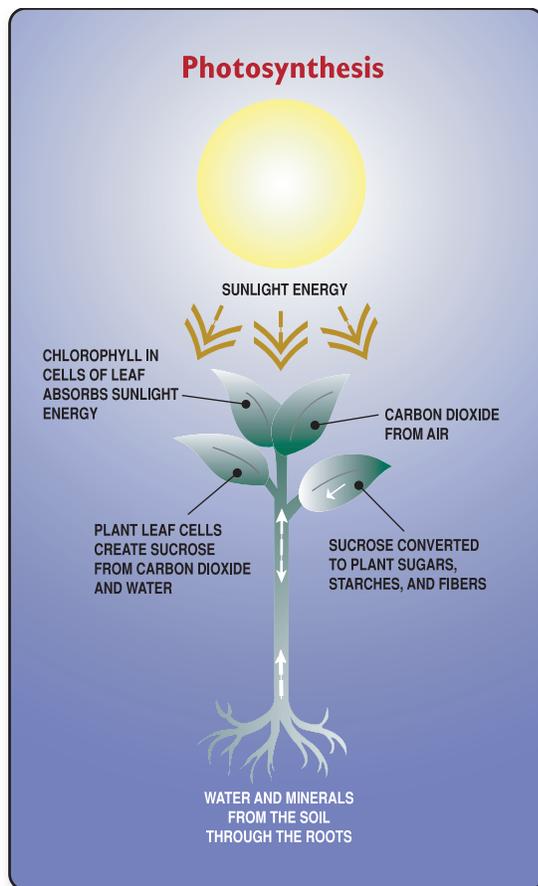


# Refining and Processing Sugar

## Consumer Fact Sheet

When you reach for the sugar bowl, you are reaching for sucrose. And, whether you know it or not, you're opting for one of the purest foods found on the kitchen pantry shelf and in prepared food products. For thousands of years sugar has been an important food ingredient that provides a balanced sweet taste, safety as a preservative and provides functional properties essential in a multitude of foods.

Sugar (sucrose) is a natural carbohydrate, found in fruits and vegetables. All green plants manufacture sugar through photosynthesis, the process by which plants generate energy and food reserves from sunlight.



Just as sugar plays a vital role in the growth and life cycle of plants, it is an important ingredient in our food supply. While all fruits and vegetables produce sugar, the sugar cane and sugar beet plants contain the most accessible stores of sucrose.

### Sugar is purified

For many people, the term “refined” has lost its original meaning “to purify” and now carries a negative connotation. With sugar the refining process simply removes all impurities and the surrounding plant matter leaving only the pure sucrose.

To further your understanding of sugar (sucrose) and its path from the field to the table, we provide the following plant to pantry tour.

### Raising CANE

Sugar cane is a tropical grass that grows 10-20 feet high. Four U.S. states produce sugar cane: Florida, Hawaii, Louisiana and Texas. A stalk of the sugar cane plant contains 12-14% sucrose. The process of separating sugar from the sugar cane plant is accomplished in two steps: at sugar mills and at sugar refineries.

