SUGAR (Saccharides)

SUBMITTED BY-

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SUGAR

SYNOPSIS

- Introduction
- Definition
- Function
- Classification
- Properties
- Conclusion
- Summary
- References

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INTRODUCTION

- The **carbohydrates**, often termed as sugar.
- On the basis of mass, they are the most abundant class of bio molecules in nature.
- Carbohydrate are also known as saccharides. (**sakcharon = sugar or sweetness**)
- They are primarily composed of the elements, **carbon, hydrogen** and **oxygen**.
- The name of carbohydrate literally means **“hydrates of carbon”.**

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DEFINITION

- **Carbohydrate** may be defined as,

  polyhydroxyaldehydes or ketones or compounds which produced them on hydrolysis.

  The term **‘sugar’** is applied to carbohydrates should in water and sweet to taste.

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FUNCTION

- They are the most abundant dietary source of energy for all organisms.
- Carbohydrates are precursors for many organic compounds.
- Carbohydrates participate in the structure of cell membrane and cellular function such as cell growth and fertilization.
- They are structural components many organisms. These include the fiber (cellulose), of plants, exoskeleton of some insects and the cell wall of micro organisms.

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CLASSIFICATION

They are broadly classified in to 3 major groups.

- Monosaccharides
- Oligosaccharides
- Polysaccharides

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MONOSACCHARIDES

Monosaccharides : is called monosaccharides
(mono = one)
(sakcharon = sugar)

- The monosaccharides, often called simple sugars, are Compounds which possess a free aldehyde (-CHO) or ketone (=CO) group and 2 or more hydroxyl (-OH) groups.

- They are in fact the simplest sugars and cannot be hydrolyzed into smaller units.

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MONOSACCHARIDES

CLASSIFICATION

1.On the basis of functional group:-

- **Aldoses :-** When the functional group in monosacchrides is Aldehyde (-CHO), they are known as aldoses.

- **Ketoses :-** When the functional group is a keto (>C=O) group,they are known as ketoses.

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MONOSACCHARIDES

2.On the basis of no.of ‘C’ atom:-

Based on the number of carbon atoms , the monosaccharides are regarded as

* Trioses
* Tetroses
* Pentoses
* Hexoses
* Heptoses

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OLIGOSACCHARIDES

Introduction:-

- It means Greek: oligo=few ,saccharides=sugar(few sugar).
- It’s yield 2 to 10 monosaccharide molecules on hydrolysis.
- Disaccharides are the most common oligosaccharides in nature.
- It’s occurring more amount in plant rather than in animal.

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OLIGOSACCHARIDES

Classification:-

- Disaccharides
- Trisaccharides
- Tetrasaccharid
- Pentasaccharides

DISACCHARIDES:-

Introduction:-

- It is the most common oligosaccharide.
- It consists of two monosaccharide units.
- Help together by a **glycosidic bond.**
- They are crystalline , water-soluble.

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DISACCHARIDES

Classification:-

***A) Based on the reducing property.**

1) Reducing disaccharides

(with free aldehyde or keto group).

e.g. Maltose,Lactose.

2) Non-reducing disaccharides

(with no free aldehyde or keto group)

e.g. Sucrose,Trehalose

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DISACCHARIDES

*B) bases of linkage present in their molecule:-

Disaccharides

Non-reducing

C1-C1 Glycosidic Linkage (e.g. Trehalose)

C1-C2 Glycosidic Linkage (e.g.Sucrose)

Reducing

C1-C4 Glycosidic Linkage (e.g.Maltose)

C1-C6 Glycosidic Linkage (e.g.Isomaltose)

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DISACCHARIDES

SUCROSE:-(C1-C2, linkage)

- Sucrose is the common sugar of commerce and kitchen (hence, also called`household' sugar) and is widely distributed in all photosynthetic plants.

