Practical General Chemistry

Lecture notes

Presented by

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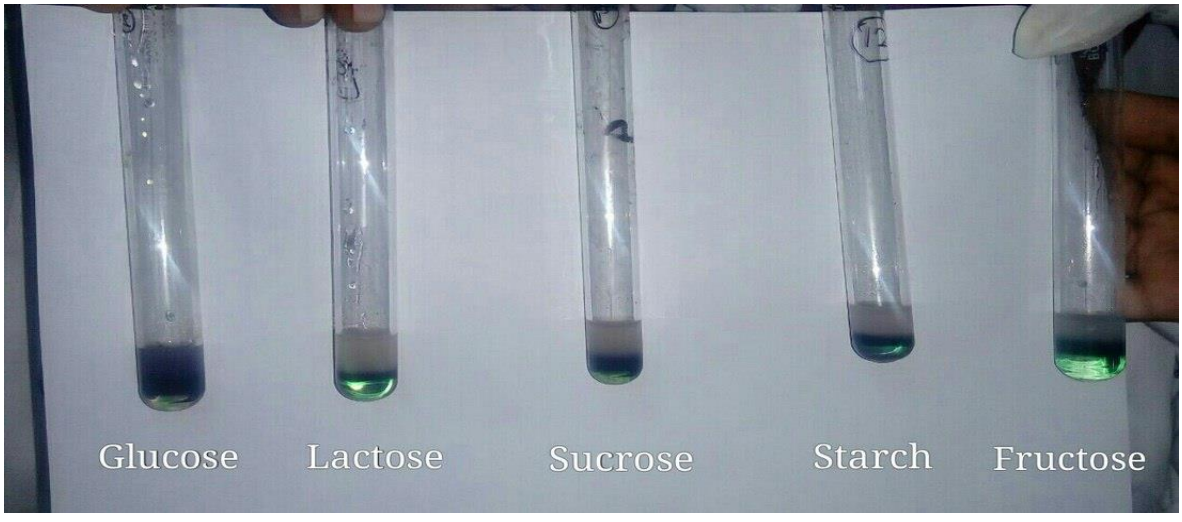
Seventh Lecture: Carbohydrates Tests

1. Molisch's test

is a chemical test which is used to check for the presence of carbohydrates in a given analyte. Molisch's test involves the addition of Molisch's reagent (a solution of ∝-naphthol in ethanol) to the analyte and the subsequent addition of a few drops of concentrated H_2SO_4 (sulfuric acid) to the mixture.

