



**University of Anbar
College of Dentistry**

Lab 5
Qualitative tests of Carbohydrates

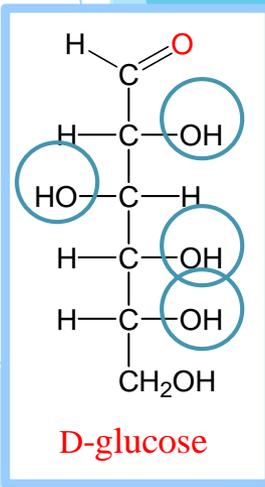
First Stage

By:

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Introduction

- ▶ Carbohydrates are the key source of energy used by living things.
- ▶ Carbohydrates are defined as polyhydroxy aldehydes or polyhydroxy ketones.
- ▶ Most, but not all carbohydrate have a formula $(\text{CH}_2\text{O})_n$ (hence the name hydrate of carbon)
- ▶ In human body, the D-glucose is used.
- ▶ Simple sugars ends with -ose



Classification

1-Simple sugar: (one unit)

Monosaccharides contain **one** monosaccharide unit.

Disaccharides contain **two** monosaccharide units.

2-Complex sugar (more than one):

- ❖ **Oligosaccharides** contain **3-9** monosaccharide units.
- ❖ **Polysaccharides** can contain more than 9 monosaccharide units.

NOTE:

- Complex carbohydrates can be broken down into smaller sugar units through a process known as **hydrolysis**.

Carbohydrates

Simple

Complex

Monosaccharides
(Glucose)

Disaccharides
(Lactose)

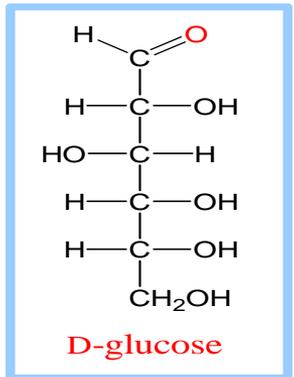
Oligosaccharides
(Maltose)

Polysaccharides
(Fibers)

Monosaccharide

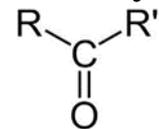
Monosaccharides: Cannot be hydrolyzed into simpler carbohydrates.

- They are classified into trioses, tetroses, pentoses, hexoses, heptoses based on the number of carbon atoms present in them.
- trioses (C-3)
- tetroses (C-4)
- pentoses (C-5)
- hexoses (C-6)
- heptoses (C-7)

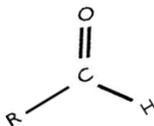


They are again divided into aldoses and ketoses based on the functional group present in them .

A **ketose** contains a carbonyl group attached to two R groups having one or more hydroxyl groups.



An **aldose** contains terminal aldehyde group in addition to R group containing -OH.



Monosaccharide

No. of carbons	Name	Aldose (aldosugar)	Ketose (keto sugar)
3	Triose	Glyceraldehyde	Dihydroxy acetone
4	Tetrose	Erythrose	Erythrulose
5	Pentose	Ribose, xylose	Ribulose, Xylulose
6	Hexose	Glucose, Galactose, Mannose	Fructose
7	Haptose	Glucuhaptose	Sedoheptulose

- **Disaccharides:** Give rise to two monosaccharide units upon hydrolysis

E.g.:

- Sucrose (glucose + fructose)
- Lactose (glucose + galactose)
- Maltose (glucose + glucose)

- **Oligosaccharides:** Yields less than ten monosaccharides.

E.g.:

- Maltotriose (3 glucose units)
- Raffinose (glucose + fructose + galactose)

- **Polysaccharides:** Contain more than ten monosaccharide units

(i) Homopolysaccharides (consisting of same type of monomeric units)

- Polymer of glucose: Starch, glycogen, cellulose
- Polymer of fructose: Inulin

(ii) Heteropolysaccharides (consisting of different types of monomeric units)

- Proteoglycans, e.g. Heparin (D-glucosamine sulfate + D-sulfated iduronic acid)
- Hyaluronic acid (D- β glucuronic acid + Nacetylglucosamine).