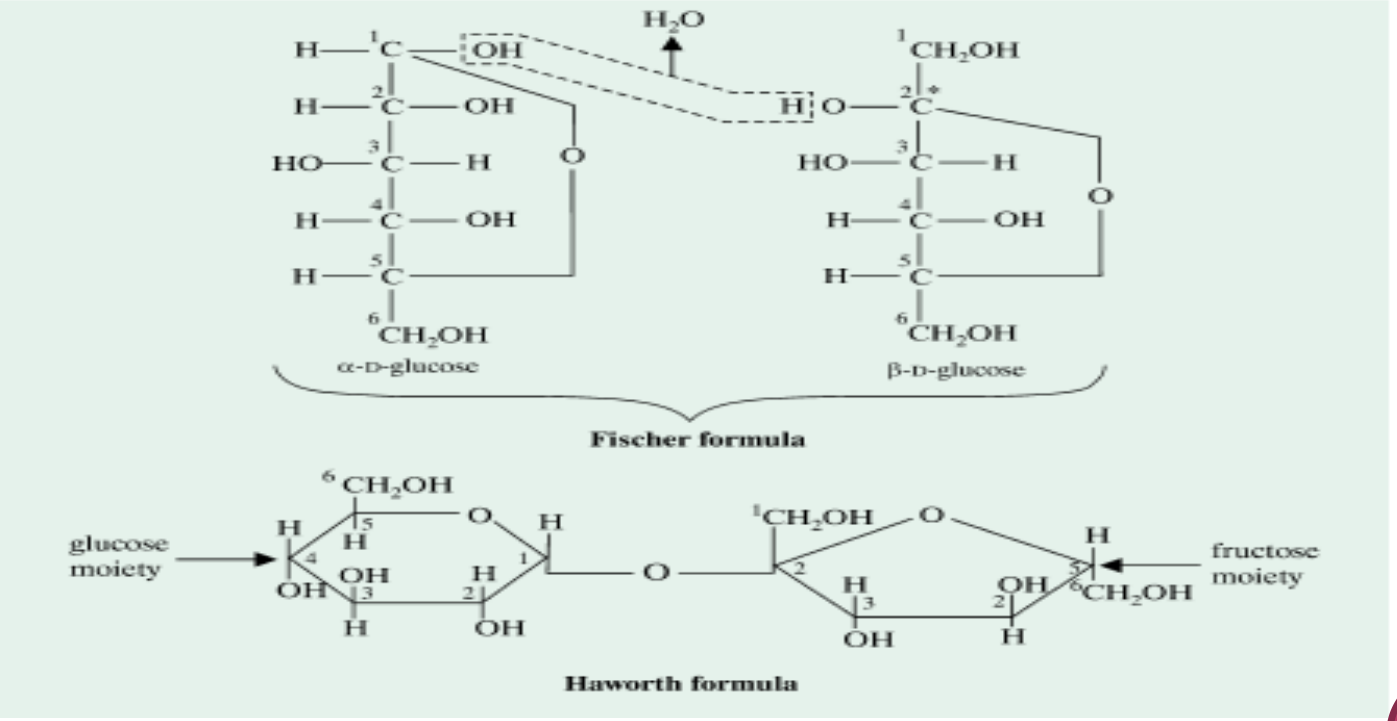

Fig. 2:- Structure of sucrose

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DISACCHARIDES

Lactose:- (C4-C1 ,linkage)

- Lactose is solely of animal origin and is found in the milk of mammals.

