SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)
COIMBATORE-35
Accredited by NBA-AICTE and Accredited by NAAC – UGC with A++ Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

UNIT I: INTRODUCTION TO LIFE

TOPIC: **General classification and important functions of carbohydrates**

Carbohydrates:

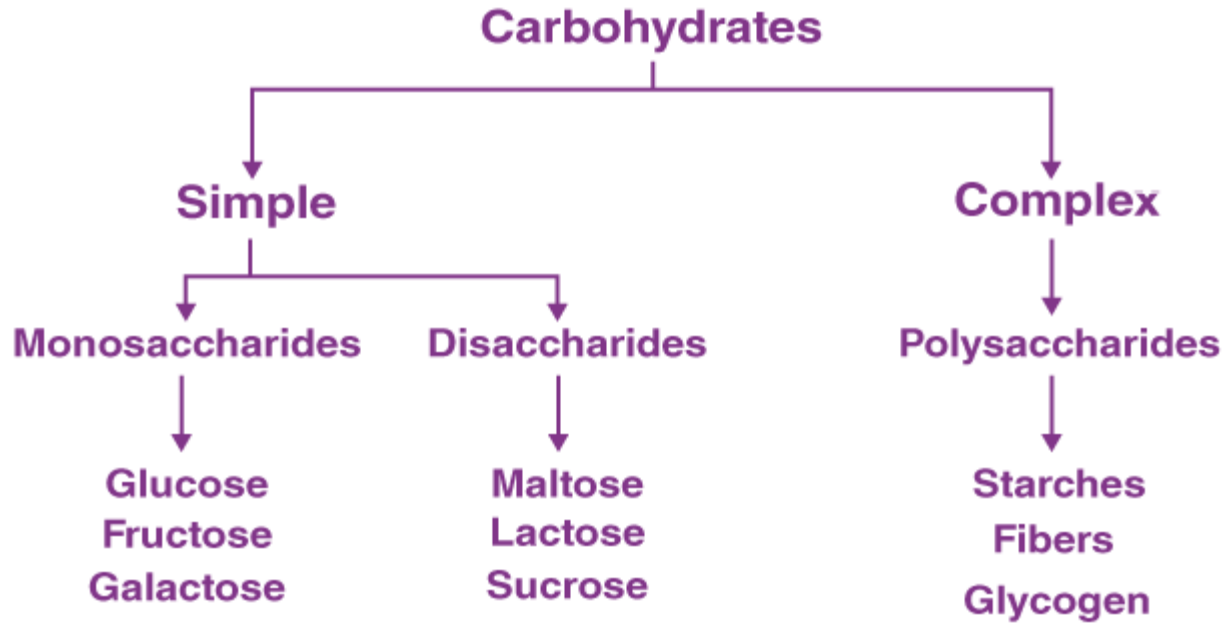The most abundant organic molecules in nature

The empiric formula is $(CH_2O)n,$ **"hydrates of carbon"**

Carbohydrates:

provide important part of energy in diet

Act as the storage form of energy in the body

are structural component of cell membranes

19GET277/ Biology for Engineers/ R.Vijayakumar/ AP / EEE

Monosaccharides

Further classified based on:

1. No. of carbon atoms

2. Functional sugar group:

Aldehyde group – **aldoses**

Keto group – **ketoses**

Generic names		Examples
3 carbons:	trioses	Glyceraldehyde
4 carbons:	tetroses	Erythrose
5 carbons:	pentoses	Ribose
6 carbons:	hexoses	Glucose
7 carbons:	heptoses	Sedoheptulose
9 carbons:	nonoses	Neuraminic acid

