

Day - Wednesday

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UNIT - 4th

Traditional / Indigenous System of Medicine

प्राचीन चिकित्सा भारतीय चिकित्सा

Modern System or Allopathy

- This system was developed in the Western countries.
- In this system drugs (tablets, capsule, injections, tonics etc) are manufactured using synthetic chemicals and derived from natural products like plants, animals, minerals etc.
- This system also uses modern equipment for diagnosis, analysis & surgery etc.
- Medicines of this system is often criticised for its treatment of symptoms rather than the cause of the disease, harmful side effects of certain drugs and for being out of reach of poor people due to the high cost of drugs and treatment.

Traditional Medicine

WHO defines traditional medicine as including diverse health practices, approaches, knowledge and beliefs incorporating plant, animal, and mineral based medicines, spiritual therapies, manual techniques and exercises which can be used to maintain well-being, as well as to treat, diagnose or prevent illness.

Types of Traditional System of Medicine

1. Ayurveda
2. Yoga (Naturopathy)
3. Unani
4. Siddha
5. Homeopathy
6. Yoga and naturopathy are drugless therapies.

AYURVEDA SYSTEM

- The term "Ayurveda" is derived from two Sanskrit words, Ayur and Veda.
- Ayur means life and Veda means knowledge or science.
- Therefore Ayurveda means science of life or way of life.
- Ayurveda basically science depends upon the religion and philosophy.
- Besides dealing with principles for maintenance of health, it is also developed a wide range therapeutic measures to combat illness.

Principle-

- The principle of Ayurveda is based on the concept of five basic elements and tridoshas.
- According to Ayurveda, the whole universe made up of five basic elements or Pancha Mahabhutas.

- The whole universe includes the material world, plant kingdom and all other living beings.
- In other words, these five elements together form the basis of all matter.
- The five elements are - Akasha (ether), Vayu (air), Agni (fire), Jala (water), Prithvi (earth).
- These five elements are responsible for a healthy life and if these elements are imbalanced and cause of different diseases.

• Ether (Akasha) - Ether is non resistance, it is located in the body cavities like mouth, thorax, abdomen, lung cavity, digestive tract.

• Air - It is related to movements, vibrations and oscillations.

They manifest movement of heart, expansion of muscle, pulsation of lungs, functioning of digestive and nervous system.

- Fire - Concerned to radiation, it manifests digestion, metabolism, temperature, vision, and intelligence.
- Water - is related to force and cohesion. Located in cytoplasm, blood, salivary glands, gastric juice.
- Earth - is concerned to resistance and solidity. They manifests skin, hair and bones.

TRIDOSHAS

- The five elements combine to form "Tri Dasha" i.e. Vata, Pitta, and Kapha. They are the "Basic forces" and also known as the "Pillars of life".
- Vata (Air principle) - the elements ether and air.
- Pitta (Fire principle) - the elements fire and water.
- Kapha (Water principle) - the elements earth and water.
- According to the Ayurveda, sickness due to the imbalance of any one or more of the three dosha.

पित्त-पी

Ex - Aggravation of Pitta leads to Indigestion, skin diseases and liver problems.

Factors -

Factors responsible for imbalance of dosha are physical, mental, spiritual and environmental may contribute for the imbalance of dosha.

Diagnosis -

In Ayurveda diagnosis is always done of the patient as whole.

Diagnosis is carried out to find out which dosha is aggravated.

For his purpose, nadi (pulse), tongue, skin, physical features, stool, Urin etc are examined.

Treatment -

The importance of treatment is to restore the balance and harmony of dosha with proper diet and drugs-

Selection of drugs - Based upon -

1. Rasa (Taste)
2. Virya (Potency)
3. Vipaka (Taste after digestion)

1. RASA -

Rasa indicates the composition, properties and probable action of the drugs.

These are six taste -

[A] Sour - (Water and Fire) - Pitta increases - stimulates enzyme

[B] Saline - (Fire and earth) - Pitta Tes.

[C] Bitter - (Air and Fire) - Pitta Tes.

[D] Pungent - (Air and ether) - Kapha and pitta decrease

[E] Astringent - (Air and earth) - Pitta Tes and Vatta Tes.

2. Virya (Potency) -

On the basis of Virya, drugs are classified - hot and cold drugs -

[A] Hot (Ushna) drugs - Aggravates pitta and

pacifies vata and kapha, garlic, drumstick.

- Cold (Sita) drugs - Aggravates kapha and
vata, pacifies pitta.
Jeera, amla.

3. Vipaka -

Food and medicine undergoes various changes during digestion (metabolism).

The taste after digestion is known as Vipaka.

The three taste, described under vipaka, sweet, sour and pungent -

[A] Sweet - Aggravates kapha and alleviates pitta and vata.