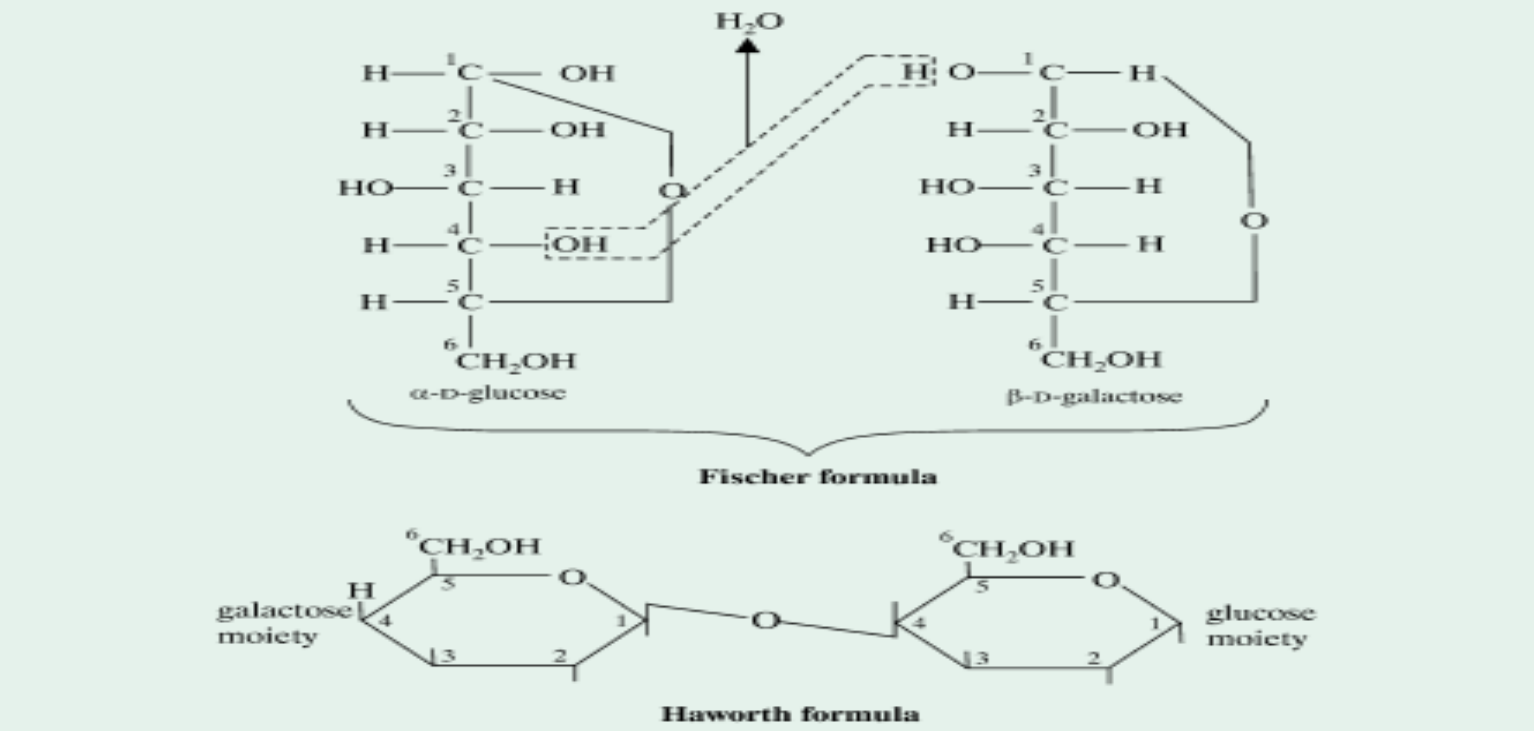

Fig.3:- Structure of lactose

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PROPERTY

General properties:-

- Monosaccharides & Disaccharides both are sweet in taste.
- Both are soluble in water.
- Both are crystalline compounds.
- Optical activity show.

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PROPERTY

Chemical property

1. Reduction
2. Reaction with phenyl hydrazine
3. Reaction with hydroxylamine
4. Fermentation

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CHEMICAL PROPERTY

1) **Reduction:-**

With strong mineral acids :-

- With *hexoses*, the reduction leads to the formation of 5-hydroxymethylfurfural,
- Which on further heating is transformed to levulinic acid.
- This reaction forms the basis of some colour tests (*e.g.*, Molisch test and Bial's orcinol testforsugars as the aldehyde products of these reactions condense with certain organic phenols to give characteristic coloured products.

