



CARBOHYDRATES MEET IN NATURE. PENTOSSES. HEXOSSES

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ABSTRACT

The article describes the process of "Carbohydrates in nature pentoses, hexoses" in the educational process of the younger generation.

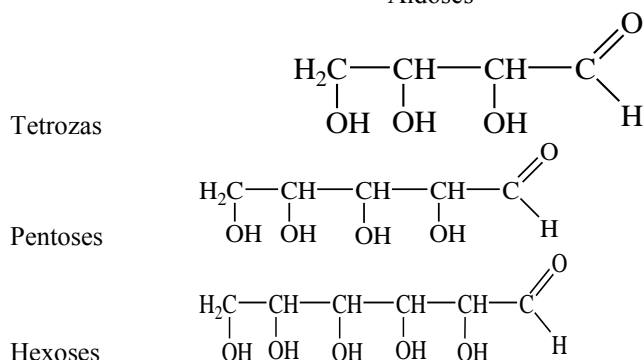
KEYWORDS: Carbohydrates, pentoses, hexoses.

DISCUSSION

Carbohydrates are one of the most abundant natural compounds in nature. Carbohydrates make up about 80% of the dry mass of plants and 2% of the body of animals. Carbohydrates are one of the main nutrients. It is used in industry as a raw material for the production of paper, ethyl alcohol, synthetic fibers and other products.

The term carbohydrates, or "carbonated waters," was coined in 1844 by K. Schmidt. Because the elemental composition of carbohydrates is

Aldoses

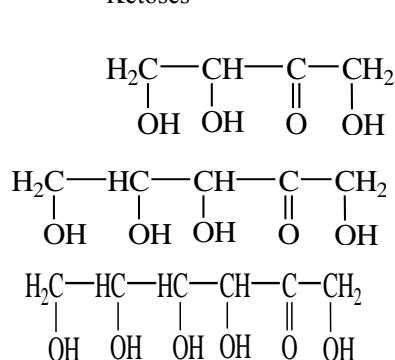


Chemically, monosaccharides are polyhydroxycarbonyl compounds. The molecules of monosaccharides are opaque, with one or more asymmetric centers. Therefore, monosaccharides have many spatial isomers. Carbohydrates extracted

expressed by the general formula $C_n (H_2O)_m$. Nowadays, carbohydrates are very diverse substances.

Carbohydrates are usually divided into mono-, oligo- and polysaccharides. Monosaccharides are the simplest carbohydrates and are classified according to the number of carbon atoms in the carbon chain and the presence of an aldehyde or ketone group. For example,

Ketoses



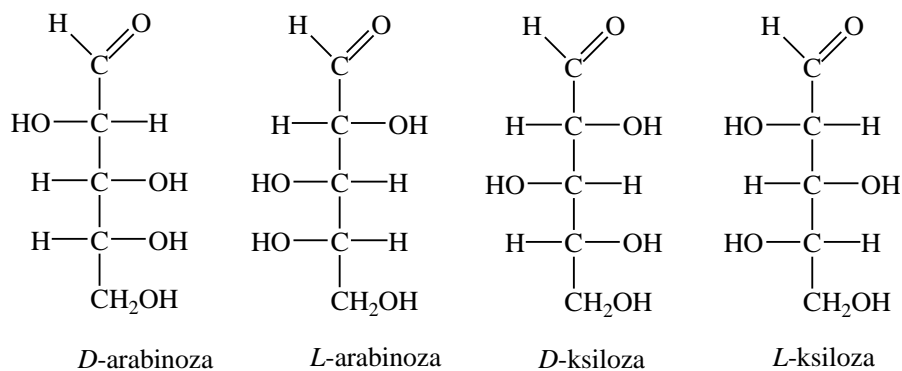
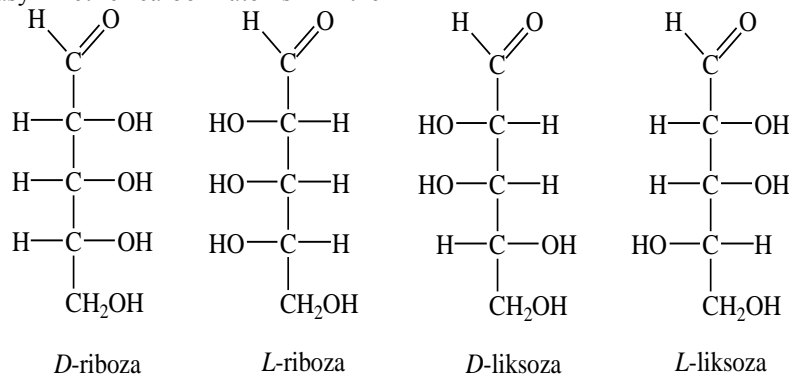
from natural products are optically active compounds.