A Aldehyde group

$$O=C-H$$
$$H-C-OH$$
$$CH_2OH$$

Glyceraldehyde

B Keto group

$$CH_2OH$$
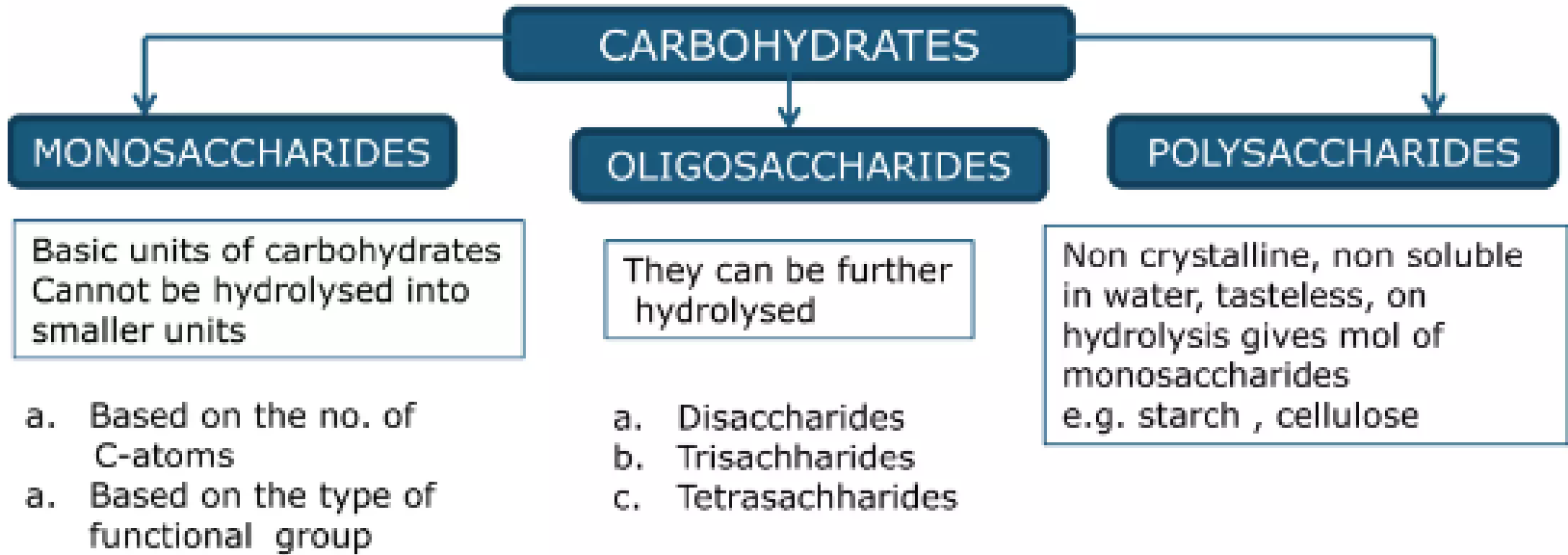$$C=O$$
$$CH_2OH$$

Dihydroxyacetone
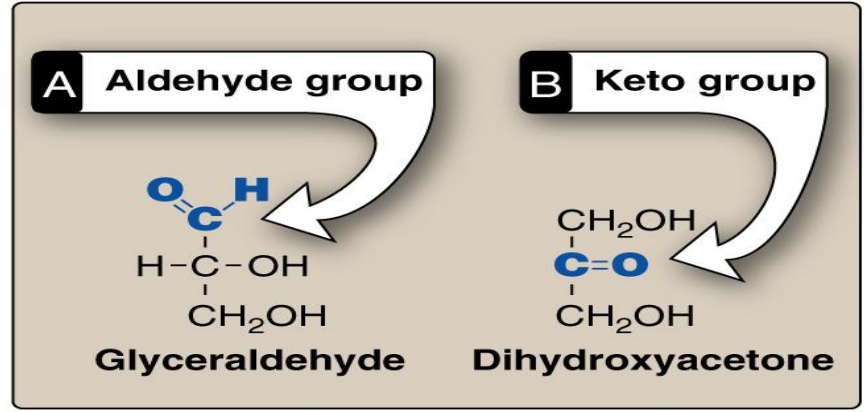
CARBOHYDRATES

Carbohydrates are the most abundant organic molecules in nature.

