To Study Some Simple Tests Of Carbohydrates

Requirements

Glucose, sucrose (cane-sugar), lactose (milk-sugar), starch, Molisch's reagent, Fehling's solution, Benedict's solution and iodine solution.

Procedure

1. Molisch's Test

All carbohydrates give this test.
Take 1-2 ml of aqueous solution of carbohydrate (suspension in case of starch) and add few drops of Molisch's reagent (1% alcoholic solution of 1-naphthol). Put one ml of cone. H_2SO_4 slowly along the side of the test tube.
A red violet ring is produced at the junction of two layers.
Chemistry of the test. Cone. H_2SO_4 converts carbohydrates into furfural or its deriva¬tive which further reacts with 1-naphthol to give a coloured product.

2. Fehling's Test

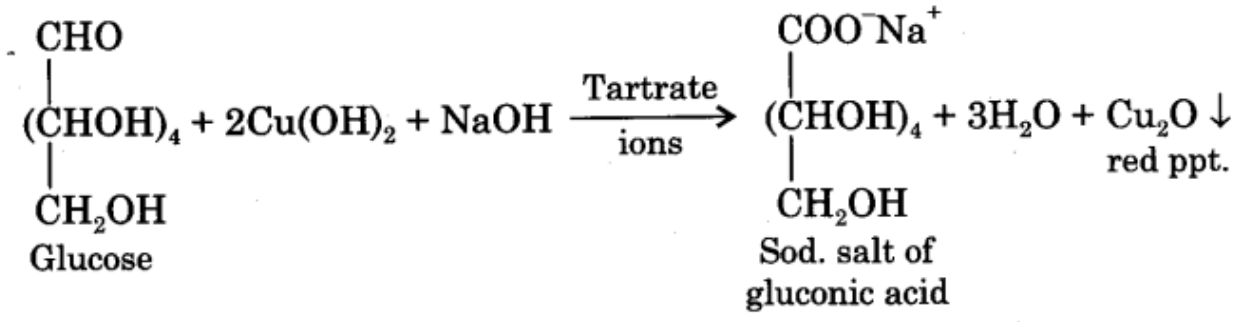
Take 2 ml of aqueous solution of carbohydrate (nearly 5%) and add 1—2 ml each of Fehling's solution A and Fehling's solution B. Keep the test tube in boiling water bath. Reddish ppt. indicates the presence of a reducing sugar.

Preparation of Fehling's Solution

Fehling's Solution A. Dissolve 17.5 g of $CuSO_4$ in 250 ml of distilled water containing few drops of H_2SO_4.

Fehling's Solution B. Dissolve 86.5 g of sodium potassium tartarate and 30 g NaOH in 250 ml of distilled water.

Chemistry of the test



3. Benedict's Test

To 1-2 ml of aqueous solution of carbohydrate in a test-tube add 1-2 ml of Benedict's reagent. Keep the test-tube in a boiling water bath.
Reddish ppt. indicates the presence of reducing sugar.
Preparation of Benedict's Reagent
Dissolve 17.3 g of sodium citrate and 10 g of anhydrous Na_2CO_3 in about 80 ml of distilled water.

Heat if necessary. Dissolve 1.73 g of copper sulphate in 10 ml of water. Mix the two and make the volume 100 ml by adding water.
Note. Chemistry of this test is the same as that of Fehling's test. Here citrate ions are used as complexing agent.

4. Tollen's Test

Take 2-3 ml of aqueous solution of carbohydrate in a test tube. Add to it 2-3 ml of Tollen's reagent. Keep the test tube in a boiling water bath for 10 minutes.
A shining silver mirror indicates the presence of reducing carbohydrate.
Preparation of Tollen's Reagent
Add NaOH solution to $AgNO_3$ solution. Then add NH_4OH solution drop wise till the ppt. just dissolve. The clear solution obtained is Tollen's reagent.

Chemistry of the test

$$AgNO_3 + NH_4OH \longrightarrow NH_4NO_3 + AgOH$$

$$2AgOH \longrightarrow Ag_2O + H_2O$$

$$Ag_2O + 2NH_4OH \longrightarrow \underset{\text{(Soluble)}}{2\,[Ag(NH_3)_2]OH} + 3H_2O$$

$$\underset{\text{Glucose}}{\begin{array}{l}CH_2OH\\|\\(CHOH)_4\\|\\CHO\end{array}} + Ag_2O \xrightarrow{NH_4OH} \underset{\text{Gluconic acid}}{\begin{array}{l}COOH\\|\\(CHOH)_4\\|\\COOH\end{array}} + \underset{\text{Silver mirror}}{2Ag}$$

5. Iodine Test (For starch only)

To the aqueous suspension of the sample, add 1-2 drops of iodine solution.
Appearance of blue colouration indicates the presence of starch.

Observations

Test	*Glucose*	*Lactose*	*Sucrose*	*Starch*
1. **Taste**	Sweet	Sweet	Sweet	Tasteless
2. **Solubility**	Soluble	Soluble	Soluble	Insoluble
3. **Molisch's test**	Purple ring	Purple ring	Purple ring	Purple ring
4. **Fehling's test**	Red ppt.	Red ppt.	Negative	Negative
5. **Benedict's test**	Red ppt.	Red ppt.	Negative	Negative
6. **Iodine test**	Negative	Negative	Negative	Blue colour

Oils and Fats

Chemically fats and oils are triesters of glycerol and higher fatty acids. At ordinary temperature oils are liquids while fats are solids. As compared to fats oils contain a large proportion of unsaturated acid radicals. Fats and oils are of vegetable or animal origin. These serve as excellent source of energy for the body as by combustion they produce heat and energy. They form fatty tissues around delicate organs to protect them from injury. They also form a heat insulating
coat around the body.