Among the monosaccharides are pentoses and hexoses, as well as their derivatives.

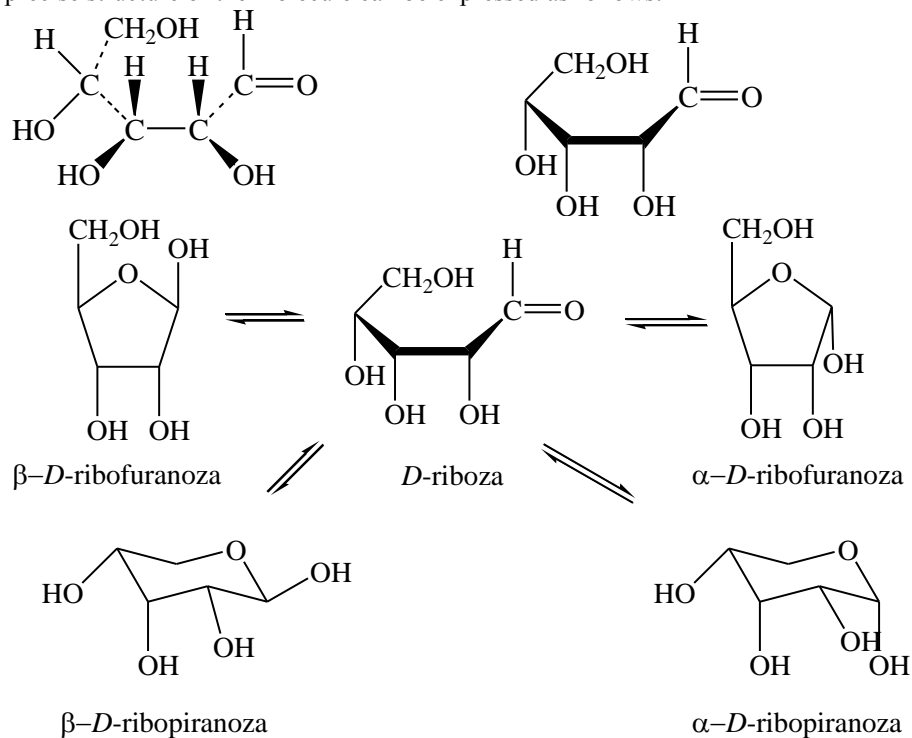
PENTOSEs.

Aldopentoses from pentoses are common in nature. They have 3 asymmetric carbon atoms in their

molecule. Therefore, $2^3 = 8$ spatial isomers and 4 pairs of enantiomers.



A more precise structure of the molecule can be expressed as follows:



Aldopentoses can form cyclic hemiacetals through hydroxyl groups in states 4 and 5. During the formation of the furanose cycle, there are 3-4

rotations. This cycle is not observed during the formation of the pyranose cycle.

In solutions of aldopentoses, the open-chain form and the cyclic form are in equilibrium, that is, a unique tautomeric system is formed.

In cyclic form, a new asymmetric carbon atom is formed. This results in two furanoses or two pyranoses. Two different cyclic isomers are called anomers. They are denoted by the letters a and b. To determine which a- or b-isomer of a molecule, the spatial position of the hydroxyl group in the first carbon and the OH group in the fourth carbon or OH is determined. These groups are b-isomers if they are in the *sis* state, and a-isomers if they are in the *trans* state. Each anomer has its own specific optical deflection value.

