

# **Pharmacognosy – I**

**[ Unit – 8 ]**

**(Section-A)**

**[ Carbohydrates & derived products ]**



**BY: MD. SHAKEEL ALAM**

**( ASSISTANT PROFESSOR )**

**S.N.S. COLLEGE OF PHARMACY, MOTIHARI**

## CARBOHYDRATES

The Carbohydrates includes simple sugars and poly saccharides. They are carbonyl alcohols containing the element Carbon, Hydrogen, And Oxygen. The last two elements are usually present in some proportion as in water. Carbohydrates are the primary product of photosynthesis and form them the plant synthesizes various chemical constituents by subsequent organic reactions. They are most abundant component of both plants (cellulose, starch, sugar) and animals (glycogen). Sugar are united with many compounds to form glycosides.

- Group of compounds composed of carbon, oxygen, and hydrogen

Examples:  $(\text{CH}_2\text{O})$  Hydrates of carbon

$(\text{CH}_3\text{COOH})$  Acetic Acid

$(\text{CH}_3\text{-CHOHCOOH})$  Lactic Acid

- It is defined as polyhydroxy aldehydes or polyhydroxy ketones that on hydrolysis produce either of the above.
- They are substance of universal occurrence and are much abundant in plant, rather than in animals.
- Carbohydrates are divided into Two parts

Simple sugar (Saccharides)

Polysaccharides

- Simple Sugar:** - (low molecular weight, less energy produce)  
It is crystalline soluble in water, Sweet in taste  
e.g. Glucose, Fructose, and Sucrose
- Polysaccharides** (High molecular weight t and also more energy produce)  
It is amorphous, tasteless & relatively less soluble in water.  
e.g. Starch, Cellulose, Gums, Pectin

### Saccharides

Monosaccharides

Disaccharides

Trisaccharides

- Monosaccharides:** -

It has sugar, which cannot be further hydrolyzed to simple sugar.

e.g. Bioses  
Trioses  
Tetroses  
Pentoses

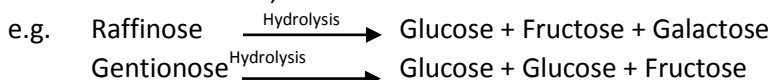
- Disaccharides:** -

Which upon hydrolysis two molecules of monosaccharides are called as disaccharides.

e.g. Sucrose  $\xrightarrow{\text{Hydrolysis}}$  Glucose + Fructose  
Maltose  $\xrightarrow{\text{Hydrolysis}}$  Glucose + Glucose  
Lactose  $\xrightarrow{\text{Hydrolysis}}$  Glucose + Galactose

## c) Trisaccharide: -

As the name indicates, these liberates 3 molecules of monosaccharides on hydrolysis.



## ❖ Polysaccharides: -

- When hydrolysis they give an indefinite no. of mono saccharides.
- By Condensation  $\xrightarrow{\text{Elimination}}$  water
- Polysaccharides are produced from monosaccharides.

**CHEMICAL TESTS FOR CARBOHYDRATES****1. Fehling's Solution test:**

The substance is heated with dil. HCl to hydrolyzed a polysaccharide. The reaction mixture is neutralized by addition of sodium hydroxide solution and then Fehling's solution 1 & 2 is added. Red precipitate of cuprous oxide is produced on heating in case of reducing sugar (all monosaccharides and many disaccharides like lactose, maltose, cellobiose and gentiobiose) Non reducing sugars including some disaccharides (sucrose & trihalose) which on boiling with acid are converted into reducing sugars.

**2. Molisch Test:**

A solution of carbohydrates is prepared in water containing  $\alpha$ -naphthol. On addition of conc.  $\text{H}_2\text{SO}_4$  Along with the side of test tube a purple ring is formed on the junction blew aqueous layer. With insoluble carbohydrates (e.g. Cellulose) the color is produced on shaking the reaction mixture.

**3. Osazone Formation:**

A sugar on heating with phenyl hydrazine HCL, sodium acetate, and acetic acid forms yellow crystal of osazone.

**4. Test for pentose:**

A solution of material is heated with aqueous volume of HCl containing a little phloroglucinol. A red color is formed in case of pentose.

**5. Keller Kiliani test for Deoxy sugars:**

A deoxy sugars (found in Cardiac Glycosides) is dissolved in acetic acid containing a trace of ferric chloride and transferred to the surface of conc.  $\text{H}_2\text{SO}_4$ . A reddish-brown color is formed at the junction which turns blue latter on.

**6. Furfural Test:**

A carbohydrates sample is heated in a test tube with a drop of syrupy phosphoric acid to convert it into furfural. A disk of filter paper moistened with a drop of 10% solution of aniline in 10 % acetic acid is placed over the mouth of the test tube. the bottom of the test tube is heated for 30-60 Seconds. A pink or Red stain appears on the reagent paper.