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CHEMICAL PROPERTY

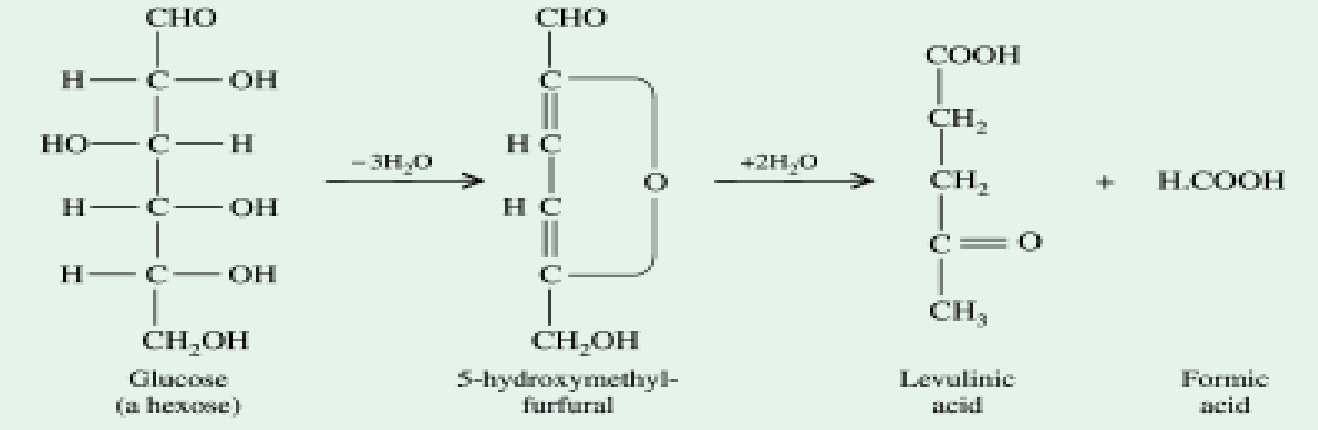

Fig : 4:- Formation of Formic acid

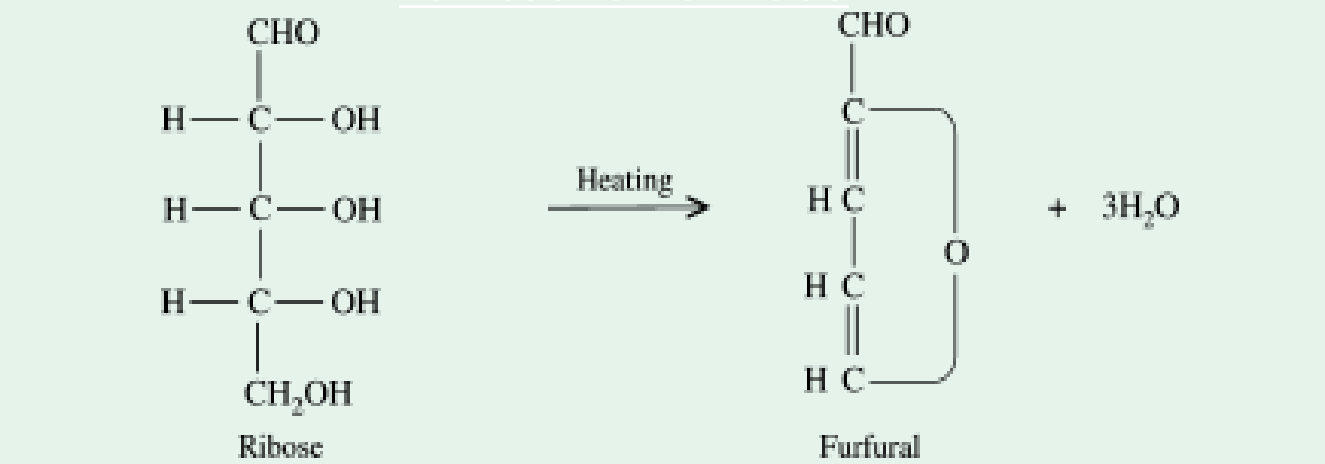

Fig: 5:- Formation of Furfural

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CHEMICAL PROPERTY

2) Reaction with phenyl hydrazine:-

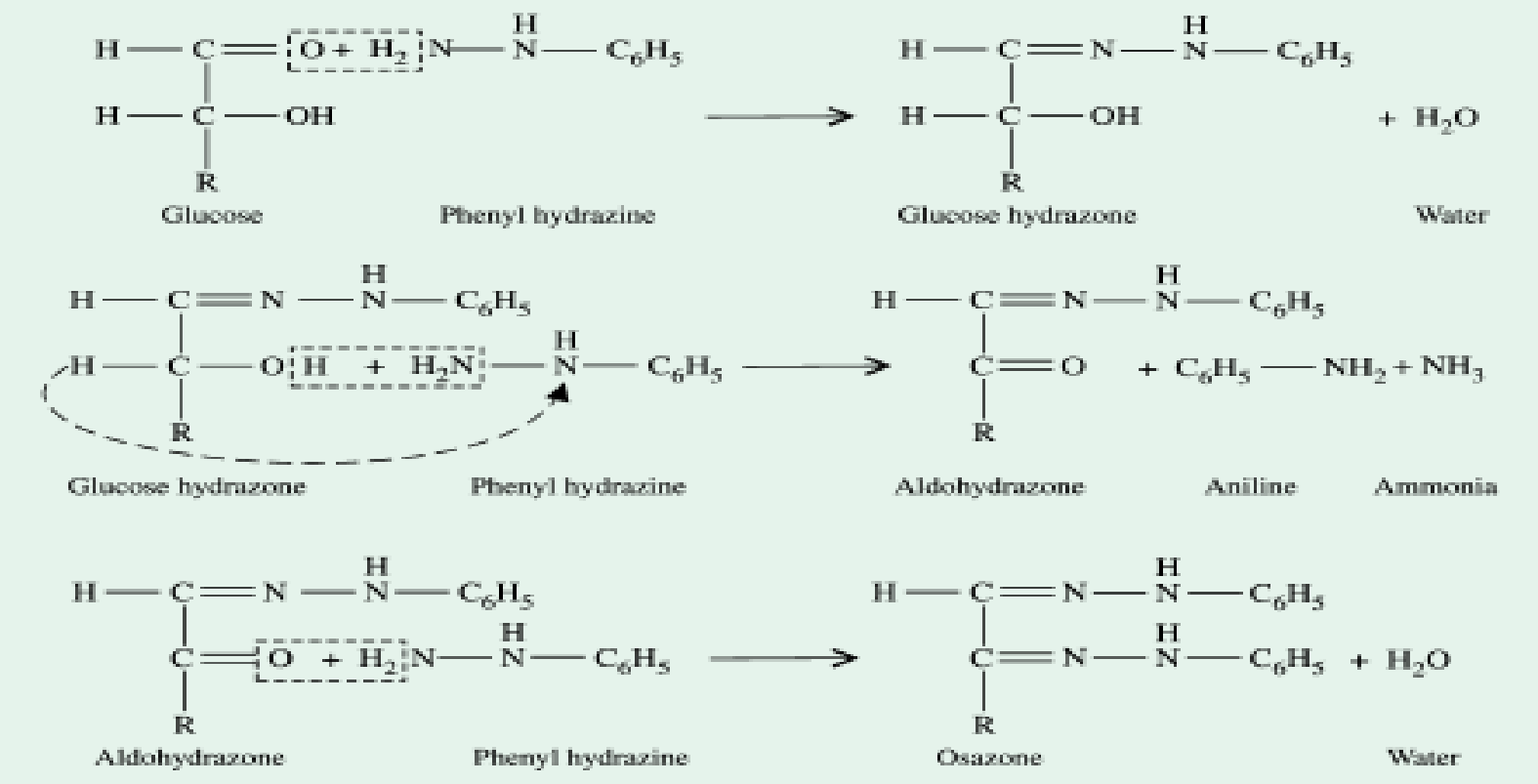

