Color Test for Ketoses and Pentoses

Done by: Sahar Al-Subaie

introduction

CLASSIFICATION OF CARBOHYDRATES

CARBOHYDRATES

Saccharides
(Sugars)

Physical Properties
* Low molecular weight
* Soluble in water
* Sweet to taste

Composition

Monosaccharides
Simple sugars

Disaccharides
Double sugars

Diagrammatic representation

General formula

$(CH_2O)_n$ When n=3 to7

Common examples

Glyceraldehyde, Glucose
Fructose, Galactose,
Ribose sugar

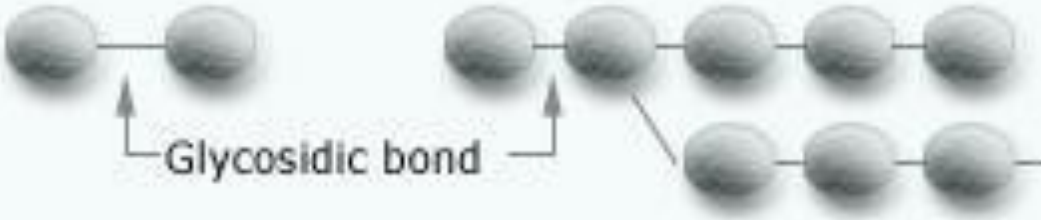
Polysaccharides
(Complex sugars)

