GOGANI COMPANY

Manufacturer of Pharmaceutical

& Biological Machinery

Bioprocess Solution

Bioprocess Consultation

Carbohydrates

(saccharides)

(Processing Systems & Machinery)

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Carbohydrates (*saccharides*)

Carbohydrates are organic compounds composed of carbon, hydrogen and oxygen ,represented as $C_n(H_2O)_n$ where hydrogen and oxygen are present in the same ratio as water (2:1).Carbohydrates are important source of energy to living organism as well as means by which chemical energy can be stored. There are number of ways in which carbohydrates can be classified. The most useful classification of carbohydrates on the basis of number of individual simple sugar units are mono saccharides **,** oligo saccharides and poly saccharides**.**

Classification of Carbohydrates :

- **Mono Saccharides**
  - **Glucose (also known as dextrose or grape sugar)**
  - **Fructose (also known as levulose or fruit sugar)**
  - **Galactose**

- **Oligosaccharides**
  - **Sucrose**
  - **Maltose (also known as malt sugar)**
  - **Lactose (also known as milk sugar)**

- **Polysaccharides**
  - **Starch**
  - **Dextrin**
  - **Glycogen**
  - **Cellulose**

Functional Groups of Carbohydrates

On the basis of functional groups carbohydrates can be classified as:

- **Aldoses** -have aldehyde group e.g. glucose ,galactose etc.
- **Ketoses**-have ketone group e.g. fructose.

Monosaccharides

These are the only sugars that can be absorbed and utilized by the body. Disaccharides and polysaccharides must be ultimately broken down into monosaccharides in the digestive process known as *hydrolysis*. Only then can they be utilized by the body. Three monosaccharides are particularly important in the study of nutritional science: glucose, fructose and galactose.

Glucose (also known as dextrose or grape sugar)

This monosaccharide is the most important carbohydrate in human nutrition because it is the one that the body fuses directly to supply its energy needs. Glucose is formed from the hydrolysis of di- and polysaccharides, including starch, dextrin, maltose, sucrose and lactose; from the monosaccharide fructose largely during absorption; and from both fructose and galactose in the liver during metabolism.

Glucose is the carbohydrate found in the bloodstream, and it provides an immediate source of energy for the body's cells and tissues. Glucose is also formed when stored body carbohydrate (glycogen) is broken down for use.

In the plant world, glucose is widely distributed. It is found in all plants and in the sap of trees. Fruits and vegetables are wholesome food sources of glucose. It is also present in such unwholesome (to humans) substances as molasses, honey and corn syrup.

Fructose (also known as levulose or fruit sugar)

Fructose, a monosaccharide, is very similar to another monosaccharide, galactose. These two simple sugars share the same chemical formula; however, the arrangements of their chemical groups along the chemical chain differ. Fructose is the sweetest of all the sugars and is found in fruits, vegetables and the nectar of flowers, as well as in the unwholesome (to humans) sweeteners, molasses and honey. In humans, fructose is produced during the hydrolysis of the disaccharide, sucrose.

Galactose

Galactose differs from the other simple sugars, glucose and fructose, in that it does not occur free in nature. It is produced in the body in the digestion of lactose, a disaccharide.

Oligosaccharides (Disaccharides)

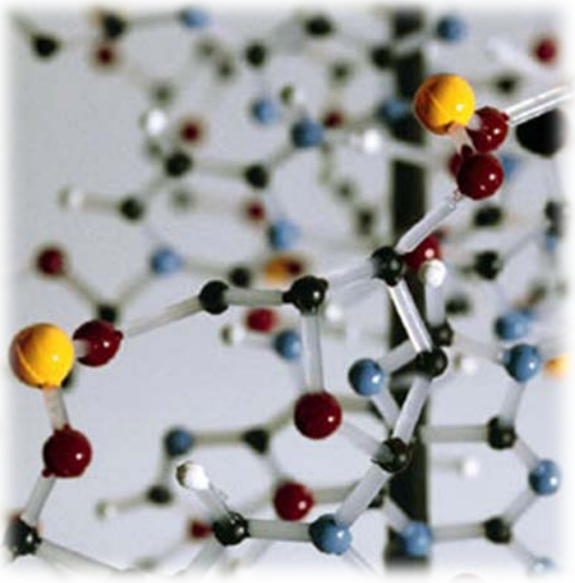
Disaccharides, on hydrolysis, yield two monosaccharide molecules. Three particular disaccharides warrant discussion in a lesson on nutritional science: sucrose, maltose and lactose.