Fig.no.6:- Osazone formation

3) Reaction with hydroxylamine:-

- **Simple sugars react with hydroxylamine to yield oximes.**

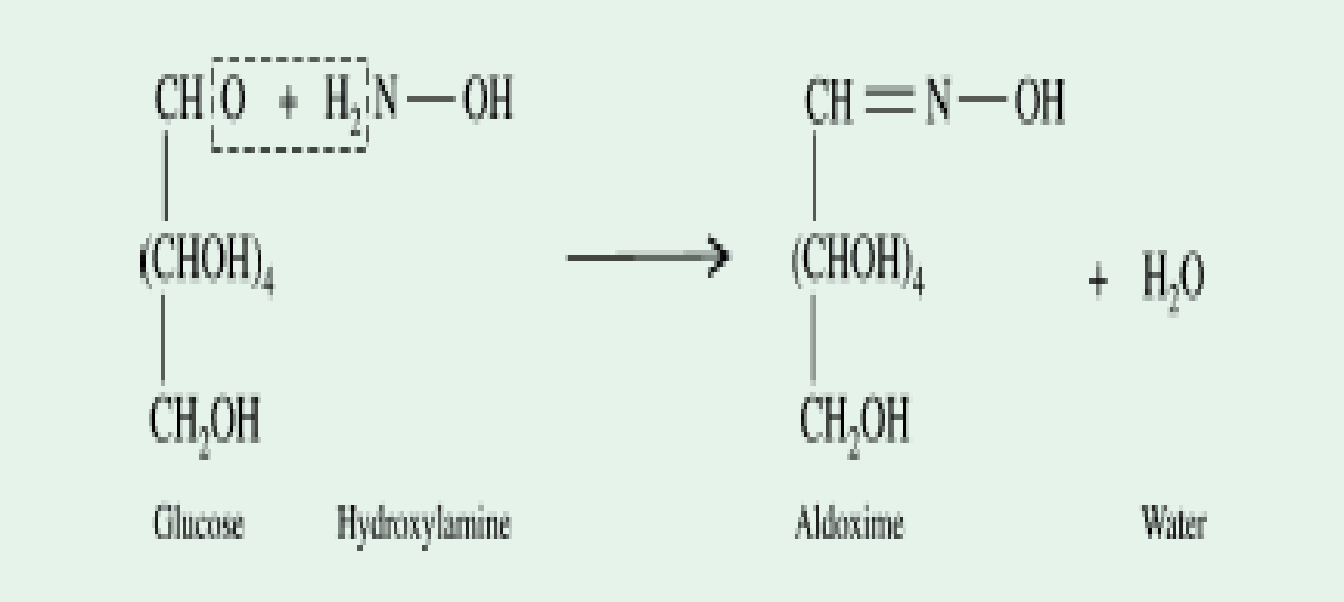

Fig.7:- Oximes formation

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CHEMICAL PROPERTY

4) Fermentation:-

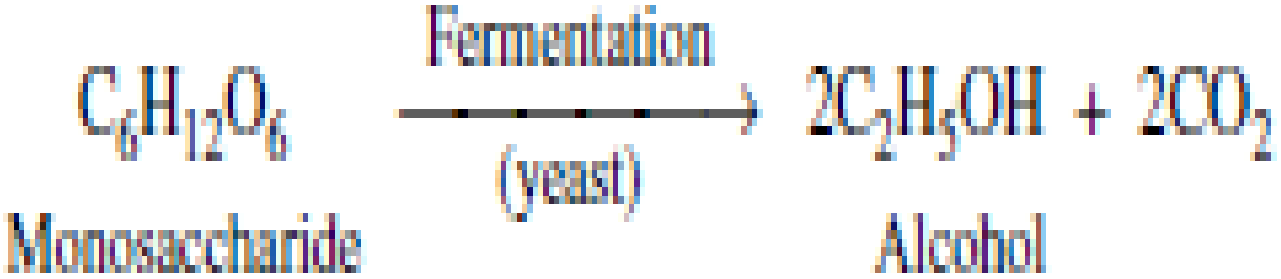

Fig. 8 :- Alcohol formation

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POLYSACCHARIDE

- These are also compound sugars and yield more than 10 molecules of monosaccharides on hydrolysis.

- Some common examples are :
- **Homopolysaccharides –**Starch, Glycogen, Inulin, Cellulose, Pectin, Chitin.
- **Heteropolysaccharides –** “Specific soluble sugar” Hyaluronic acid, Chondrotin, Heparin.