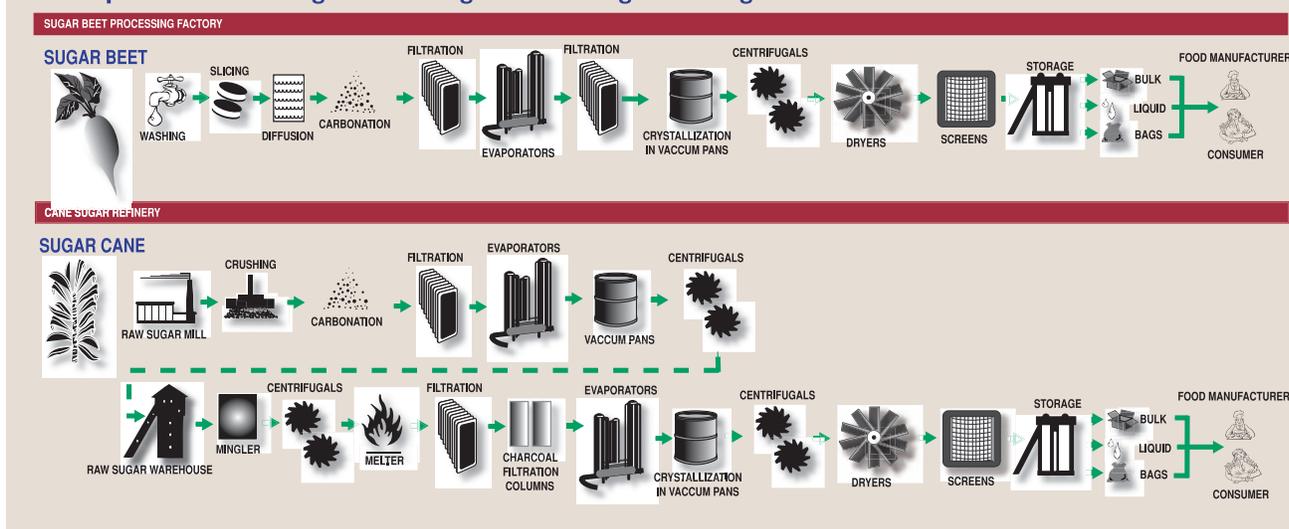


**The Sugar Mills** are located near the sugar cane fields. It is here that the raw sugar is separated from the plant and shipped to a refinery. First, the sugar cane stalks are washed and cut into shreds by rotating knives. Next, huge rollers press the juice out of the shredded pulp. This juice is then:

**Make an informed choice.**

**Choose pure natural sugar – 15 calories per teaspoon.**

## A Comparison of Beet Sugar Processing and Cane Sugar Refining



- **Clarified**-by adding milk of lime and carbon dioxide. The carbon dioxide bubbles through the mixture forming calcium carbonate, a chalk like crystal which attracts the non-sugar plant materials like wax, fats, and gums from the juice. In a clarifier, the calcium carbonate and the other materials fall out of the sucrose solution and settle to the bottom.

- **Concentrated**-by removing water from the clarified juice in multiple stages under vacuum. This allows the juice to boil at lower temperatures to protect the sugar from caramelization. The juice becomes a clear, rich brown syrup during this step.

- **Crystallized**-by evaporating the last portion of water under very tight controls in a vacuum pan. Seed grain (pulverized sugar) is fed into the pan as the water evaporates and crystals begin to form. The mixture leaves the vacuum pan as a thick crystal mass and is sent to a centrifuge, a large perforated basket spinning very rapidly much like a washing machine in the spin cycle, where it is spun and dried, yielding golden raw sugar.

**Raw sugar** is approximately 96-98% sucrose. The nearly pure sugar crystal is covered by a thin film of molasses, the thick raw syrup from the mill. The molasses coating contains sugar, water, plant material, minerals, and other non-sugars.

**The Cane Sugar Refinery** transforms raw sugar into granulated sugar, brown sugar, and

other consumer and food industry products.

- Bulk raw sugar arrives at the refinery on ships or in railroad boxcars. It is mixed with warm affination syrup (a solution of water and sugar) to loosen the molasses surrounding the raw sugar crystals. This produces a batter-like mixture called **magma**.

- Large centrifuges spin the magma and separate the molasses film from the crystals.

- The crystals are washed, dissolved, clarified or filtered to remove the molasses and insoluble impurities. At this point, the product is a clear, golden-colored liquid.

- Carbon filters remove the remaining color, producing a water-white sugar syrup. The syrup is concentrated by evaporating some of the water.

- This concentrated syrup is fed into a vacuum pan where it is seeded with fine sugar crystals. Through the skillful evaporation of the remaining water, these fine crystals are grown in the rich solution of sugar to produce perfect sugar crystals of the proper size.

- The sugar is spun in a centrifuge where the remaining syrup is spun off and the sugar crystals are washed with fresh, hot water. From the centrifuge the damp crystals are conveyed to large dryers where the moisture content of the sugar crystals is reduced from approximately 1% to .03%.

- The dried granulated sugar passes over screens to separate the various sizes of sugar crystals. Large and small crystals are packaged for standard consumer use and according to the specifications of industrial customers.

### It's in the BEET

Sugar beets flourish in temperate climates where the soil is rich and the growing season is about five months long. Farms can be found in California, Colorado, Idaho, Michigan, Minnesota, Montana, Nebraska, North Dakota, Oregon, and Wyoming.

Sugar beets contain 16-18% sucrose and are processed at factories near the farms. Since



sugar beets are grown and harvested seasonally, factories generally operate for a campaign (a period of time) of four to seven months. During these campaigns, facilities operate around-the-clock, seven days a week.

### The Sugar Beet Factory

Sugar beet processing takes place in one location. At the factory, sugar beets are washed and sliced into thin strips called cossettes. The cossettes go through a large tank called a diffuser where raw juice is extracted. Here's how:

- The cossettes are gently lifted from the bottom to the top of the diffuser as hot water washes over them absorbing the sugar. After the sugar laden raw juice is drawn off, the beet pulp is left behind. This pulp is processed separately into pellets for livestock feed and other products.

- The juice is then filtered leaving a golden light brown clarified thin juice. This juice is boiled under vacuum where much of the water is evaporated, forming a thicker juice similar to pancake syrup.

