Sucrose or table sugar is obtained from sugar cane or sugar beets. Sucrose is made from glucose and fructose units. The glucose and fructose units are joined by an acetal oxygen bridge in the alpha orientation. The structure is easy to recognize because it contains the six member ring of glucose and the five member ring of fructose.

**Introduction**

To recognize glucose look for the horizontal projection of the -OH on carbon #4. The alpha acetal is really part of a double acetal, since the two monosaccharides are joined at the hemiacetal of glucose and the hemiketal of the fructose. There are no hemiacetals remaining in the sucrose and therefore sucrose is a *non-reducing sugar*.

Figure \(\PageIndex{1}\) : Sucrose

**Sugar Processing**

Sugar or more specifically sucrose is a carbohydrate that occurs naturally in every fruit and vegetable. It is the major product of photosynthesis, the process by which plants transform the sun's energy into food. Sugar occurs in greatest quantities in sugar cane and sugar beets from which it is separated for commercial use.

In the first stage of processing the natural sugar stored in the cane stalk or beet root is separated from the rest of the plant material by physical methods. For sugar cane, this is accomplished by:

1. pressing the cane to extract the juice containing the sugar
2. boiling the juice until it begins to thicken and sugar begins to crystallize
3. spinning the sugar crystals in a centrifuge to remove the syrup, producing raw sugar; the raw sugar still contains many impurities
4. shipping the raw sugar to a refinery where it is washed and filtered to remove remaining non-sugar ingredients and color
5. crystallizing, drying and packaging the refined sugar.

Beet sugar processing is similar, but it is done in one continuous process without the raw sugar stage. The sugar beets are washed, sliced and soaked in hot water to separate the sugar-containing juice from the beet fiber. The sugar-laden juice is purified, filtered, concentrated and dried in a series of steps similar to cane sugar processing.

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**Acetal Functional Group**

Carbon # 1 (red on left) is called the *anomeric carbon* and is the center of an acetal functional group. A carbon that has two ether oxygens attached is an acetal. The *Alpha position* is defined as the ether oxygen being on the opposite side of the ring as the C # 6. In the chair structure this results in a down projection. This is the same definition as the -OH in a hemiacetal.

A second acetal grouping is defined by the green atoms. This result because the the formation reaction of the disaccharide is between the hemiacetal of glucose and the hemiketal of the fructose.

*A Figure 2*

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**Invert Sugar**

When sucrose is hydrolyzed it forms a 1:1 mixture of glucose and fructose. This mixture is the main ingredient in honey. It is called *invert sugar* because the angle of the specific rotation of the plain polarized light changes from a positive to a negative value due to the presence of the optical isomers of the mixture of glucose and fructose sugars.
Hydrolysis of Sucrose

In the hydrolysis of any di- or poly saccharide, a water molecule helps to break the acetal bond as shown in red. The acetal bond is broken, the H from the water is added to the oxygen on the glucose. The -OH is then added to the carbon on the fructose.

**Exercise (PageIndex{1})**

Is glucose - alpha or beta?

**Answer**

The -OH on carbon # 1 is projected down therefore, alpha.

**Exercise (PageIndex{2})**

Is fructose - alpha or beta?

**Answer**

The -OH on carbon # 1 is projected down and is on the same side of the ring as C#6, extreme right on fructose therefore, beta.
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