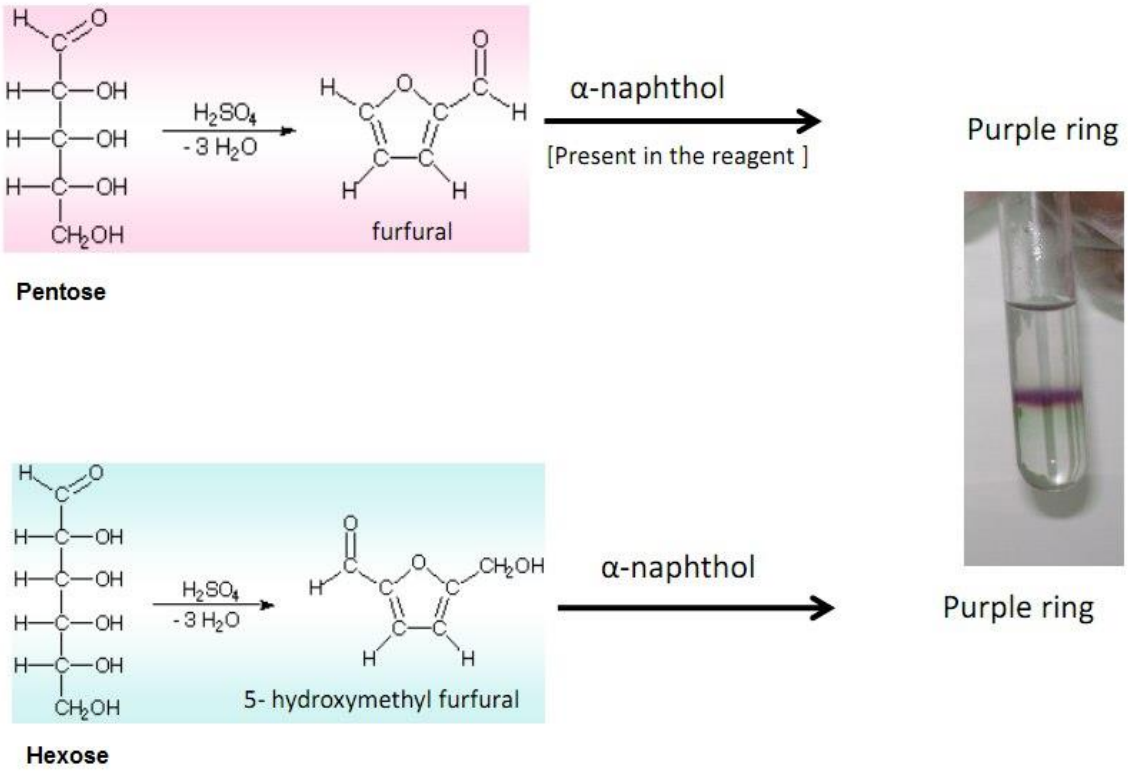
Principle of Molisch's Test

The formation of **a purple or a purplish-red ring** at the point of contact between the **(H_2SO_4 and the analyte + Molisch's reagent mixture confirms the presence of carbohydrates in the analyte)**. An image detailing a positive result for Molisch's test is provided below.



The formation of a purple ring is a positive indicator for Molisch's Test

The reaction equation below



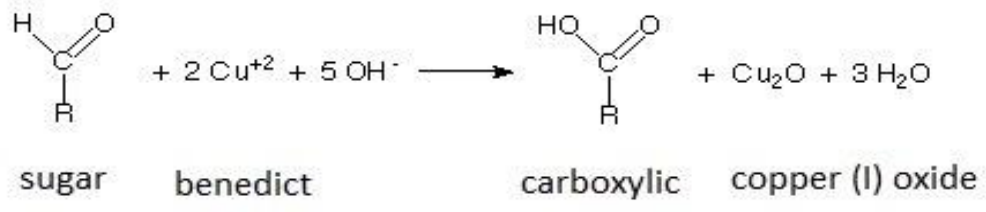
2.Benedict's Test

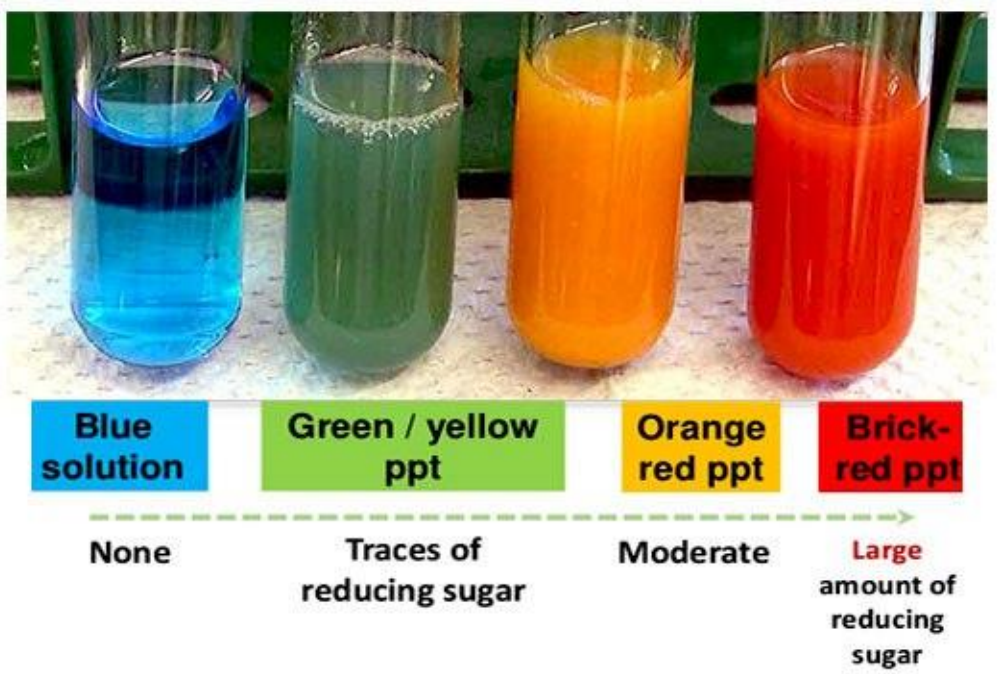
is used to test for simple carbohydrates. The Benedict's test identifies reducing sugars (monosaccharides and some disaccharides), which have free ketone or aldehyde functional groups. Benedict's solution can be used to test for the presence of glucose in urine.