[B] Sour - Aggravates pitta and alleviates kapha and vata.

[C] Pungent - Aggravates vata and alleviates kapha.

HOMEOPATHY System

Homeopathy is relatively a recent system of medicine.

The word "Homeopathy" is derived from two Greek words.

Homois meaning similar and pathos meaning suffering.

Homeopathy simply means treating diseases with ^{small} remedies, prescribed in minute doses, which are capable of producing symptoms similar to the disease when they taken by the healthy people.

It is based on the natural law of healing.

"Similia Similibus curantur" which means "Likes are cured by likes".

Origin and Development

Homeopathy is a system of medicine medical treatment introduced by Dr. Christian Friedrich Samuel Hahnemann, a German Physician.

He had spend a long and useful life of 88 years during which he benefited the suffering humanity immense by introducing this new system of medicine.

Defination / Meaning

Homeopathy is a system of treatment (branch of medical science) works on the principle of "Similia similibus curantur".

About the Founder DR. HAHNEMANN

The Founder of homeopathy was born on 10th April, 1755 at Meissen in Saxony of Germany.

He was basically a M.D medicine allopathic doctor who turned in to Homoeopath.

He Died on 2nd July 1843.

Fundamental Principle of Homeopathy

1. Law of Similia
2. Law of Simplex
3. Law of minimum
4. Doctrine of Drug proving
5. Theory of chronic disease
7. Theory of vital force
8. Doctrine of Drug-dynamization

Principle -

The cause of the disease itself can be its treatment i.e. law of similia

This is the basic principle of Homeopathy.

According to Hahnemann, disease are ^{congenital} and caused by gene mutations.

Toxic or poisonous substances are called Miasms are responsible for gene mutation

- Miasms are of three type -

~~Psora~~ Psora

- Syphilis
- Psychosis

- These exist in a sleeping state in a person.
- As long as they are in that state, the person does not suffer from disease due to resistance power.
- If any one of them stimulated, then the person loses his resistance power and suffers from disease related to it.
- Therefore Homeopathy is called a genetic medicine.

UNANI System

- The unani system of medicine has a long and impressive history in India.
- It was introduced in India by the Arabs Persians sometimes around the 11th century.
- Today, India is one of the leading countries in so far as the practice of unani medicine is concerned.
- It has the largest number of unani educational, research and health care institutions.

Origin and Development of Unani System

- Unani System originated in Greece.
- Hakim Ajmal Khan is UNANI Physician but also one of the foremost freedom fighters in the country.
- He established an Ayurvedic and Unani Tibbia collage and Hindustani Dawakhana - a pharmaceutical company - for Ayurvedic and Unani medicine in Delhi in 1916.

Principle and Concepts

- According to basic principles of Unani the body is made up of the four basic elements -
 - Earth, air, water, fire which have different temp. i.e. cold, hot, wet, hot dry, cold wet, and cold and dry.
- The body has the simple and compound organs which get their nourishment (The substances necessary for growth, health, and good condition)

through four humours, i.e. blood, phlegm, yellow bile and black bile.

- The humour (Put into a good mood) is also assigned temperament as - blood is hot and wet, Phlegm is cold and wet, Yellow is hot and dry and Black bile is cold and dry.
- Phlegm is cold and hot (Thick, sticky, stringy mucus secreted by the mucous membrane of the respiratory tract, as during a cold)
- Yellow bile is hot and dry (A yellow, or greenish viscid fluid, usually alkaline in reaction, secreted by the the liver. It passes into the intestine, where it aids in the digestive)
- Black bile is cold and dry. (A humor that was once believed to be secreted by the kidney or spleen and cause sadness.)

- Unani medicine believes in promotion of health prevention of diseases and cure.
- Health of human is based on the six essentials -
 - Atmospheric air
 - Physical activity and rest.
 - Drinks and food.
 - Sleep and wakefulness.
 - Excretion and ~~sterc~~ retention.
 - Mental activity and rest.

The human body is considered to be made up of the following seven components are-

- Elements (Arkan)
- Temperature ^{ment} (Mizaj)
- Humors (Akhlat)
- Organs (Aza)
- Spirits (Arwah)
- Faculties (Quwa)
- Functions (~~Afadl~~ (afaal)).

• Elements (Arkan) -

The human body contains four elements - (earth, air, water, fire).

Each of the four elements has its own temperament as follows -

Element Temperament - Air: hot and moist, earth: cold and dry, Fire: hot and dry, water: cold and moist.

- Temperament - (Mizaj) - Temperament of the individual is very important as it is considered to be unique. The individual's temperament is believed to be the result of interaction of 4 elements.
- Humors (Akhlat) - Humors are the moist and fluid parts of the body which is produced after transformation and metabolism.