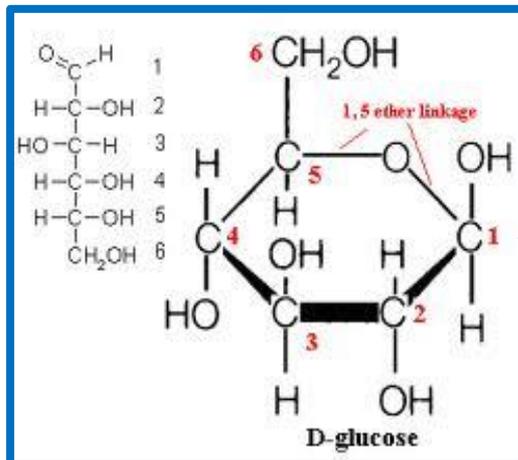
Solubility

Monosaccharide and disaccharide can be dissolved freely in water because water is a polar substance, while polysaccharide cannot be dissolved easily in water, because, it has high molecular weight, which give colloidal solutions in water soluble.

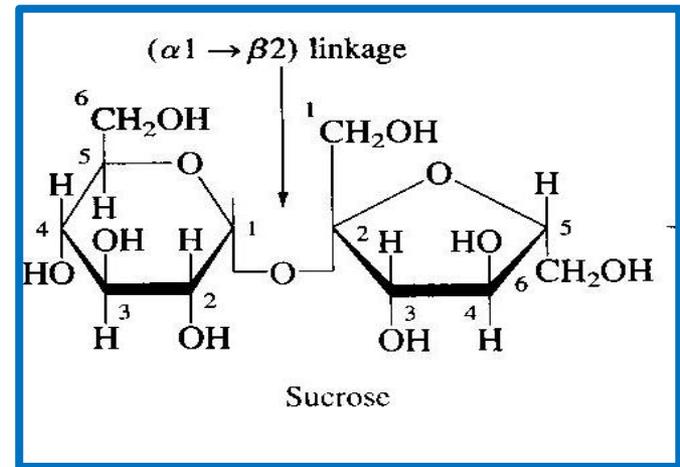


Reducing and Non-Reducing Sugars

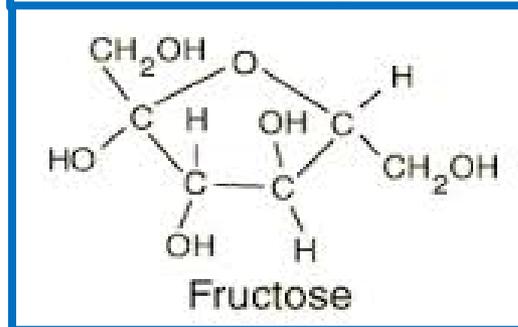
Reducing and non reducing sugar :If the oxygen on the anomeric carbon of a sugar is not attached to any other structure, that sugar can act as a reducing agent and is termed a reducing sugar.