Physical Properties
* High molecular weight
* Insoluble in water
* Tasteless

Composition

Multiple sugars

Diagrammatic representation



General formula

$C_{12}H_{22}O_{11}$

Common examples

Maltose,Sucrose
Lactose

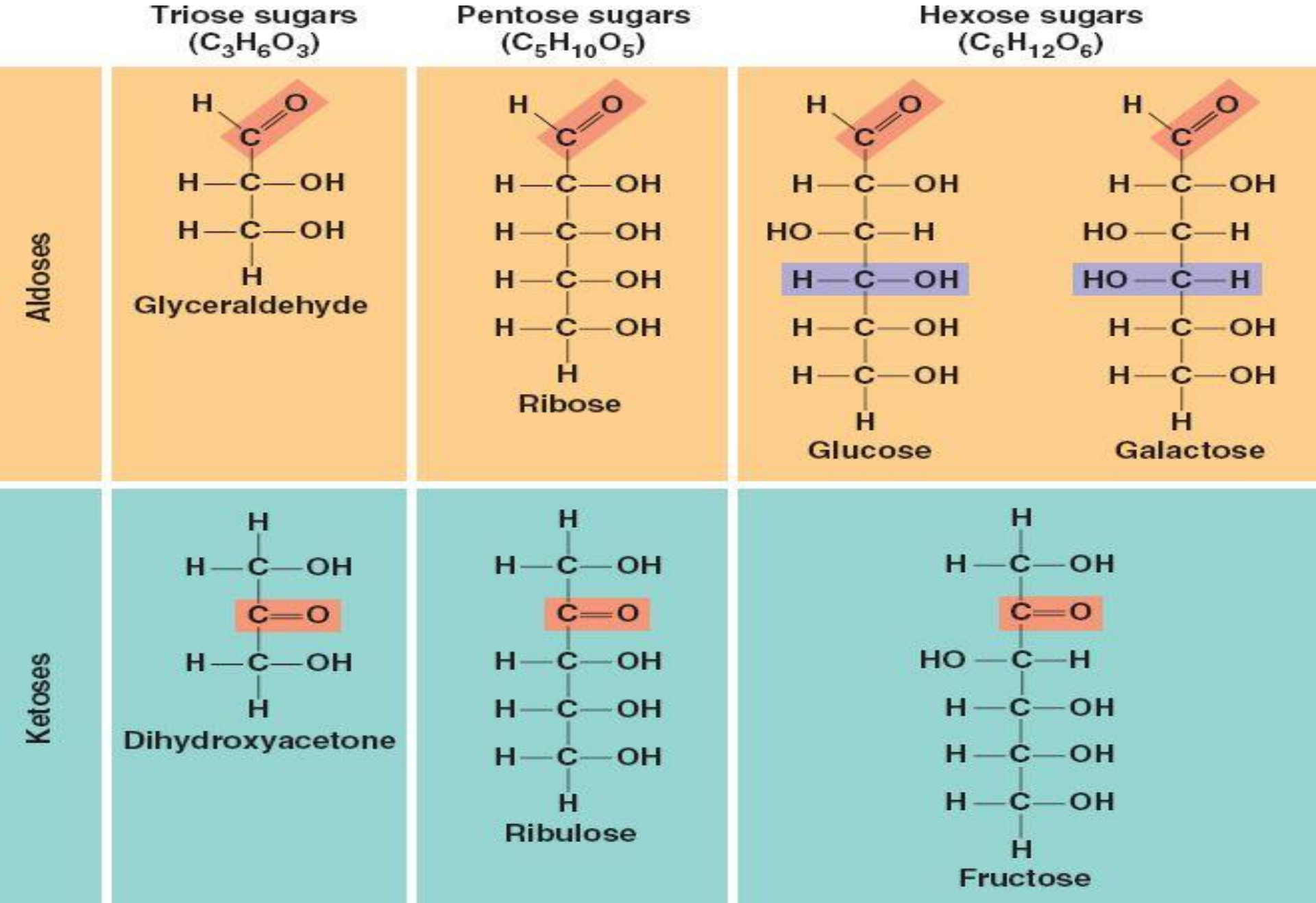
General formula

$C_x(H_2O)_n$

Common examples

Starch, Glycogen
Cellulose, Lignin, Chitin

Monosaccharide classification


Triose sugars
(C3H6O3)
Pentose sugars
(C5H10O5)
Hexose sugars
(C6H12O6)
Aldoses
Ketoses
Glyceraldehyde
Ribose
Glucose
Galactose
Dihydroxyacetone
Ribulose
Fructose

Today's experiments

- Seliwanoff's Resorcinol Test.
- Bial's Orcinol Test.
- Iodine Test for Polysaccharide.

Seliwanoff's Resorcinol Test

The Aim:

This test is used to distinguish between aldoses and ketoses.

Shows positive test for:

Ketohexoses

The principle:

The monosaccharide +HCL $\xrightarrow{\text{heat}}$ furfrual (or furfural drevtives)

$-3\,H_2O$


hexoses+HCL
heat
-3 H2O
hydroxymethylfurfural

hydroxymethylfurfural +resorcinol ~~heat~~ → red product

$-3\,H_2O$

But:

- Ketohexoses is about 20 to 25 times faster than aldohexoses in producing furfural derivatives.
- And form considerably more furfural derivatives.

So:

If you end the reaction within 1minute , you get positive result with the fastest sugar (ketohexoses).

Note:

free or bounded ketohexoses can respond the test.

e.g. sucrose that contains fructose.

Interference:

- Aldohexoses.
- Pentoses.

Interference of aldohexose:

- at high concentration
- or long incubation period
  - it gives positive result.

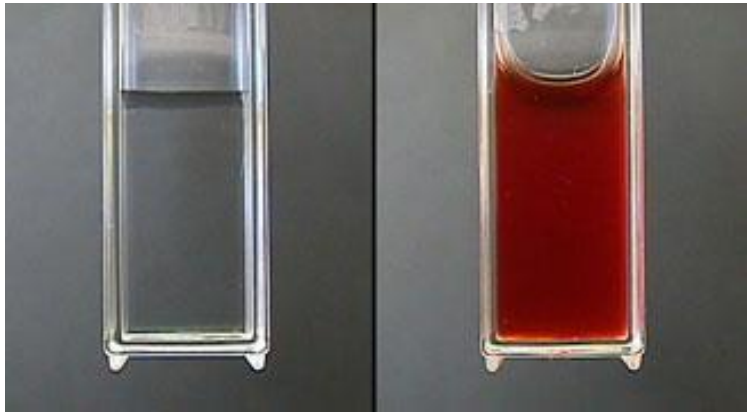
How could you prevent this interference?

- aldohexose e.g. glucose must not be present in amount greater than 2%.
- Concentration of HCL must not be more than 12%.
- The incubation period must be shorter than 1 minute.