Some sugars such as glucose are called reducing sugars because they are capable of transferring hydrogens (electrons) to other compounds, a process called reduction. When reducing sugars are mixed with Benedicts reagent and heated, a reduction reaction causes the Benedicts reagent to change color. **The color varies from green to dark red (brick)** or rusty-brown, depending on the amount of and type of sugar.

Principle of Benedict's Test

When Benedict's solution and simple carbohydrates are heated, the solution changes to orange red/ brick red. This reaction is caused by the reducing property of simple carbohydrates. The copper (II) ions in the Benedict's solution are reduced to Copper (I) ions, which causes the color change:





3. Barfoed's test

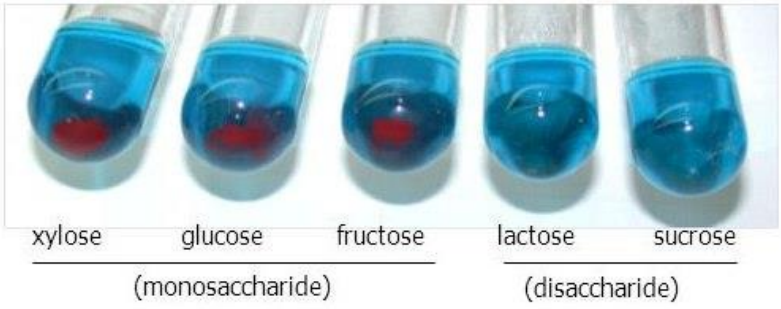
This test is used to differentiate reducing monosaccharide from a disaccharide sugar. The reaction is conducted in a slightly acidic medium. A mixture of ethanoic (acetic) acid and copper (II) acetate, is added to the test solution and boiled.

$RCHO + 2\ Cu^{2+} + 2\ H2O \longrightarrow RCOOH + Cu_2O + 4H^+$

Reducing monosaccharides react with Bedford's reagent much faster than disaccharides and produce a copious amount of red precipitate of copper (I) oxide within three minutes. Disaccharide sugars as they are weaker reducing agents, react at a slower rate and so do not form red precipitate even for ten minutes. Some

hydrolysis of disaccharides may lead to trace precipitates which tends to adhere to the walls of the test tube.

Barfoed's test
(test for
monosaccharides)