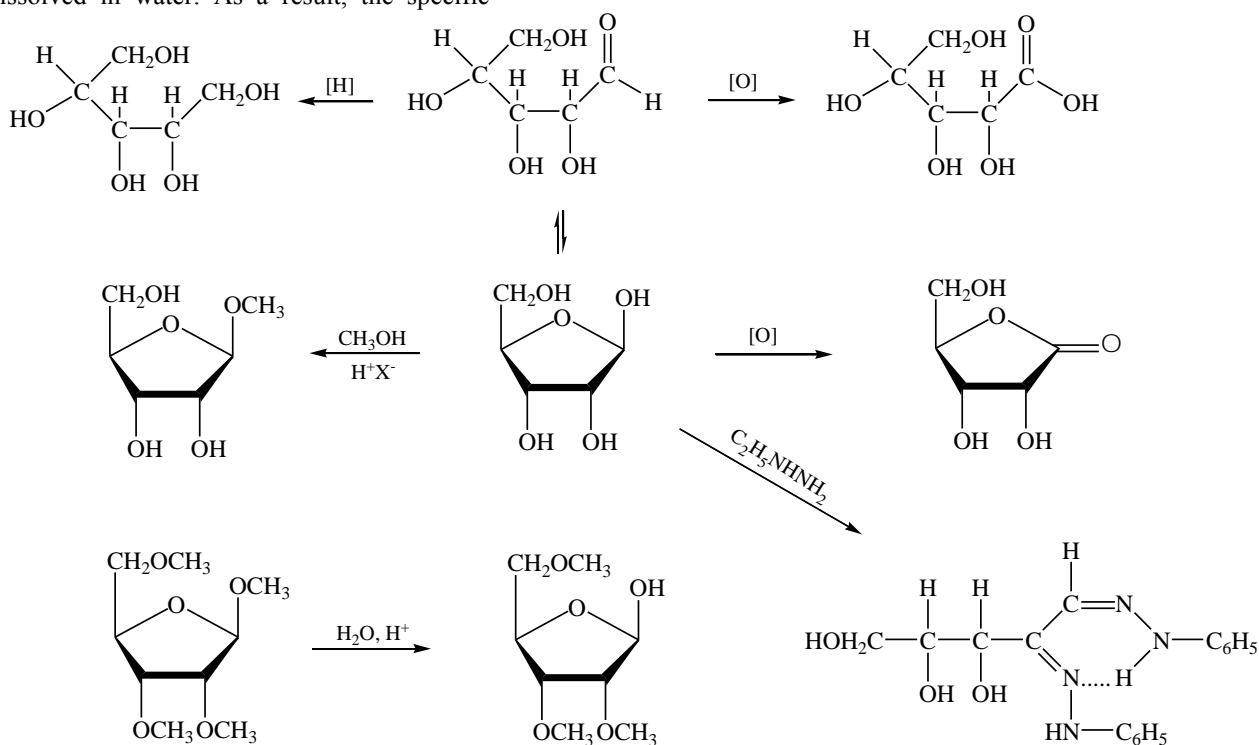
When aldopentose is present in a certain form in the crystalline state, tautomeric changes are observed when the a- and b-isomers are equilibrated when dissolved in water. As a result, the specific

optical deflection value changes to a constant value. This phenomenon is called mutarotation.

Chemical properties.

Aldopentoses are involved in all reactions specific to aldehydes and polyhydric alcohols. They are oxidized, react with silver mirrors, react with Fehling's reagent, form carbonic acids under the influence of weak oxidants (in the form of lactone), when converted into five-atom pentites, and so on.

When alkyl pentoses are alkylated, simple esters are formed. First, the hydrocarbon group-glycoside or semi-acetal group in the first carbon reacts. strong alkylating reagents, such as dimethyl sulfate, form tetraalkyl esters. The methyl group attached to the first carbon in these esters is easily separated.



Important representatives.

Xylose (wood sugar) is a colorless crystalline substance that liquefies at 145 oC and is optically active $[\alpha]_D = + 93.60$. Contains xylan polysaccharides. Xylans are found in wood, sunflower husks, corn husks, and straw. When they are hydrolyzed, xylose is formed. It belongs to the D-series monosaccharides, is crystalline in the form of pyranose, and its spatial structure corresponds to the α -anomer.