They serve the function of nutrition, growth and repair and produce energy for the preservation of individual and his species.

The humors are responsible for maintaining moisture of different organs of the body and also provide nutrition to the body.

- Organ (Aaza) - These are the various organs of human body.

The health or disease of each individual organ affects the state of health of whole body.

- Spirits (Arwah) - Rūḥ (Spirit) is a gaseous substance, obtained from the inspired air, it helps in all the metabolic activities of the body. It is the

Source of vitality for all organs of the body.

It is important in the diagnosis and treatment of disease.

These are the sources of different powers, which make the whole body system and its parts functional.

• Faculties (Quwal)-

These are of three kinds -

[A] Natural power (Quwa Tabiyah)-

Natural power is the power of metabolism and reproduction.

Liver is the seat of this power and the process is carried on in every tissue of the body.

Metabolism is concerned with the process of nutrition and growth of human.

Nutrition comes from the food and is carried to all parts of body, while growth power is responsible for the construction and growth of human organism.

[B] Psychic power - refers to nervous and psychic power. It is located in side the brain and is responsible for perceptive and motive power.

Perceptive power conveys impressions or sensation and motive power brings about movements as a response to sensation.

[C] Vital power (Quwa Haywaniyah) -

Vital power ~~are~~ is responsible for maintaining life enables all the organs to accept the effect of psychic power.

This power is located in the heart. It keeps life running in the tissues.

● Functions (Afaal Afaal) -

This component refers to the movements and functions of all the organs of the body.

In the case of a healthy body the various organs are not only in proper shape but are also performing their respective functions.

This makes it necessary to have full knowledge of the functions of the human body in full detail.

Diagnosis

- The Diagnostic process in Unani system is dependent on observation and physical examination.
- Diagnosis involves investigating the cause of disease thoroughly and in detail. For this, the physicians depend mainly on pulse reading and examination of urine and stool.
- The ten conditions of pulse observed during the diagnosis are
 - Quantity
 - Force
 - Duration of movement
 - Condition of the vessel wall
 - Volume.
 - Duration of rest period.
 - Palpitation of the pulse.
 - Balance of the pulse
 - Rhythm.

Physical examination -

The following observations of urine are made -

- Colour
 - Consistency
 - Clearness and Turbidity
 - Odour
 - Foam or Froth
 - Precipitates
 - Quantity.
- The examination of stool, its colour, quantity, consistency and presence of foreign body help very much in diagnosis of various disease.
- Besides the means of pulse reading and physical examination of urine and stool, inspection, palpitation, percussion and occultation are also used for diagnosis purposes.

Strength of Unani -

Strength of unani following disorder -

- Skin disorders
- Digestive disorders

- Mental disorders.
- Sexual disorders.
- Neurological disorders.

Siddha System of Medicine

Introduction

- According to traditional knowledge Lord Shiva unfolded the Siddha system of medicine to Parvati and handed to Nandi.
- Developed in preayurvedic age at Mohenjodaro civilization around 7000 years ago.
- Siddha System accounted for total 4448 disease symptoms and its cure.
- Thousands of herb and minerals were included in Siddha system providing good and easy management of chronic to degenerative, viral to cardiac disease.

Basic Principle-

The 5 principles of Panchmahabhuta theory are Prithvi (earth), Appu (water), Theyu (Fire), Vayu (air), Akash (ether) imbalance in this system causes of diseases.

The equilibrium of humor is considered health and its imbalance is disease.

Based on principle of Triguna - Vata, pita, kapha.

Content -

- Character of Vataguna - Stout, black, inactive personality. Tised Vata develops Flatulence, acidity, dysentery, obesity.
- Character of Pittaguna - Lean, wheatish complexion, hot personality, Tised pitta results in greying of hair, reddish eyed, more sexual desire.
- Character of Kaphaguna - Well built good complexion and good behaved personality. more affinity for sweet food and sex. Tised kapha causes jaundice fever anaemia.

Dignosis

- The dignosis of diseases involve identifying its causes.
- The physician generally involve conservation factor cheaking nadi (Pulse), dhvani (Speech), twaka (skin along with tongue), deiham (body),

Malam (Feces), Muturam (Urine) vizhi (eye colour)

- The system has worked out detailed procedure for urine examination include colour, smell, density, also oil drop spreading.

Treatment

- Treatment based on all diagnostic character of patient.
- Treatment takes into account about environment, age, sex, race, habit, diet, physical and physiological condition.
- Vaidya has knowledge of herbs its effectiveness.
- Use of metals like gold, silver, sulphur, zinc, copper, mica etc. are only seen in siddha system of medicine.