- After a second filtration to ensure that all non-sugar materials are removed, the juice goes to the boiling pans. Once again the juice is boiled under vacuum and crystals begin to

form. The resulting sugar crystal and syrup mix is called **massecuite**.

- The massecuite is then sent to centrifuges for separation. By spinning rapidly in a perforated cylindrical basket, the syrup is thrown off through the screen holes. Clean hot water is used to wash the sugar, producing pure white sugar crystals.

- The damp crystals are dried with filtered air in a rotating drum granulator and the dried sugar passes over screens which separate the various sizes of sugar crystals. The products are then packaged and shipped to grocery stores and food manufacturers.

### Sugar Sweet by Nature

The sugar that results from sugar cane and sugar beet processing is the same sucrose that is found naturally in the original plants and in fruits and vegetables. The raw sugar color is removed by physical separation of plant materials and by carbon filters which absorb colored impurities. Since the pure sugar crystals are naturally colorless, no bleaching or whitening is necessary. A byproduct of the cane and beet sugar refining process is molasses which has a multitude of uses. Molasses is an important feed stock in the production of antibiotics, bakers yeast, rum and fuel alcohol, as well as an animal feed supplement.

### The Sweet Story

Sugar is an important source of carbohydrate, contains no fat or cholesterol, and at 15 calories a teaspoon is kind to the waistline especially when combined with low-fat foods. Sugar is listed by the Food and Drug Administration (FDA) as GRAS (Generally Recognized As Safe).

Sugar plays an important part in making good foods taste even better and has many functional attributes in food preparation. In addition to its role as a flavor enhancer, sugar can act as a preservative, a bulking agent, a balancing agent, and a fermentation aid. It is sugar that helps bread to rise, heightens flavor and preserves fruit in jams and jellies, provides smooth texture to candies and sauces, and balances the tart flavors of other ingredients in many main dish recipes.

## Questions Most Frequently Asked About Sugar

### 1. What nutritional impact does white sugar have on my diet?

White sugar is pure sucrose, a carbohydrate. Carbohydrates provide energy, contain no fat, and like protein contribute 4 calories per gram in your diet (as opposed to the 9 calories per gram contributed by fat). Your body treats sucrose like any other carbohydrate – it is converted into glucose and used by the cells for energy.

### 2. Are some sugar products more or less refined than others?

All sugar products on the market are refined. In addition to traditional light and dark brown sugar and pure white granulated sugar, some manufacturers produce lightly colored sugars (golden or tan) for specialty uses. Consumer sugar products range from about 96% sucrose (brown sugar) to 99.9% sucrose (white granulated sugar). Turbinado sugar is a light tan washed raw sugar product available in some areas. Demerara sugar is a golden colored specialty sugar product. These products undergo refining to separate sucrose from the plant material.

### 3. What is brown sugar?

Brown sugar is sugar crystals in a specially prepared molasses syrup with controlled natural flavor and color components. A number of sugar refiners make brown sugar by preparing and boiling a special syrup containing these components until brown sugar crystals form. Others produce brown sugar by blending a special molasses syrup with white sugar crystals.

### 4. Does sugar contain preservatives or other additives?

No. Sugar is – pure sucrose. It contains no preservatives or additives of any kind.

### 5. What quality controls are in place at the sugar cane refinery or sugar beet processing plant?

Plenty. Samples of the sugar are examined from start to finish. Rigid standards are maintained by testing at each stage of the manufacturing process. Testing begins when the raw sugar (from sugar cane) or the sugar beets

arrive at the refineries or processing plants. The initial tests are for purity and sucrose content. Then a battery of tests are continually run to ensure proper pH balance, temperature, color, and consistency as the sugar solution makes its way through the facility. Equipment and filtering materials are also monitored around the clock to ensure that they are working efficiently. Because it's 99.9% pure sucrose, refined sugar is one of the highest quality products found in your grocery store.

### 6. What happens to the materials left over from sugar processing ?

Many of the materials are recycled and reused. The plant matter from which the sugar is extracted is reused. The sugar cane stalk residue, called bagasse, often is used as a fuel to run the cane factory. Most sugar cane mills and refineries produce their own electricity and some even supply power to nearby towns. The beet residue, or pulp, is generally used for animal feed or further processed for use as fiber or other products. Molasses, used by distillers, bakers, pharmaceutical companies and others, is recycled through the beet sugar and cane sugar refining process an average of four times to extract the maximum amount of sucrose. Carbon chips, used in filtration, are recharged (revivified) and reused, too. In addition, much of the water removed along the way still contains sucrose (called sweetwater) so it is pumped back into the stations to be used again. Little is wasted in sugar refining.

For more information on the natural goodness of sugar contact the Sugar Association.  
[www.sugar.org](http://www.sugar.org)

