



CHAPTER#13

BIO – CHEMISTRY

Carbohydrates:-

Carbohydrates are most abundant class of organic compound. Their general formula is $C_x(H_2O)_y$. They are also called hydrates of carbon. Plants produce carbohydrates through the process of photosynthesis.



Classification of Carbohydrates:-

There are three classes of carbohydrates.

- i) Monosaccharides
- ii) Oligosaccharides.
- i) Polysaccharides.
- i. **Monosaccharides:-**

Monosaccharides are the simplest form of carbohydrates. They cannot be hydrolyzed. Their general formula is $(CH_2O)_n$. Where “n” represent 3 to 6 carbon atoms.

Those monosaccharide which contain 3 carbon atoms are called trioses.

Those monosaccharides which contain 4 carbon atoms are called tetroses.

Those monosaccharides which contain 5 carbon atoms are called pentoses.

Those monosaccharides which contain 6 carbon atoms are called hexoses.

Example:-

Glucose and fructose are examples of monosaccharides. Their molecular formula is $C_6H_{12}O_6$.

Glucose is a pentahydroxy aldehyde and fructose is a pentahydroxy ketone.

Dextro Rotatory or Dextrose Sugars:-



Some monosaccharide molecules can rotate the plane of plane polarized light to clockwise direction. These monosaccharides molecules are called dextro-rotatory or dextrose sugars.

Properties of Monosaccharides:-

- i. Monosaccharides are white crystalline solids.
- ii. They are soluble in water and have sweet taste.
- iii. They cannot be hydrolized.
- iv. They are reducing in nature.

ii. Oligosaccharides:-

Those carbohydrates which upon hydrolysis form 2 to 9 molecules of monosaccharides or simple sugars are called oligosaccharides.

Those oligosaccharides which are formed by hydrolysis of two molecules of monosaccharides (simple sugars) are called disaccharides.

Those oligosaccharides which are formed by the hydrolysis of three molecules of simple sugar are called trisaccharides.

Similarly tetrasaccharides, pentasaccharides, hexasaccharides etc are formed.

Properties:-

Oligosaccharides are white crystalline solids. They are soluble in water and have sweet taste.

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iii. Polysaccharides:-

Those carbohydrates which upon hydrolysis form 10 to 1000 units of simple sugars are called polysaccharides.

Properties:-

Polysaccharides are amorphous solid, they are insoluble in water. They are tasteless and non-reducing in nature.

Example: Starch and cellulose are examples of polysaccharides.

Sources of Carbohydrates:-

- i. Monosaccharides such as glucose, fructose and galactose are obtained from fruits, vegetables and cereals. They are also present in honey.
- ii. Disaccharide such as sucrose is obtained from sugar-cane and fruits.
- iii. Cellulose is obtained from plants. Cotton is pure cellulose.
- iv. Starch is present in cereals, wheat, barley, rice, maize, and potato.

Uses of Carbohydrates:-

- i. Carbohydrates store and transport energy in both plants and animals. 1g of glucose provides us 15.6 kJ of energy.
- ii. Carbohydrates serve as food source for most organisms.
- iii. Sucrose is a special type of carbohydrates and it is used as common table sugar.
- iv. Glucose is stored in animal muscles and liver cells in the form of glycogen. This glycogen is a long term energy source. It can be converted back to glucose when needed.
- v. Cellulose is a special types of carbohydrates and it is used by animals such as cows, cattle, goats and sheep to derive nutrition.

Proteins

Proteins are complex nitrogenous substances that produce amino acids on complete hydrolysis.

The building blocks of all proteins are amino acids therefore proteins produce amino acids on hydrolysis. The human body contains tens of thousands of different proteins.

Functions of Proteins in Human Body:-

- i. Proteins transport and store oxygen and nutrients in human body.
- ii. Proteins act as catalyst for many chemical reactions that make life possible.
- iii. Proteins regulate many important systems in human body.

Amino Acids:

Amino acids are building blocks of all proteins. Twenty different types of amino acids are involved in protein synthesis.

Non-Essential Amino Acids:

Those ten amino acids which can be synthesized by human body are called non-essential amino acids.

Essential Amino Acids:

Those ten amino acids which cannot be synthesized by human body are called essential amino acids. They must be present in our diet.

Sources of Proteins:-

- i. Most of the proteins are obtained from animals sources.
- ii. Meat, fish, eggs, milk and cheese are important sources of proteins.
- iii. Plants also provide us proteins e.g. pulses and beans are rich sources of proteins.

Uses of Proteins:-

- i. Proteins provide us amino acids which are used to make muscles, hair, enzymes and they repair body tissues.
- ii. Proteins are essential for the formation of protoplasm and component of cells.
- iii. Proteins are essential for physical and mental growth in children.
- iv. A very special protein known as gelatin which is obtained by heating bones and tendons in water. It is used in bakery products.



- v. Enzymes are special proteins which are used as a catalyst for many biological reactions.
- vi. The anti-bodies that help us to fight against diseases are protein molecules.

Question:-

What kind of solution is used in drips to give those patients who are unable to eat?

Ans: 5% m/v aqueous solution of dextrose is used in drips. 5% m/v aqueous solution means 5 grams of dextrose dissolved in water to form 100 cm³ of solution. This solution is given to a patient who is severely dehydrated or a patient that is unable to eat or who is not allowed to eat.