Introduction of Secondary Metabolites

Definition - 1. Alkaloids

Alkaloids, which means alkali-like substances are basic nitrogenous compounds of plant or animal origin and generally possessing a marked physiological action on man or animals.

The nitrogen is usually contained in a heterocyclic ring system and it mainly derived from amino acids.

Function of alkaloids in plants

1. Basically alkaloids are bitter in nature, and it act insecticides inside the plant.
2. In certain cases act detoxification of products in metabolic reactions, therefore considered as waste product of metabolism.
3. They may provide nitrogen to the plant organ in case of nitrogen deficiency (source of nitrogen).
4. They, sometimes act as growth regulator in certain metabolic system.

5. They may be utilized as a source of energy in case of deficiency in carbon dioxide assimilation, especially those alkaloids containing a sugar moiety.

• Some alkaloids are extremely poisonous -

Ex Ergot alkaloids caused epidemic poisoning in the middle ages in Europe as a result of feeding on rye bread contaminated with the fungus.

• The extracts of plant containing such alkaloids have been used as arrow poisons in hunting and warfare.

Ex - Curare extract that contains tubocurarine alkaloids

• At the time of Roman Empire, Belladonna (the source of atropine) has been mixed with food with the purpose of murdering.

Nomenclature -

Alkaloids terminate with the suffix -ine their name may be derived from the -

- Genus name Ex - Atropine from Atropa
- Species name Ex - Cocaine from Coca.

- Common name eg - Ergotamine from Ergot.
- Physiological name eg - Emetine (emetic).
- Discoverer eg - Pelletierine from pelletier.

Prefixes and Suffixes -

Prefixes -

"Nori" - Designates N-demethylation.

Ex - Norpseudoephedrine and Nor nicotine.

"Apo" - Designated dehydration.

Ex - Apomorphine.

"Iso, pseudo-, neo-, and epi-" Indicates different types of isomers.

Ex - Nescio Nicotine
Nicotine
Morphin.

v.v. most

Classification -

[1] Pharmacological action (Biological activity).

[2] Chemical structure (Type of nitrogen, heterocyclic or non-heterocyclic and type of ring structure).

[3] Biochemical origin (Biosynthesis pathway of production in the plant)

[5] Taxonomical origin - (Plant families rich in alkaloids)

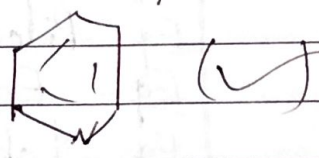
v.v most

1. According to Hegnauer's classification -

Which is based on both the type of nitrogen and biochemical origin, three type of alkaloids present -

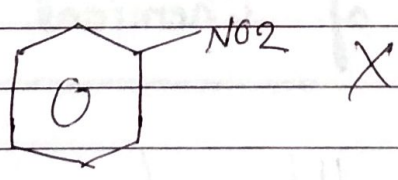
[1] True alkaloids - These are derived from amino acids and have nitrogen in a heterocyclic ring.

amino acid (✓)



[2] Proto alkaloids - These are derived from amino acids and do not have nitrogen in a heterocyclic ring.

amino acid ✓



[3] Pseudo alkaloids - These are not derived from amino acids but have nitrogen in heterocyclic ring.

<u>Types of alkaloids</u>	<u>Precursor</u>	<u>Types of nitrogen</u>
Trope alkaloid	Amino acid	Heterocyclic
Protoalkaloid	Amino acid	Non-heterocyclic
Pseudoalkaloids	Non-amino acids	Heterocyclic.

2. On the basis of Pharmacological action -

• Analgesics	Eg - Morphine and Codeine
• CNS stimulants.	Eg - Caffeine and strychnine.
• Anti-cancers	Eg - Vincristine, Vinblastine and Taxol
• Mydriatics	Eg - Atropine
• Myotics	Eg - Pilocarpine
• Anti-asthmatics	Eg - Ephedrine.
• Expectorants	Eg - Lobelline
• Anti-hypertensives	Eg - Reserpine
• Smooth muscle relaxants.	Eg - Atropine and papaverine
• Skeletal muscle relaxants	Eg - Tubocurarine.
• Antiparasitics.	Eg - Quinine and emetics

3. On the basis of Chemical structure -

1. Types of nitrogen, Heterocyclic or non-heterocyclic.
2. According to type of ring structure -

(a) Non - Heterocyclic or atypical alkaloids.

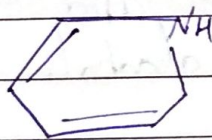
- Sometimes called Protoalkaloids or Biological amines.

Eg- Ephedrine, Colchicine and Taxol.

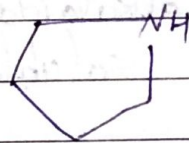
- All have exocyclic N - atoms.