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POLYSACCHARIDE

HOMOPOLYSACCHARIDES

- These yield, on hydrolysis, a single monosaccharide. They serve as both storage (starch, glycogen,inulin) and structural (cellulose, pectin, chitin) polysaccharides.

1.STARCH

- It is the most important reserve food material of the higher plants and is found in cereals, legumes, potatoes and other vegetables.

- Natural starches consist of two components : *amylose* (15–20%), a long unbranched
- straight-chain component and *amylopectin* (80–85%), a branched chain polysaccharide.

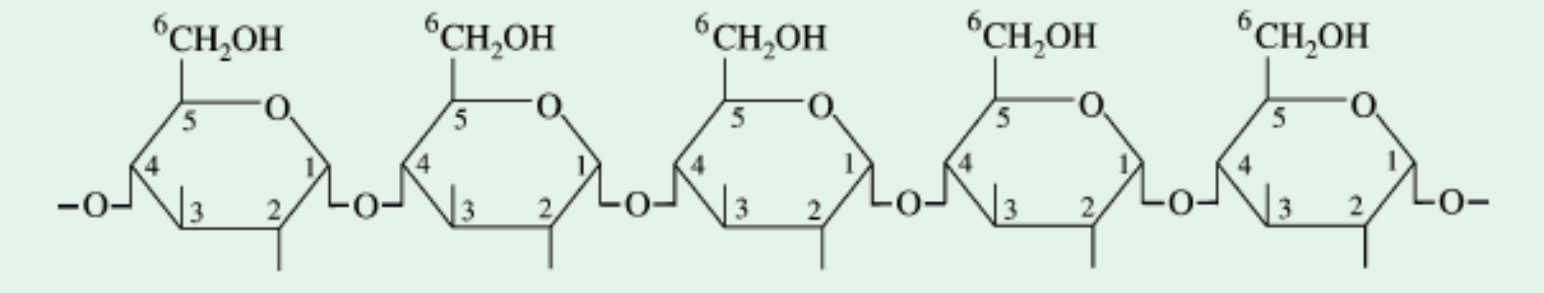

Fig: 9 :- Structure of Amylose

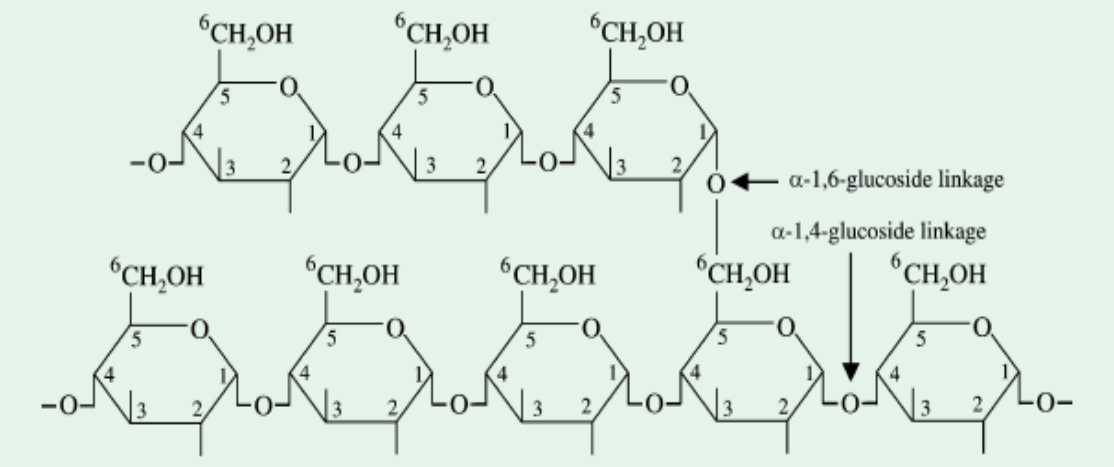

Fig:10 :- Structure of Amylopectin

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POLYSACCHARIDE

HETEROPOLYSACCHARIDES

- It is composed of a mixture of monosaccharides.
- On hydrolysis, they yield a mixture of monosaccharides.
- Heteropolysaccharides - are further classified into two types:
  - NEUTRAL SUGARS.
  - MUCOPOLYSACCHARIDES

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POLYSACCHARIDE

a.NEUTRAL SUGARS.