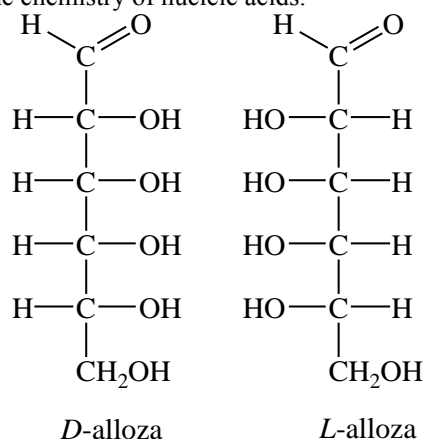
When α -D-xylopyranose is dissolved in water, mutarotation is observed, $[\alpha]$ forming an equilibrium mixture containing 33% α -anomer with $D = + 18.80$.

When xylose is heated in sulfuric acid solutions, it dehydrates to form a heterocyclic compound, furfural.

Ribose is a colorless crystalline substance that liquefies at 87 oC, optically active $[\alpha]_D = - 23.10$. It belongs to the D-series monosaccharides, in the form of furanose in the crystalline state, the spatial structure of which corresponds to the b-anomer. Mutation is observed in the aqueous solution. $[\alpha]$ An equilibrium mixture containing 26% α -anomer is formed, where $D = -23.70$.

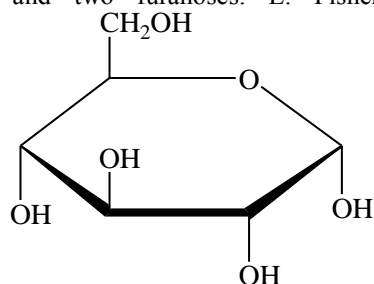
Ribose is one of the most important natural compounds in ribonucleic acid. Obtained by hydrolysis of ribonucleic acids. Used in the chemistry of nucleic acids in the synthesis of nucleosides.

In deoxyribonucleic acids, the derivative of D-ribose is 2-deoxyribose. This compound forms colorless crystals that liquefy at 78–82 °C, optically active $[\alpha]_D = -910$. In the crystalline state it is in the form of furanose. Used in the synthesis of nucleosides in the chemistry of nucleic acids.



Aldohexoses are crystalline in the form of pyranoses, and their solutions form a balanced mixture of cyclic and open forms.

Each aldohexose molecule can exist in the form of two pyranoses and two furanoses. E. Fisher's



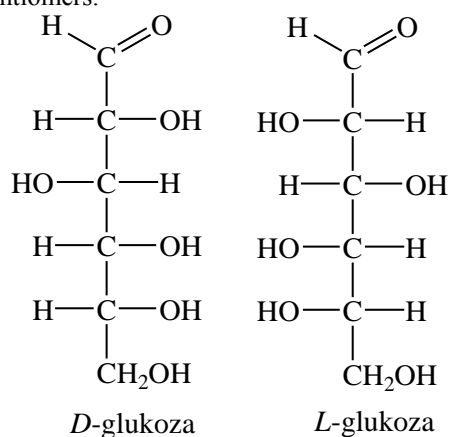
The D-glucose solution can undergo ring-chain tautomeric changes. Aldohexoses can form cyclic semi-acetals through hydroxyl groups in cases 4 and 5. This results in the formation of rings of furanose (less in aldohexoses) and pyranose, respectively. In the formation of the ring structure, there is a rotation around the bond between 4-5 carbon atoms.

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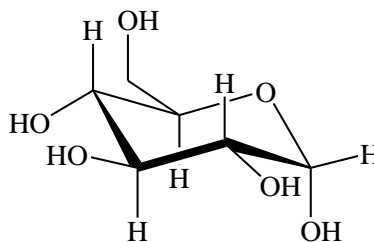
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HEXOSES

Hexoses also occur in the form of aldohexoses and ketohexoses. The aldohexose molecule contains four asymmetric carbon atoms, so there may be $2^4 = 16$ stereoisomers, or 8 pairs of enantiomers.



projection formulas can be used to represent cyclic shapes, or the more perfect U. Haworth perspective formulas. For example, α -D-glucopyranose is expressed as follows:



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