(b) Heterocyclic or typical alkaloids which sub-
divided into several groups according to
their ring structure.

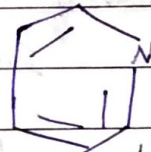
Examples -



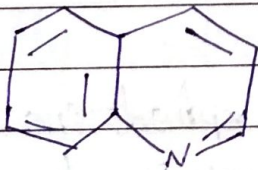
Pyrrole



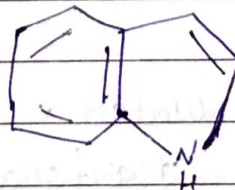
Pyrrolidine
Quinaline



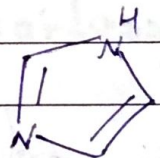
Pyridine.



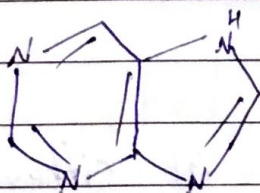
Quinaline



Indole.



Imidazole.



Purine.

Physical Properties of alkaloids

- Most alkaloids are crystalline solids. Some are liquid that are ether-

→ Volatile Ex Nicotine and coniine.

→ Non-Volatile Ex Pilocarpine and Hyosamine.

- Color- The majority of alkaloids are colorless but some are colored.

Ex Colchicine and Berberine are yellow.

- Solubility- Both alkaloidal bases and their salts are soluble in alcohol.

Generally, the bases are soluble in organic solvents and insoluble in water.

Exceptions -

Bases soluble in water - caffeine, ephedrine, codeine, pilocarpine and quaternary ammonium bases.

Bases insoluble or sparingly soluble in certain organic solvents -

Morphine and physostigmine in ether,

Theobromine and theophylline in benzene.

- Salts - are usually soluble in water and insoluble or sparingly soluble in organic solvents.

Exceptions -

Salts insoluble in water.

Ex. quinine monosulphate.

Salts soluble in organic solvents.

Ex. Lobeline hydrochloride soluble in chloroform.

Optical activity -

- Many alkaloids are optically active due to the presence of one or more asymmetric carbon atom (chiral) in their molecule.

- Optically active isomers show different physiological activities.

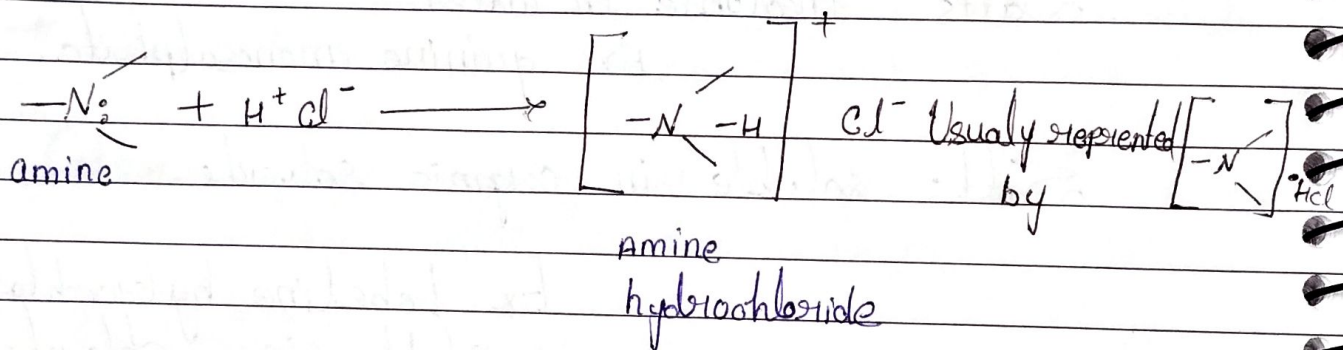
- Usually, the l(-) isomer is more active than d(+) isomer.

Ex - l-ephedrine is 3 times more active than d-ephedrine

l-ergotamine is 3 times more active than d-ergotamine.

Chemical characters of alkaloids

- Basicity - The unshared electron pairs on nitrogen atom is responsible for alkaloidal basicity.



- Strong basic alkaloids can form salts even with very weak acids. While weak bases require more acidic medium.
- Amphoteric alkaloids (eg- Morphine, psyllidine and cephaline contain a phenolic group and ~~paracetamol~~ paracetamol contains COOH group).

Effect of heat and acid on alkaloidal stability

- Heat - Alkaloids generally decompose on heating which some of them sublime.

Eg - Caffeine.

121 Acids - Cold conc. acid may cause dramatic changes (mean while heating with dilute acids may cause similar changes).

131 Dehydration - Some alkaloids lose water molecule to form the anhydro- or apo alkaloids.

Ex - Morphine to apomorphine.
Atropine to Apoatropine.