# AGAR

## Synonyms:

Agar-agar, Japanese isinglass.

## Biological source:

Agar is the dried, hydrophilic, colloidal polysaccharide complex extracted from various species of genus *Gelidium* like [*Gelidium Cartilagineum* Linn], [*Gelidium Amansii*]

## Family:

Gelidiaceae

## Geographical source:

Agar is obtained mainly from Japan, Korea, South Africa, U.S.A., China, Indonesia, Australia and India.

## Morphological Characteristics

- Color- colour less or pale yellow
- Taste- mucilaginous
- Odour- slight/odourless
- Solubility- soluble in inorganic solvents, insoluble in water.

## Chemical Constituents:

- On hydrolysis agar gives Galactose.
- It is heterogenous polysaccharides, agarose- responsible for gel strength.
- It also contains L-Galactose and D- Galactose.

## Uses:

1. It is used as a bulk laxative (an agent to induce active movement of the bowels) and
2. In chronic constipation (unmanageable constipation). Generally, it is given in combination with other Anthraquinones vegetable drugs.
3. In the preparation of vaginal capsules and suppositories (a cone shaped capsule like structure with the medicine in it, to be introduced into rectum, urethra or vagina).
4. To prepare nutrient media in bacteriological culture.
5. In industrial applications like emulsion, silk textiles, adhesives and thickening ice-cream.

## GUAR GUM

### Synonyms:

Guar Flour, Jaguar, Jaguar gum

### Biological source:

Guar gum obtained from the refined endosperm of the seeds of [Cyamopsis tetragonolobus Linn]

### Family:

Leguminosae.

### Geographical source:

It is commercially grown in India, Pakistan, and U.S.A. and to limited extent in South Africa, Brazil and Australia. In India, Rajasthan is the major guar-gum growing state.

### Morphological Characteristics:

- Colour- white or yellowish white.
- Odour -odourless.
- Taste-Characteristic/gummy
- It is soluble in cold and hot water and forms neutral colloidal solution.
- Guar gum is insoluble in alcohol, oils hydrocarbons, ketone, etc.
- Guar gum contains muchthickening capacity than starch.

### Chemical constituents:

- Carbohydrate
- Gum-Guaran, the water-soluble portion of the gum and yields on hydrolysis galactose 35% and mannose 60-65%.
- Also contains small quantity of protein.

### Uses:

1. Used as binding agent and disintegrating agent in tablet formulations.
2. In bulk laxatives.
3. It is used in peptic ulcer therapy.
4. It also reducing blood glucose concentration in diabetic patients and serum concentration in hyper lipidaemia.
5. It is a good emulsion stabilizer.
6. Paper manufacturing
7. Printing, polishing, textiles and also used in food and cosmetic industries.

**ACACIA****Synonyms:**

Gum Arabic, Gum acacia, Babul and Gondu.

**Biological source:**

It consists of the dried gummy exudation obtained from the stem and branches of [Acacia Arabica Wild]. (Acacia Senegal)

**Family:**

Leguminosae.

**Geographical source:**

It is found in Sudan, India, Morocco, Sri Lanka and Africa.

**Morphological Characters**

- Size – variable
- Color – colorless or slightly yellowish
- Fracture – brittle
- Fracture surface – smooth/glossy
- Odour- odourless
- Taste – mucilaginous

**Chemical constituents:**

- Polysaccharide Arabin (Mixture of calcium, magnesium and potassium salts of arabic acid).
- Arabic acid on hydrolysis gives D-galactose, L-arabinose, L-rhamnose and D-glucuronic acid.
- Also contain enzyme oxidase and peroxidase.

**Uses:**

1. Demulcent.
2. Emulsifying agent.
3. Suspending agent.
4. Binding agent.
5. Used in inflammation of intestinal mucosa.
6. Used to cover inflamed surfaces such as burns, sore nipples, etc.
7. Used in the manufacture of adhesive and ink.

# HONEY

**Synonyms:**

Madhu (Hind), Honey

**Biological source:**

Honey is the saccharine liquid prepared from the nectar of the flowers by the hive-bee [Apis mellifica] and bees of other species of Apis.

**Family:**

Apidae

**Geographical source:**

Honey is produced in certain parts of West Indies, California, Chile, Africa, Australia, and New Zealand and also in India.

**Description:**

- Honey is viscid, translucent, and white to pale yellow or yellow brown- coloured liquid. On keeping it crystals of glucose separate. Odour is pleasant and characteristic and taste is sweet.
- The odour and taste depend on the flowers from which nectar is sucked.

