GENERAL TESTS FOR CARBOHYDRATE

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Introduction

* Carbohydrates are of great importance to human beings.
* They are major part of our diet, providing 60-70% of total energy required by the body.
* Chemically, Carbohydrates are aldehydes and ketones of polyhydroxy alcohols.
* Commonly found carbohydrates are glucose, fructose, sucrose, starch etc.

Introduction

* They are classified into monosaccharaides (Glucose, Fructose, Ribose), disaccharides (Lactose, Maltose, Sucrose) and Polysaccharides (Starch, Cellulose, Glycogen etc.)

1. Molisch's Test

- It is a general test for carbohydrates.
- A positive Molisch Test indicates the presence of carbohydrate in a given test solution.

1. Molisch's Test

- All Carbohydrates except **amino sugars** give Molisch test positive.
- Disaccharides and Polysaccharides are easily hydrolysed by Concentrated H_2SO_4 into monosaccharide and therefore give a positive test.

Procedure of Molisch Test

Test	Observation	Inference
Take 1 ml of carbohydrate solution in a test tube. Add 1-2 drops of 1% alcoholic α-Naphthol solution to it. Mix it well and then add 2 ml concentrated H_2SO_4 from side of the test tube and observe. (DO NOT SHAKE)	Violet coloured ring is obtained at the junction of the two liquids.	Carbohydrates present in the given solution.

Ring of any other colour is due to impurities.

PRINCIPLE OF MOLISCH'S TEST

- When Carbohydrate reacts with concentrated H_2SO_4 undergoes dehydration to give hydroxymethyl furfural derivative, which condenses with 2 molecules of alcoholic α-Naphthol to form **Purple** coloured complex.

2. Iodine Test

- This is a specific test for polysaccharides (Ex. Starch) which adsorb iodine and form coloured complex.
- Starch gives **blue** colour while glycogen gives **Reddish brown** colour.
- The most commonly available polysaccharides is Starch which is mixture of amylose and Amylopectin.

2. IODINE TEST

- The individual glucose units in Amylose are linked by α-1,4 glycosidic linkages.
- Amylopectine has branching points contributed by α-1,6 glycosidic bonds.
- Starch is insoluble in cold water but forms a colloidal solution in hot water.
- Starch has no detectable reducing activity.

2. Iodine Test

Test	Observation	Inference
Take 2ml carbohydrate solution in a test tube, then add 1-2 drops of dilute iodine solution to it. Mix it well and observe.	Blue or Violet Colour obtained	Polysaccharides present.

2. Iodine Test

Test	Observation	Inference
Effect of Heating and cooling : **(i) Take 2ml carbohydrate solution in a test tube. Then add 1-2 drops of dilute iodine solution to it. Mix it well, heat it and observe.**	**Blue or Violet Colour disappear**	**Due to heat, helical coiled structure of Amylose is disrupted, Iodine dissociated out, so blue or violet colour disappear.**
(ii) Cool it at room temp. or under running tap water and observe	**Blue Colour reappear**	**On cooling, helical coiled structure of Amylose again reformed, so blue colour reappears.**

2. Iodine Test

Test	Observation	Inference
Effect of Alkali and Acid : **(i) Take 2ml carbohydrate solution in a test tube.** **Then add 1-2 drops of dilute iodine solution to it. Mix it well and then add 1ml of 10% NaOH solution to it. Mix it well and observe.**	**Blue or Violet Colour disappear**	**Due to alkali (NaOH), iodine molecule are taken up by alkali to form sodium hypo iodide complex (NaOI), so blue or violet colour disappear.**
(ii) After colour disappear then add same amount of glacial acetic acid mix well and observe.	**Blue Colour reappear**	**When acid is added, iodine liberated from sodium hypoiodide (NaOI) complex reacts with polysaccharide solution to form blue or violet colour.**

Principle of Iodine Test

- Iodine forms a coordinate complex between the helically coiled polysaccharides chain and iodine centrally located within the helix due to adsorption.
- The colour obtained depends upon the length of the unbranched or linear chain available for complex formation.

3. Benedict's Test Before hydrolysis

Test	Observation	Inference
Take 5 ml Benedic's reagent and then add 8 drops of carbohydrate solution. Mix it well, boil it for 2 min, mix well and observe.	No coloured precipitate obtained.	Non-reducing Sugars are present

4. Starch Hydrolysis Test

Test	Observation	Inference
Take 2 ml starch solution then add 2 ml conc. HCl. Boil it for 5 min then cool under tap water and then add 2 ml of 40% NaOH solution. Check with red litmus paper. Then perform Benedict‟s Test with this hydrolysate. **(i) Benedict's Test After hydrolysis**	G/Y/O/R coloured precipitate obtained.	After hydrolysis reducing Sugars are present

Results

- **The Given solution is of Carbohydrates, Polysaccharides, Non-Reducing Sugar, Starch present.**