Interference of Pentoses:

Pentoses give a blue to green product with this test.

The Results:



- Ketose + resorcinol ⟶ red complex
- Aldose + resorcinol ⟶ light yellow to faintly pink color
- Pentose + resorcinol ⟶ blue to green color

Bial's Orcinol Test

The Aim:

It is a simple, rapid qualitative test for pentoses

The principle:

- Pentose(or uronic acid)+HCL $\xrightarrow[-3\,H_2O]{\text{heat}}$ furfural
- Furfural + orcinol $\longrightarrow$ blue-green color

Bial's reagent :

- Orcinol
- HCL
- ferric chloride. (increases the sensitivity of the test).

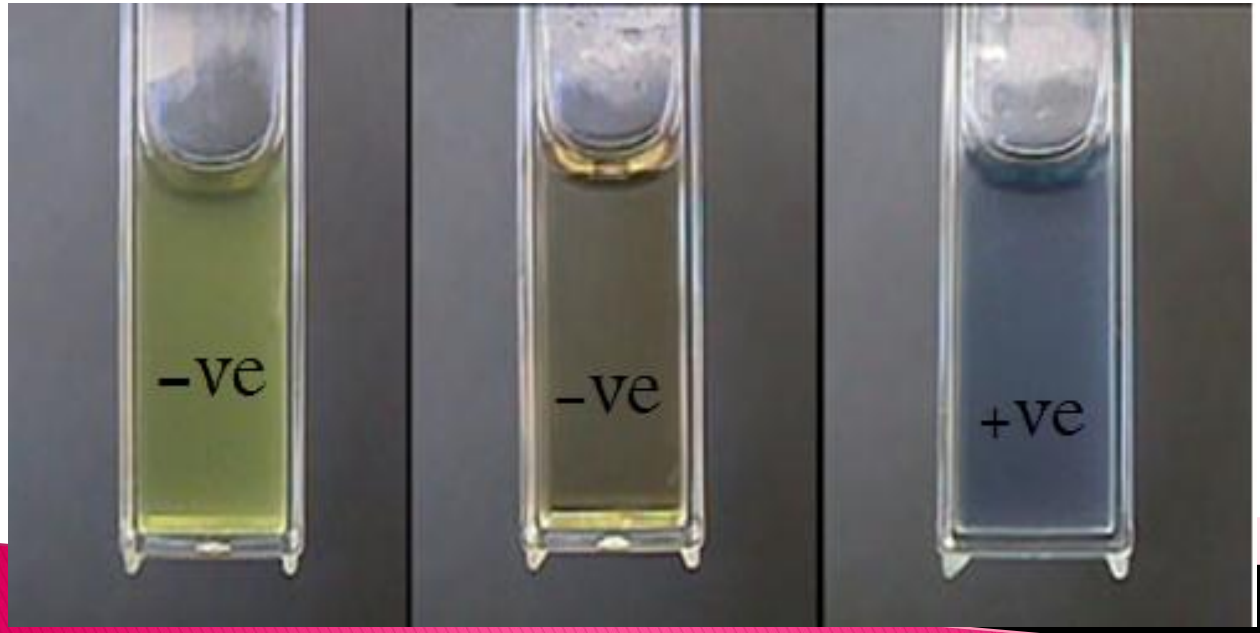
The applications of the test:

For quantitative assay of pentoses (e.g:Ribonuclic acid) in the absence of interfering substances.

Interferance:

- hexoses generally react to form green, red, or brown products.
- But all of them are negative.

The result:



Iodine Test for Polysaccharide

The principle:

Iodine forms colored adsorption complexes with polysaccharides.

This iodine color is due to coordination complex between

- the helically coiled polysaccharide chains
- and the iodine centrally located within the helix.

The Result:

Starch + Iodine → blue to black color

Dextrin + Iodine → red to violet color

Glycogen + Iodine → red to brown color

Notes:

- The iodine can be removed by extraction with ethanol or by reduction with sodium thiosulphate.
- So, the iodine is very loosely bound in the complex and that is still in the oxidized state.
- Agar and xylan suspended particles will absorb the iodine to give blue to purple colors.


Thank you!