**Chemical constituents:**

- ❖ Honey consists chiefly a mixture of dextrose and laevulose (70-80%) and water (14-20%). contains sucrose (1.2-4.5),
- ❖ Dextrin (0.06-1.25%), volatile oil, pollen grains enzymes
- ❖ Vitamins
- ❖ Amino acids
- ❖ Proteins
- ❖ Colouring matters, etc.

**Uses:**

- Honey is used as nutritive.
- Demulcent
- Mild laxative.
- It is used as an important component of linctuses and cough mixtures.
- It is a sweetening agent.
- It is used as antiseptic and bactericidal.
- This is also used as a vehicle in Ayurvedic and Unani preparations.
- As a pill recipients

# ISABGOL

## Synonyms

Ispaghula, Isapgol, Spogel seeds, Isabghol.

## Biological source:

It consists of dried seeds of [Plantago ovata Forsk]

## Family:

Plantaginaceae.

## Geographical source:

Plant is cultivated largely in Gujarat, Punjab, Southern Rajasthan, Maharashtra and Karnataka. The variety *P. psyllium* Linn is cultivated in Spain, Cuba and France.

## Morphological Characteristics

Size- 1 to 3.5 mm length and 1 to 1.75 mm wide

Shape – ovate and boat shaped

Odour – odourless

Taste – Mucilaginous.

## Chemical Constituents:

- Ispaghula seeds contains 10-30% of hydrocolloids.
- Chemically, it contains pentosan and aldobionic acid, Rhamnose, arabinose and galactouronic acids are hydrolyzed products of mucilage.
- Fixed oils and proteins are also present in the drug.

## Uses:

- Demulcents.
- It is used in treatment of chronic constipation.
- It is used in chronic dysentery of amoebic and bacillary origin.
- It is used in chronic diarrhea.
- It is also used as a stabilizer in ice cream industry.
- Recently, it is used in the preparation of creams, lotions, soft drink and candies also.



# PECTIN

## Synonyms:

Pectin

## Biological source:

Pectin is a purified polysaccharide substance obtained from the various plant sources such as inner peel of citrus fruits, apple, raw papaya, etc.

## Geographical source:

Lemon and oranges are mostly grown in India, Africa and other tropical countries. Apple is grown in the Himalayas, California, many European countries and the countries located in the Mediterranean climatic zone

## Preparation

Pectin present in the cell wall is insoluble in nature known as prospecting, when the fruit pulp is treated with dilute acid at 90°C and pH 3.5-4 for 30 minutes. The solution is filtered and alcohol is added to filtrate, pectin precipitates out. This is separated and dried under reduced pressure.

## Morphological Characters

- Pectin is available as coarse or fine powder
- Colour - yellowish white
- Taste - mucilaginous
- Odour – odourless
- With water it forms colloidal solution
- It is mild acidic in nature
- It is stable at slightly acid pH

## Chemical constituents:

- Chemically pectins are polygalacturonic acids in which some of the carboxyl groups are present as methyl esters.
- Pectic acid is an aldobionic acid, which on hydrolysis gives galacturonic acid, arabinose, galactose, and methyl pectose.
- Pectin is a methoxy ester of pectic acid. It is hydrolysed by pectase or dilute caustic soda, produce pectic acid and methyl alcohol, component of pectin and cellulose. It is insoluble in water.
- Alkaline hydrolysis of pectose forms pectin and cellulose.

## Uses:

- ❖ It is used in the treatment of diarrhea and gastroenteritis.
- ❖ It is used in the treatment of wounds (2% sterile solution).
- ❖ As a substitute for blood plasma.
- ❖ In conjugation with kaolin as an absorbent of intestinal toxins. .
- ❖ To dampen and mask the taste.

# STARCH

## Synonyms:

Amylum.

## Biological source:

Starch consists of polysaccharide granules obtained from the grains of

Maize - Zea mays Linn

Rice - Oryza sativa Linn

Wheat - Triticum aestivum Linn

## Family:

Solanaceae

## Geographical source:

Starch is commercially produced in tropical and subtropical countries. Argentina, U.S.A, China, India and Japan are the main starch producing countries of the world.

## Preparation

Depending upon the raw material to be used for processing or type of the starch to be produced, different processes are used for the commercial manufacture of starch.

**Potato Starch:** The potatoes are washed to remove the earthy matter. They are crushed or cut and converted into slurry. Slurry is filtered to remove the cellular matter. As potatoes do not contain gluten, they are very easy to process further. After filtration, the milky slurry containing starch is purified by centrifugation and washing. Then, it is dried and sent to the market.