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Vitamins:-

Vitamins are specific organic compounds which are required by our body to prevent specific diseases. Vitamins are not produce by our body. Therefore they must be present in our diet.

Different types of Vitamins

Vitamins A:

It is very important in the process of vision. It helps in the chemical transmission of images from the eye to the brain. It also keeps the cornea moist.

Vitamins C:

It is required for formation of blood. It also protects us from certain illness such as common cancer.

Vitamins B:

It is useful to regulate nerve impulse. It is used in the formation of Homeoglobin.

Vitamins D:

Vitamins “D” are very important for proper growth of bones & teeth. It also regulates the amounts of calcium in our body.

Fat Soluble Vitamins:-

A vitamin that dissolves in fat is called fat soluble vitamin. Vitamin A, D, E and K are examples of fat soluble vitamins. Taking on excess amount of fat soluble vitamins A can cause dry skin and feeling of pressure inside the head. An excess amount of vitamin D can cause pain in bones, kidneys and weight loss.

Water Soluble Vitamins:-

A vitamin that dissolves in water is called water soluble vitamin. Vitamin B (complex) and vitamins C are examples of water soluble vitamins. These vitamins are not toxic even if they are taken in excess amount.

Lipids:-

A lipid is any component of plant or animal tissue that is insoluble in water but soluble in low polarity solvents such as ether, benzene, hexane and carbon tetrachloride. There are four major components of lipids.

- i) Fats and oils. ii) Cholesterol iii) Component of cell membrane (phospholipids).
- ii) Vitamins such as A, D, E and K.

Sources of Lipids:-

- i. Animals, plants and marine organism such as whales and salmon are rich sources of lipids.

- ii. Milk is an important sources of animal fat from which butter, ghee and cheese are obtained.
- iii. Seeds of many plants such as sunflower, corn, cotton, ground nut, coconut and olive oil are good sources of lipids. (Vegetable oils)

Uses of lipids:-

- i. Butter, ghee and vegetables oils are used for cooking and frying of food. They are also used in preparing bakery products and sweets.
- ii. In mammals a layer of fat is present under the skin this layer act as thermal insulator.
- iii. A layer of fat around our heart and kidneys protect these organs from injury.
- iv. Lipid provide some important vitamins such as A, D and E. These vitamins are very important for our health.
- v. Fats and oils are used for the manufacture of soaps and detergents.
- vi. Vegetable oils are converted into vegetable ghee by a special process known as catalytic hydrogenation.

Q. When a lipid is called fats and when a lipid is called oil?

Ans:- A lipid is called fat if it is solid at room temperature and a lipid is called oil if it is liquid at room temperature.

Q. What kind of deficiencies is caused by the lack of proteins and vitamins?

Ans:- An extreme lack of proteins and vitamins causes a deficiency disease called Kwashiokor. The symptoms of this disease include retarded growth, discolouration of skin and hair, a swollen belly and mental apathy.

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Q. How the amount of cholesterol in eggs can be decreased?

Ans:- From different experiments it has been found that feeding hens a diet containing a lot of flax seeds lowers the amount of cholesterol in eggs.

Q. Does any kind of cholesterol comes from vegetable products?

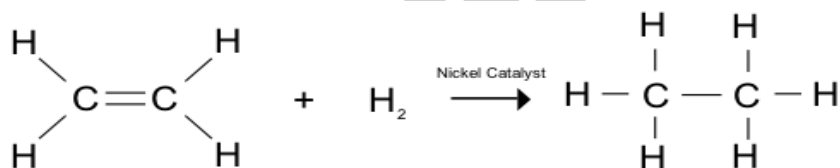
Ans: All the cholesterol in human diet comes from animal products such as milk, meat, cheese, and eggs. No vegetable product contains cholesterol.

Hydrogenation:-

Addition of hydrogen to an alkene is called hydrogenation. This reaction takes place in the presence of (Ni, Pd, or Pt) as catalyst.

This reaction is used to make margarine or vegetable ghee. Fatty acid component of vegetable oil contain carbon – carbon double bond. When hydrogen is added to these oils then as a result of a chemical reaction (hydrogenation) these oils

become saturated and harder.



Chemical reaction:-

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Nucleic Acids:-

Nucleic acids are a special class of nitrogen containing compounds present in the nuclei of cells. Nucleic acids are very important component of life. They are found in every living cell. They serve as the information and control centers of the cells. They were first obtained from the pus of infected wounds.

Nucleic acids are long chain molecules made up of Nucleotides and each nucleotide consist of three components.

- i. Nitrogenous base
- ii. A pentose sugar (five carbon atoms)
- iii. Phosphate group

Types of Nucleic Acids

There are two types of nucleic acids.



- i. Deoxyribonucleic acid (DNA)
- ii. Ribonucleic acid (RNA)

i. Deoxyribonucleic Acid (DNA):-

DNA exist in the form of two strands twisted around each other in a spiral formation. This spiral formation is called double helix. Each strand of DNA is made up of Deoxyribose sugar, phosphate unit and a nitrogen base. The strands of DNA are held together by hydrogen bonds. DNA store genetic information and pass it on from one generation to the next generation.

ii. Ribonucleic Acid (RNA):-

RNA exists in the form of single strand. It consists of three major components.

- i) Ribose sugar
- ii) Phosphate unit
- iii) Nitrogen base

RNA is responsible for synthesis of new proteins. RNA receives, reads, decodes and uses genetic information from DNA to synthesize new proteins.