The term carbohydrate is derived from the French term
hydrate de carbone i.e. it is a hydrate of carbon or $C_n(H_2O)_n$

Carbohydrates are defined as organic substances having C, H & O
Wherein H and O are in the ratio 2:1 as found in H_2O

FUNCTIONS OF CARBOHYDRATES

- Most abundant **source of energy** (4 cal/g)
- **Precursors** for many organic compounds **(fats, amino acids)**
- Present **as glycoproteins and glycolipids** in the **cell memebrane** and functions such as cell growth and fertilization
- Present as structural components like **cellulose in plants**, **exoskeleton** of some insects, **cell wall** of microorganisms
- **Storage form of energy** (glycogen) to meet the energy demands of the body.

CARBOHYDRATES

MONOSACCHARIDES

Basic units of carbohydrates
Cannot be hydrolysed into
smaller units

a. Based on the no. of
   C-atoms
a. Based on the type of
   functional group

OLIGOSACCHARIDES

They can be further
hydrolysed

a. Disaccharides
b. Trisachharides
c. Tetrasachharides

POLYSACCHARIDES

Non crystalline, non soluble
in water, tasteless, on
hydrolysis gives mol of
monosaccharides
e.g. starch , cellulose

MONOSACCHARIDES

**Based on the no of C-atoms**

- **Trioses** ($C_3H_6O_3$)
  e.g. Glyceraldehyde,
      Dihydroxyacetone
- **Tetroses** ($C_4H_8O_4$)
  e.g. Erythrose, Threose

- **Pentoses** ($C_5H_{10}O_5$)
  e.g. Ribulose, Xylose
      Arabinose
  (*deoxyribose – $C_5H_{10}O_4$*)
- **Hexoses** ($C_6H_{12}O_6$)
  e.g. glucose, fructose
      galactose, mannose
- **Heptoses** ($C_7H_{14}O_7$)
  e.g. sedoheptulose
      glucoheptose

Based on the functional group

- **Aldoses** : the functional group is
  Aldehyde –CHO
  e.g. Glyceraldehyde, glucose
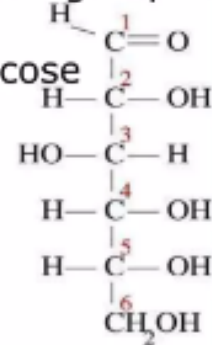
- **Ketoses** : the functional
  group is ketone
  (C = O)
  e.g. Dihydroxyacetone,
      fructose
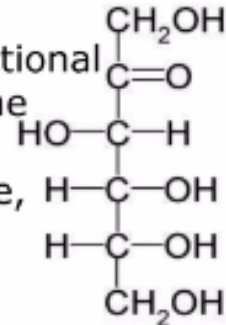
Derivatives of Monosaccharides

1. **Deoxy Sugars** :   Deoxygenation of ribose produces deoxyribose, which is a structural component of DNA

2. **Amino Sugars** :   When 1 or more –OH groups of monosaccharides are replaced by $-NH_2$ (amino group) it forms an amino sugar e.g. Glucosamine, which forms chitin, fungal cellulose, hyaluronic acid.

3. **Sugar Acid** :   Oxidation of –CHO or –OH group forms sugar acids. Ascorbic acid is a sugar acid

4. **Sugar alcohols** : Reduction of aldoses or ketoses. Glycerol and Mannitol.

OLIGOSACCHARIDES

They are formed by condensation of 2-9 monosaccharides

Depending upon the no. of monosachharide molecules they are :

a. Disaccharides (sucrose, lactose)

b. Trisaccharides (raffinose)

c. Tetrasaccharides (stachyose)

The smallest and the commonest oligosaccharides are Disaccharides

STRUCTURAL POLYSACCHARIDES

CELLULOSE

1. Occurs exclusively in plants and is the **most abundant organic substance** in plant kingdom.
2. Predominant constituent of plant cell wall.
3. **It is totally absent in animals.**

CHITIN

1. **Second most abundant** organic substance.
2. Complex carbohydrate of **Heteropolysaccharide** type.
3. Found in the exoskeletons of some invertebrates like insects and crustaceans. Provides both strength and elasticity.
4. Becomes hard when impregnated with calcium carbonate.

RECAP....

...THANK YOU