141 Demethylation - N- or - O - demethylation of certain alkaloids can take place upon heating with mineral acids.

Ex - Quinine, Narcotine, Codeine, P₁₁P and Papaverine.

Tests for detection and Identification

Name of Reagent	Composition	Remarks
Alkaloidal Precipitant to Mayer's	Potassium - mercuric iodide.	Color of ppt. Creamy white (Positive with most alkaloids, except caffeine and dilute ephedrine).

2. Wagner's	Iodine in potassium iodide	Raddish brown
3. Hager's	Saturated sol ⁿ of picric acid	Yellow
4. Dragendorff's	Potassium bismuth iodide	Orange-raddish brown
5. Marime's	Potassium cadmium iodide	Yellow PPT.

2. Glycosides

Defination - Organic natural compounds present in a lot of plants and some animals. These compound upon hydrolysis give one or more sugars (glycone) and non sugar (aglycone) moiety.

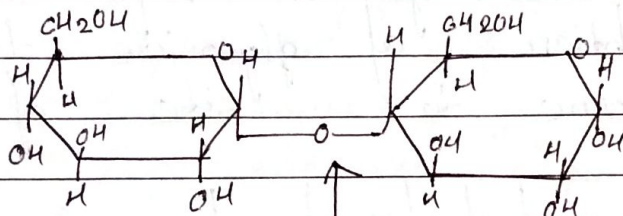
$$\text{Glycoside} = \text{Sugar group (glycone)} + \text{Non sugar group (aglycone or genin)}$$

Glycone and aglycone are linked by glycosidic linkage.

Glycosidic linkage is formed b/w -

-OH group of sugar and, -H group of non sugar moieties OR other sugar with loss of water molecule. Glycoside bond.

glycosides = glycone {-----O-----} aglycon.

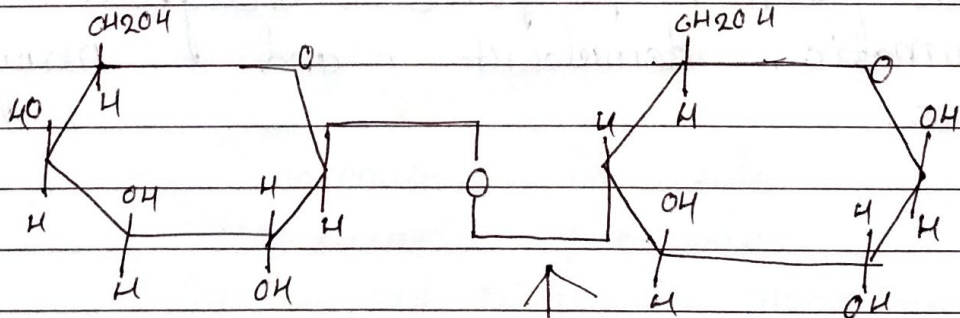


(Maltose)

α -D-glucose

α -D-glucose

α glycosidic bond.



(Lactose)

β -D-glucose

β -D-glucose

β glycosidic bond.

- Sugar in glycosides is mostly beta-D glucose but other sugars like galactose, mannose, rhamnose, digitoxose can present.
- Glycosides can be alpha or beta but plants contains only beta glycosides.
- Therapeutic effect of glycosides is only due to aglycon part only and sugar moiety facilitate absorption of glycoside. transformation of aglycone to site of action.
- So glycosides are hydrolysed to give aglycon part for action.

Glycosides have therapeutic effect in human and animals as they are used in traditional and modern medicines as cardio tonic, purgative, analgesic, anti-rheumatic, demulcent, and many other uses.

Classification

1. Classification based on type of aglycone in glycoside -

- Anthraquinone or anthracene glycoside.
- Steroid or cardiac glycoside.
- Saponin glycoside
- Cyanogenic glycoside
- Isothiocyanate glycoside
- Coumarins and Furanocoumarins.
- Aldehyde glycoside
- Phenol glycoside
- Steroidal glycoside
- Miscellaneous glycosides

2. Classification based on type of Sugar (glycone) part. -

glucose - glucoside

Rhamnose - rhamnoside

Digitoxose - digitoxoside

Glucose and rhamnose - glucorhamnoside

Rhamnose and glucose rhamnoglucoside.

3. Classification based on their use -

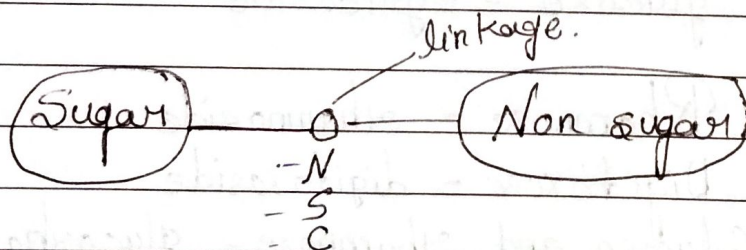
Cathartics, Cardio tonics, analgesics,
anti-rheumatics, anti-ulcer/etc.