- This group Includes some **hemicellulose,** some **gums, mucilages & pectic substances.**

b.MUCOPOLYSACCHARIDES .

- Mucopolysaccharides are heteroglycans made up of polysaccharides made up of repeating units of sugar derivatives, namely amino sugars & uronic sugar.
- Mucopolysaccharides are essential components of tissue structure.
- Some Mucopolysaccharides are found in combination with proteins to form Mucoproteins or mucoids or proteoglycans .
- Mucopolysaccharides include hyaluronic *acid* , *chondroitin, heparin.*

HEPARIN

- Heparin is an anticoagulant (prevents blood clotting) that occurs in blood, lung, liver, kidney, spleen etc.
- Made in mast cell & released into the blood.

Heparin is composed of alternating units of N-sulfo D-glucosamine 6-sulfate & glucoronate 2-sulfate.

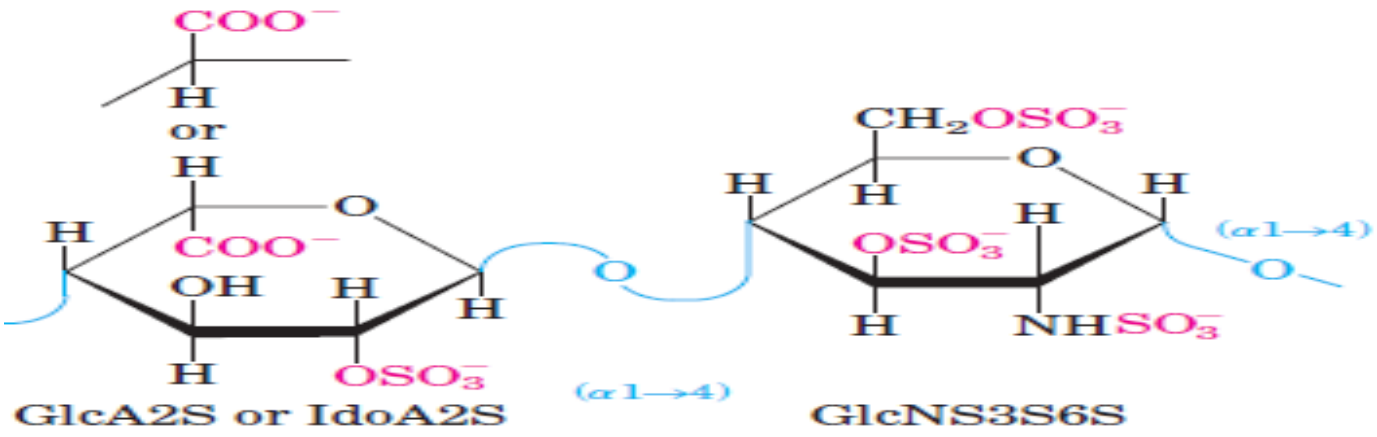

Fig:11:- Structure of Heparin

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POLYSACCHARIDE

- **Biological Importance**

- Sugar are used an energy source by the body.

- Carbohydrates are an intermediates in glycolysis .

- They are an intermediate in photosynthesis.

- Sugar involve in structure of RNA.

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CONCLUSION

- After the study of monosaccharides & disaccharides, we conclude that they are the simplest group of carbohydrate & are often referred as simplest sugars.
- Stereoisomerism is an important character of monosaccharides & show many chemical reaction.
- Polysaccharides play important role in structure & storage for plants.
- Polysaccharides are also help in cell envelope development in bacteria.
- Polysaccharides provides exoskeleton in spiders & insects.

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SUMMARY

- Carbohydrates , it’s classification & property.
- Monosaccharides, It’s classification & property.
- Disaccharides ,it’s classification & property.
- Physical properties of monosaccharides & disaccharides.
- Optical activity of monosaccharides.
- Mirror image formation.
- Chemical property of monosaccharides & disaccharides
- Oxidation ,reduction property of both.
- Polysaccharide , it’s types.

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THANKYOU