Anomeric carbon



Non-reducing



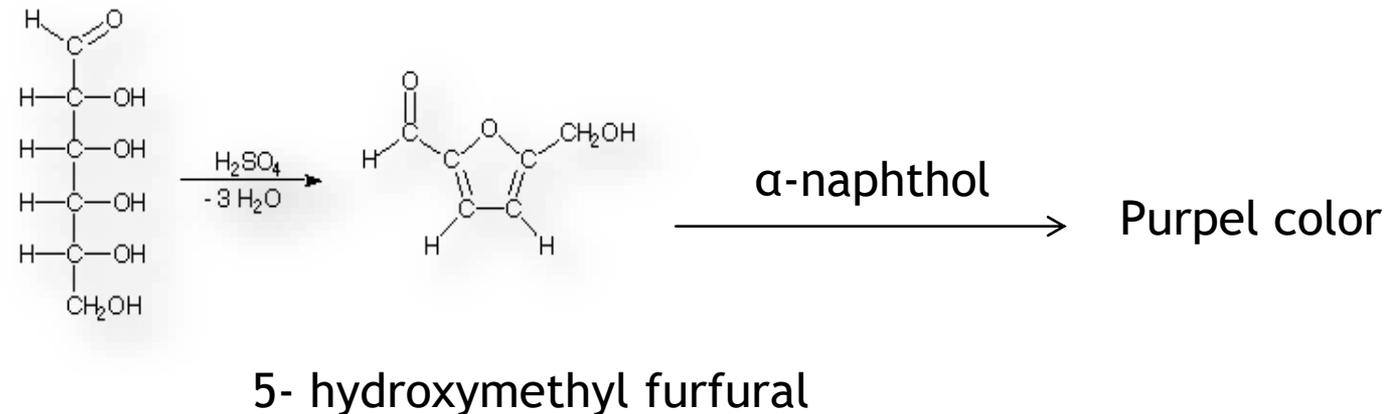
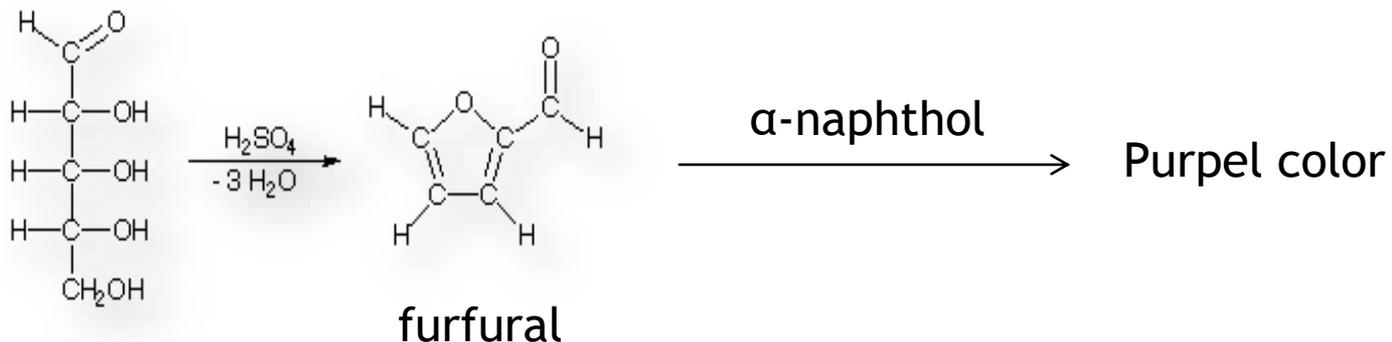
Reducing

REACTIONS OF CARBOHYDRATES

1. Molisch Test

- ▶ Molisch Test (α -Naphthol Reaction)
- ▶ This test is specific for all carbohydrates. Monosaccharide gives a rapid positive test, Disaccharides and polysaccharides react slower.
- ▶ Objective: To identify the carbohydrate and hence the presence of monosaccharide from other macromolecules lipids and proteins.
- ▶ Application of the test:
- ▶ Used as a general test to detect carbohydrates.

- ▶ **Principle:** The test reagent (**H₂SO₄**) dehydrates pentose to form furfural and dehydrates hexoses to form 5- hydroxymethyl furfural.
- ▶ The furfural and 5- hydroxymethyl furfural further react with α -naphthol present in the test reagent to produce a purple product.



PROCEDURE:

1. To 5 ml of sugar solution in a test tube
2. Then add two drops of Molisch reagent. Mix thoroughly.
3. Add 3 ml of concentrated sulphuric acid along the sides of the test tube by slightly inclining the tube, thus forming a layer of acid (acid being heavier goes down beneath the sugar solution) in the lower part.

Observation:

A reddish violet ring appears at the junction of two liquids

Tube	observation
1-glucose	
2-ribose	
3-sucrose	
4-starch	

Thank you