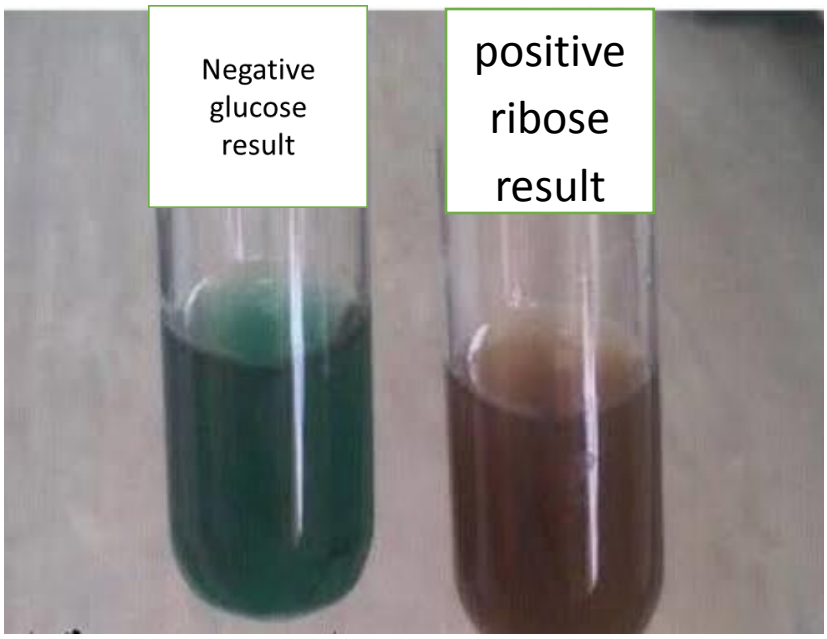
4. Bile test

to distinguish between five sugars (ribose-arybus) and single-six sugars (hexoxes such as glucose and fructose).

Principle Bile of Test

If the solution of the pentose is heated with concentrated hydrochloric acid for a short period, ferral is formed and this interacts with the orsinol in the presence of iron ions where a bluish green color is formed.

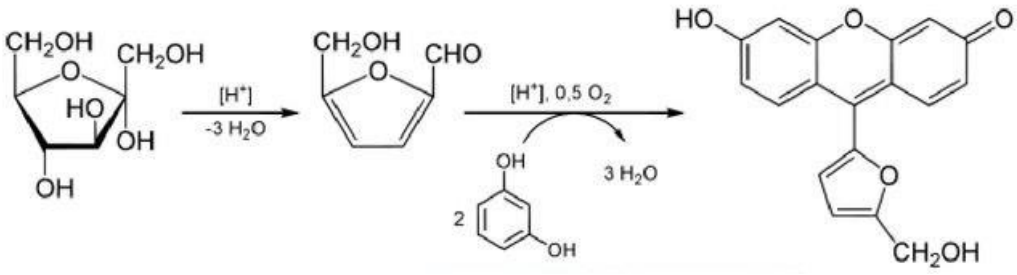
It is noted that prolonged heating may prevent hexose from converting to hydroxymethylviral, which interacts with the orsinol.



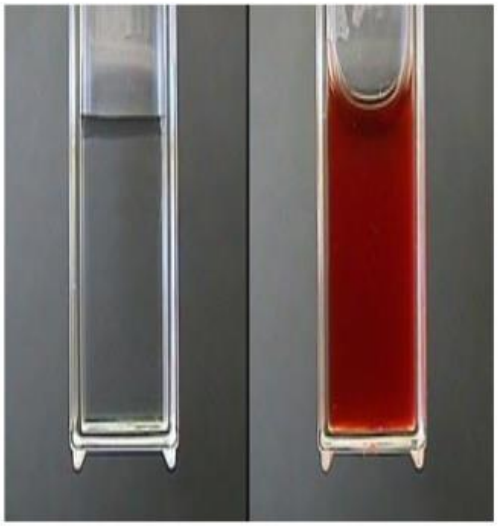
5. Seliwanoff's test

is used to distinguish aldoses from ketoses. On treatment with a concentrated Acid, ketoses are dehydrated more rapidly to give furfural derivatives and on condensation with resorcinol give cherry red complex. The test will be answered by fructose, sucrose and other keto containing carbohydrates. If the reaction is allowed for a longer time (more than 10minutes), aldoses also may produce positive results. Seliwanoff's test is often considered to be a test for ketohexoses in carbohydrates.

It can be noted that Sugars having free aldehyde or keto functional groups can oxidize Tollen's, Benedict's and Fehling's Solutions. The product of oxidation can be used to identify carbohydrates.



Seliwanoff's test



- Aldoses and Ketoses are detected by Seliwanoff's Test