Sucrose

The disaccharide, sucrose, consists of one molecule of each of two monosaccharides—glucose and fructose. Sucrose is found in fruits and vegetables and is particularly plentiful in sugar beets (roots) and sugarcane (a grass). Refined white and brown sugars are close to 100% sucrose because almost everything else (including the other kinds of sugars present, the vitamins, the minerals and the proteins) have been removed in the refining process. Maple syrup and molasses are, like refined sugars, unwholesome sweeteners; both contain over 50% sucrose. It almost goes without saying that any foods, so-called, containing significant amounts of refined sugar are high in sucrose.

Maltose (also known as malt sugar)

This disaccharide, unlike sucrose, is not consumed in large amounts in the average American diet. It is found in malted cereals, malted milks and sprouted grains. Also, corn syrup is 26 percent maltose and corn sugar is 4 percent maltose. None of these "foods" is wholesome, with perhaps, the exception of sprouted grains.



Maltose occurs in the body as an intermediate product of starch digestion. (Starch is a polysaccharide.) When maltose is hydrolyzed, it yields two molecules of glucose.

Lactose (also known as milk sugar)

This disaccharide is found only in milk. Human milk contains about 4.8 g per 100 ml and cow's milk contains approximately 6.8 g per 100 ml. When lactose is hydrolyzed it yields one unit of the monosaccharide glucose and one unit of the monosaccharide galactose. The enzyme lactase is needed to digest lactose, and this enzyme is not present in most, if any,

people over age three. This is one of the many reasons why milk is an unwholesome food for people over three years of age.

Polysaccharides

Like the disaccharides, the polysaccharides cannot be directly utilized by the body. They must first be broken down into monosaccharides, the only sugar form the body can use.

Polysaccharides contain up to 60,000 simple carbohydrate molecules. These carbohydrate molecules are arranged in long chains in either a straight or in a branched structure. There are four polysaccharides that are important in the study of nutritional science: starch, dextrin, glycogen and cellulose.

Starch

Starch is abundant in the plant world and is found in granular form in the cells of plants. Starch granules can be seen under a microscope and they differ in size, shape and markings in various plants. The starch granules of wheat, for example, are oval-shaped; whereas the starch granules of corn are small, rounded and angular.

These starch granules are laid down in the storage organs of plants—in the seeds, tubers, roots and stem pith. They provide a reserve food supply for the plant, sustain the root or tuber through the winter and nourish the growing embryo during germination.

Most starches are a mix of two different molecular structures, amylose and amylopectin. The former has a linear structure and the latter has a branched or bushy structure. The proportion of the two fractions varies according to the species of plant. For example, potato starch and most cereal starches have approximately 15-30% amylose. But the waxy cereal grains, including some varieties of corn plus rice and grain sorghum, have their starch most entirely as amylopectin. The starches in green peas and in some sweet corn varieties are mainly amylose.

The polysaccharides, as mentioned earlier, are not water soluble as are the mono- and disaccharides. Though not water soluble, starches can be dispersed in water heated to a certain temperature. The granules swell and gelatinize. When cooled, this gelatin sets to a paste. The jelling characteristics of starches are considered to result from the amylose present, while amylopectin is considered to be responsible for the gummy and cohesive properties of the paste.

Dextrin

There are several "varieties" of this polysaccharide. Dextrins are most commonly consumed in cooked starch foods, as they are obtained from starch by the action of heat. Dextrins are intermediary products of starch digestion, also, and are formed by the action of amylases on starches. They render the disaccharide maltose on hydrolysis.

Glycogen

Glycogen is the reserve carbohydrate in humans. It is to animals as starch is to plants. Glycogen is very similar to amylopectin, having a high molecular weight and branched-chain structures made up of thousands of glucose molecules. The main difference between glycogen and amylopectin is that glycogen has more and shorter branches, resulting in a more compact, bushlike molecule with greater solubility and lower viscosity (less stickiness or gumminess).

Glycogen is stored primarily in the liver and muscles of animals. About two-thirds of total body glycogen is stored in the muscles and about one-third is stored in the liver.

Cellulose

Like starch and glycogen, cellulose is composed of thousands of glucose molecules. It comprises over 50% of the carbon in vegetation and is the structural constituent of the cell walls of plants. Cellulose is, therefore, the most abundant naturally-occurring organic substance. It is characterized by its insolubility, its chemical inertness and its physical rigidity. This polysaccharide can be digested only by herbivores such as cows, sheep, horses, etc., as these animals have bacteria in their rumens (stomachs) whose enzyme systems break down cellulose molecules. Humans do not have the enzyme needed to digest cellulose, so it is passed through the digestive tract unchanged.

شرکت گوگانی

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مهر و امضاء متقاضی

Notes توضیحات