**Rice Starch:** The broken pieces of rice resulted during the polishing are used for processing. The pieces of rice are soaked in water with dilute sodium hydroxide solution (0.5%), which causes softening and dissolution of the gluten. After this, the soaked rice pieces are crushed and starch prepared as described under potato starch.

**Wheat Starch:** Wheat being the major article of food is restrictedly used for preparation of starch. In this process, the wheat flour is converted into dough and kept for-a-while. The gluten in the dough swells and the masses are taken to grooved rollers, wherein water is poured over them with constant shaking. The starchy liquid coming out of the rollers is processed conveniently to take out the starch, which is then dried and packed suitably.

**Description:**

- Colour – Rice and maize grains are white, while wheat is cream colored and potato is slightly yellowish in color
- Odour – Odourless
- Taste – Mucilaginous
- Shape – Starch occur in fine powder, irregular, angular masses, readily reducible to powder

**Chemical constituents:**

- Starch contains generally a mixture of two polysaccharides, amylopectin ( $\alpha$ -amylose) and amylose ( $\beta$ -amylose).
- Amylopectin it is the main constituent of most of the starches (more than 80%) and is present in outer parts of granules. It contains both straight chained and branched glucose unit. It is insoluble in water and is responsible for gelatinizing property. It gives bluish black colour with iodine solution.
- Amylose most starches contain 20% amylose. It contains straight chained glucose units and is present in inner parts of granules. It is soluble in water and produces blue colour with iodine solution.

**Identification Tests**

Boil 1 g of starch with 15 ml of water and cool. The translucent viscous jelly is produced. The above jelly turns deep blue by the addition of solution of iodine. The blue colour disappears on warming and reappears on cooling.

**Uses:**

- It is mainly used as a dusting powder.
- As a Pharmaceutical aid.
- Used as an antidote for iodine poisoning.
- Source of Food-nutrition.
- Protective and demulcent.
- Used as Absorbent
- as a disintegrating agent in pills and tablets
- Glycerin of starch is used as an emollient and as a base for suppositories
- It is the starting product from which liquid glucose, dextrose, dextrin are made.
- Acts as a basis for identification of drugs in Pharmacognosy.

## STERCULIA

### Synonyms:

Indian Tragacanth, Bassore Tragacanth, Kadaya, Kullo, Gum Karaya, Karaya Gum

### Biological source:

Sterculia is the dried gummy gummy exudate of the tree [Sterculia Urens]

### Family:

Sterculiaceae

### Geographical source:

The tree is found in Pakistan and South Africa, in India (Guajrat, Maharastra, Madras, Rajasthan M.P. and Chota Nagpur)

### Morphological Characters

- Color : White, pink or brown
- Odour : Slight
- Taste : Mucilaginous
- Shape & size : Irregular Tears

### Chemical constituents:

Sterculia gum consists heteropolysaccharide with a high composition of D-galacturonic acid and D-glucuronic acid, also contain D-tageetose, D-galactose and rhamnase small amount.

### Uses:

- ❖ Bulk Laxative
- ❖ Emulsifying and suspending agent
- ❖ Dental adhesives
- ❖ Thickening agent
- ❖ Used in skin lotions, textiles and printing industries
- ❖ Preparation of food products
- ❖ Also used in building materials and other preparations
- ❖ Powdered gum is used in lozenges, powders preparations of dentals

## TRAGACANTH

### Synonyms:

Gum Tragacanth, Hindi-Anjira.

### Biological source:

Tragacanth is dried gummy exudation obtained from the stem of [*Astragalus gummifer* Labill], and certain other species of *Astragalus*

### Family:

Leguminosae.

### Geographical source:

It is a native of Southern and Eastern Europe. The plant is widely distributed in Iran, Afghanistan, Iraq, Syria, Anatolia and India. In India, few species of *Astragalus* are available in Garhwal, Shimla, and Kashmir and Hilly region of Kumaon.

### Macroscopical characters:

- Colour-white or pale yellow
- Size-it coours in the form of ribbon sixe about 25x12x2.5 cm
- Taste-Mucilaginous
- Odour-None/odourless

### Chemical constituents:

It contains a complex polysaccharide carbohydrate.

- Water-soluble Tragacanthin (30-40%)
- Water insoluble Bassorin (60-70%)

Tragacanth consists of

- ❖ tragacanthic acid + (galacturonic acid + xylose + fructose + galactose) and
- ❖ Arabinogalactan + (arabinose + galactose + galacturonic + Rhamnose in small quantities).
- ❖ It is also contains 3% starch and cellulose.

### Uses:

- It is used as a demulcent (soothing).
- Suspending agent.
- Binding agent.
- Emulsifying agent.
- Laxative.
- It is used in adhesive
- In textile industry.