

Topic: Carbohydrates; Properties

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Properties of Carbohydrates

Physical Properties of Carbohydrates

Stereoisomerism – Compound having the same structural formula but they differ in spatial configuration. Example: Glucose has two isomers with respect to the penultimate carbon atom. They are D-glucose and L-glucose.

Optical Activity – It is the rotation of plane-polarized light forming (+) glucose and (-) glucose.

Diastereo isomers – It the configurational changes with regard to C2, C3, or C4 in glucose. Example: Mannose, galactose.

Anomerism – It is the spatial configuration with respect to the first carbon atom in aldoses and second carbon atom in ketoses.

Chemical Properties of Carbohydrates

Osazone formation: Osazone are carbohydrate derivatives when sugars are reacted with an excess of phenylhydrazine. eg. Glucosazone

Benedict's test: Reducing sugars when heated in the presence of an alkali gets converted to powerful reducing species known as enediols. When Benedict's reagent solution and reducing sugars are heated together, the solution changes its color to orange-red/ brick red.

Oxidation: Monosaccharides are reducing sugars if their carbonyl groups oxidize to give carboxylic acids. In Benedict's test, D-glucose is oxidized to D-gluconic acid thus, glucose is considered a reducing sugar.

Reduction to alcohols: The C=O groups in open-chain forms of carbohydrates can be reduced to alcohols by sodium borohydride, NaBH_4 , or catalytic hydrogenation (H_2 , Ni, EtOH/ H_2O). The products are known as "alditols".

Properties of Monosaccharides

- ❖ Most monosaccharides have a sweet taste (fructose is sweetest; 73% sweeter than sucrose).
- ❖ They are solids at room temperature.
- ❖ They are extremely soluble in water: – Despite their high molecular weights, the presence of large numbers of OH groups make the monosaccharides much more water-soluble than most molecules of similar MW.
- ❖ Glucose can dissolve in minute amounts of water to make syrup (1 g / 1 ml H₂O).
- ❖ The simple carbohydrates include single sugars (monosaccharides) and polymers, oligosaccharides, and polysaccharides.