4. Classification based on type of linkage b/w glycone and aglycone -

Linkage b/w -OH group of glycone and -H group of RADICALS like -CH, -OH, -SH, -NH of aglycone.

Glycoside is named by prefix like -

- C-glycoside, - Sugar linked to carbon atom of aglycone.
- N-glycoside, - Sugar linked to nitrogen atom of aglycone.
- O-glycoside, - Sugar linked to oxygen atom of aglycone.
- S-glycoside - Sugar linked to sulfur atom of aglycone.



Physical and chemical properties -

- Colorless, solid, amorphous, nonvolatile.
- Give +ve reaction with Molisch's and Fehling's solution test (after hydrolysis).
- They are water soluble compounds, insoluble in organic solvents.
- Most of them have bitter taste.
- Odorless except saponin (glycyrrhizin).
- When a glycoside has a lot of sugars its solubility in water rises.
- Glycosides hydrolyzed by using mineral acids and temperature or by using enzymes.

Identification Test

1. Borntrager's Test (Anthraquinones) -

To the extract add dil. sulphuric acid. Boil and filter, to the cold wa filtrate, add equal volume of benzene or chloroform. Shake well separate the organic solvent then add ammonia. Ammonical layer turn pink or red.

2. Foam Test (Saponins) -

Shake the drug extract or dry powder with water. persistent foam was observed.

3. Legal test (Cardiac Glycoside) -

To the drug, add 1 ml of pyridine and 1 ml of sodium nitroprusside. Pink to deep red color is produced.

4. Keller Killiani test (Cardiac Glycoside) -

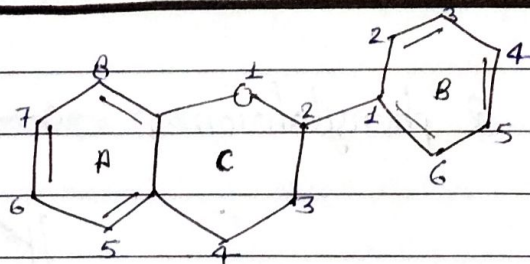
To 2 ml of extract add glacial acetic acid, one drop of 5% ferric chloride. Add one or two drop of concentrated sulphuric acid.

Reddish brown colour appears at junction of the two liquid layers.

Flavonoids

- Flavonoids are group of plant metabolites through to provide health benefits through cell signalling pathways and antioxidant effects.
- These molecules are found in a variety of fruits and vegetables.
- Flavonoids are polyphenolic molecules containing 15 carbon atoms and are soluble in water.
- They have been reported to have antiviral, antitumor, anti-allergic, antiplatelet, anti-inflammatory and antioxidant activities.

Structure of Flavonoids



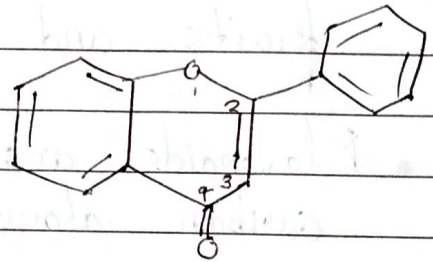
Their basic structure is a skeleton of diphenylpropane, namely two benzene ring (ring A and B, see figure) linked by a three carbon chain that forms a closed pyran ring (heterocyclic ring containing oxygen, the C ring) with benzenic A ring.

Classification-

They are classified according to chemical structure.

(1) Flavones-

2-phenylchromen-4-one.



Ex - (A) Apigenin.

(B) Luteolin

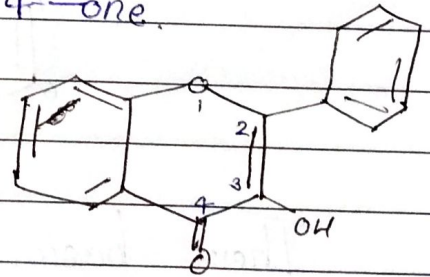
(C) Tangeritin

(D) Diosmetin.

Source - Celery, parsley, Red pepper.

(2) Flavonol-

3-hydroxy-2-phenylchromen-4-one.



Ex - (A) Kaempferol.

(B) Rutin.

(C) Myc Myricetin.

(D) Quercetin.

(E) Quercetin.

