

Carbohydrates

Carbohydrates are a class of organic compounds such as sugar, starch, glycogen, cellulose. Carbohydrates were considered to be hydrates of carbon because they contain hydrogen and oxygen in the ratio of 2:1 just as in water and the general formula of carbohydrates is $C_n(H_2O)_n$.

Carbohydrates are defined as aldehydes or ketones of polyhydroxy alcohols.

Carbohydrates are divided into three major categories:

- 1- Monosaccharides are simple sugars, that can't be changed into simpler sugars upon hydrolysis (reaction with H_2O) e.g. glucose, fructose, galactose, arabinose and xylose.
- 2- Disaccharides are double monosaccharides: on hydrolysis they yield two simple sugars. e.g. maltose, sucrose and lactose.
- 3- Polysaccharides are complex saccharides: on hydrolysis a polysaccharide yields many simple sugars.

Sugars which contain free aldehyde or ketone group have a reducing ability and are known as an aldoses or ketoses respectively.

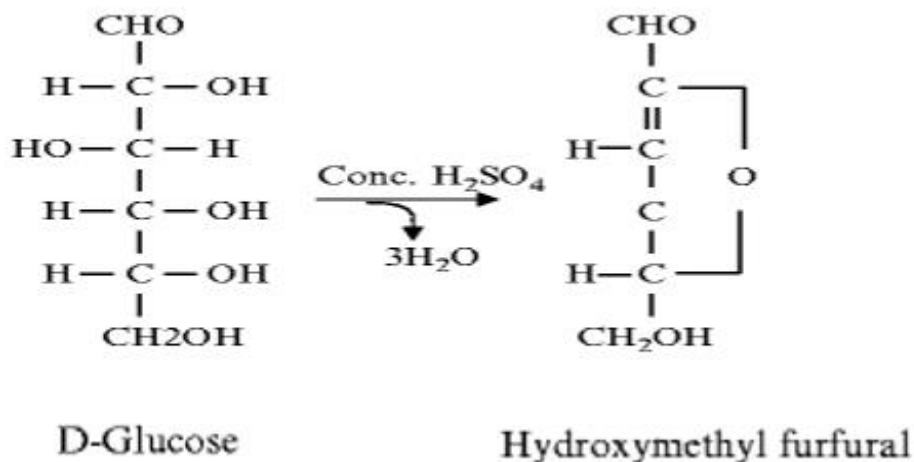
Carbohydrates form first by photosynthesis in plants from CO_2 and H_2O .

Carbohydrates can be a source of energy, stores of energy, structural units in the living body or are part of function molecule such as antibodies and certain hormones.

Qualitative Tests for Carbohydrates:

Molisch test:

Concentrated sulphuric acid H_2SO_4 hydrolyse glycosidic bonds to give monosaccharides which are then dehydrated to give furfural (from pentoses) or its derivative (hydroxy-methyl furfural) from hexoses, which in turn combine with sulphonated naphthol to give purple ring.

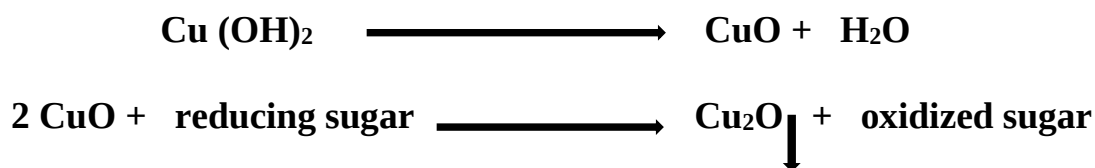


Procedure:

- 1) Add 2 drops of α -Naphthol to 10 drops of sugar solution in a test tube.
- 2) Carefully add about 20 drops of conc. H_2SO_4 down the side of the tube, two layers will be formed, observe the purple ring at the junction of the two layers.

Benedict's test:

Carbohydrates with a free aldehyde or ketone group have reducing properties in alkaline solution of copper (II) hydroxide $\text{Cu}(\text{OH})_2$, forming rust-brown cuprous oxide precipitate.



Procedure:

- 1) Add 10 drops of the sugar solution to 15 drops of Benedict's reagent in a test tube.
- 2) Place the tube in a boiling water bath, observe any change in color or precipitate.