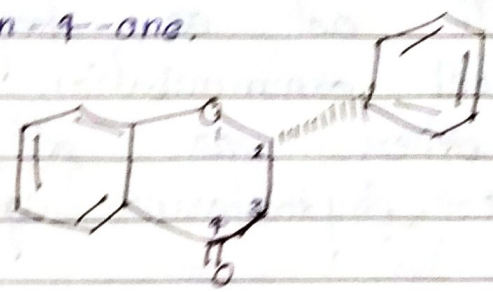
(F) Fisetin.

Source - Yellow onions, broccoli, Apple, berries.

[3] Flavonone -

2,3-dihydro-2-phenylchromen-4-one.

Ex- Hesperetin.
Naringenin.

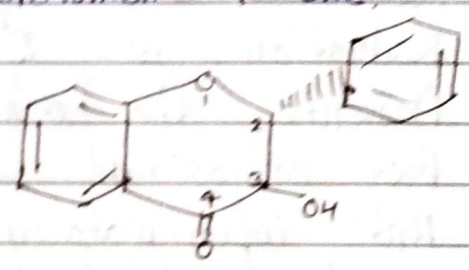


Source- Orange, Lemons, Grapes.

[4] Flavonol -

3-hydroxy-2,3-dihydro-2-phenylchromen-4-one.

Ex- Taxifolin.
Silymarin.

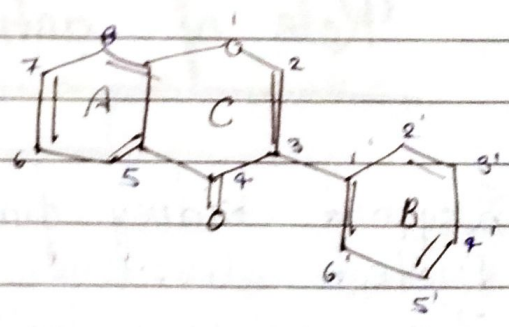


Source- Blueberries, plum, grapes.

[5] Isoflavones -

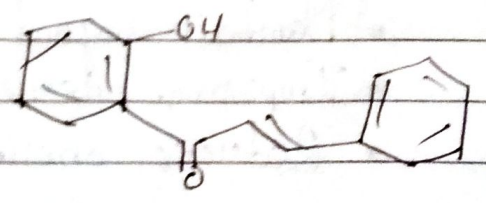
3-Phenylchromen-4-one

Source- Soyabean.



[6] Chalcones -

Source- Tomato, pears, strawberry.
Weak product.



Role of Flavonoids in Plants

It act as key chemical modulators of plant communication with insects and microbes. either as attractants or repellants or as phytoalexins against pathogens and herbivores.

Beneficial effects associated with consumption of Flavonoids

- Reduction risk of cardiovascular disease
- Reduction in BP due to its vasodilatory effect.
- Prevents the onset of disease.
- Best antioxidant
- Anti-inflammatory activity.
- Inhibit platelet aggregation.
- Antiviral
- Antibacterial.
- Improvement of endothelial functions.

Role of antioxidants on human health

- Support kidney function.
- Protect liver
- Improve reproduction function.
- Maintain good dental health
- Improve nervous system functioning.
- Reduces obesity.
- Maintain healthy vision.
- Support respiratory system.

Tests for detection of flavonoids

[1] Shinoda Test -

To ethanolic extract + added four pieces of magnesium filings (ribbon) + few drops of concentrated HCl. A pink or red colour indicates the presence of flavonoid.

- Orange to red indicated flavones.
- red to pink indicated flavonoids.
- pink to magenta indicated flavanones.

[2] Sodium hydroxide test -

To the aqueous extract + add 10% aqueous sodium hydroxide. This gives a yellow color. A change in color from yellow to colorless on ~~add~~ addition of dilute HCl is an indication for the presence of flavonoids.

[3] p-Dimethylaminocinnamaldehyde Test -

A colorimetric assay based upon the reaction of A-rings with the chromogen p-dimethyl amino cinnamaldehyde (DMACA) has been developed for flavonoids in beverages that can be compared with the vanillin procedure.

Tannins

Tannins are polyphenolic substances found in many plants product of secondary metabolism.

Its water soluble nature allows easy extraction and is useful in various application in chemical and pharmaceutical industry.

Definition - The complex, organic non-nitrogenous, polyphenolic substances of higher molecular weight.

They are used as antiseptics and in GIT disease like diarrhea and also used in leather industry.

Properties - Pale yellow to light brown-red amorphous substances widely distributed in plants and used chiefly in tanning leather, dyeing, fabric and making ink.

- Their solutions are acid and have an astringent taste.
 - They are isolated from oak bark, sumac and galls.
 - Tannins give tea astringency, color, and flavor.
- Tannins are phenol glycosides.

Physical Properties -

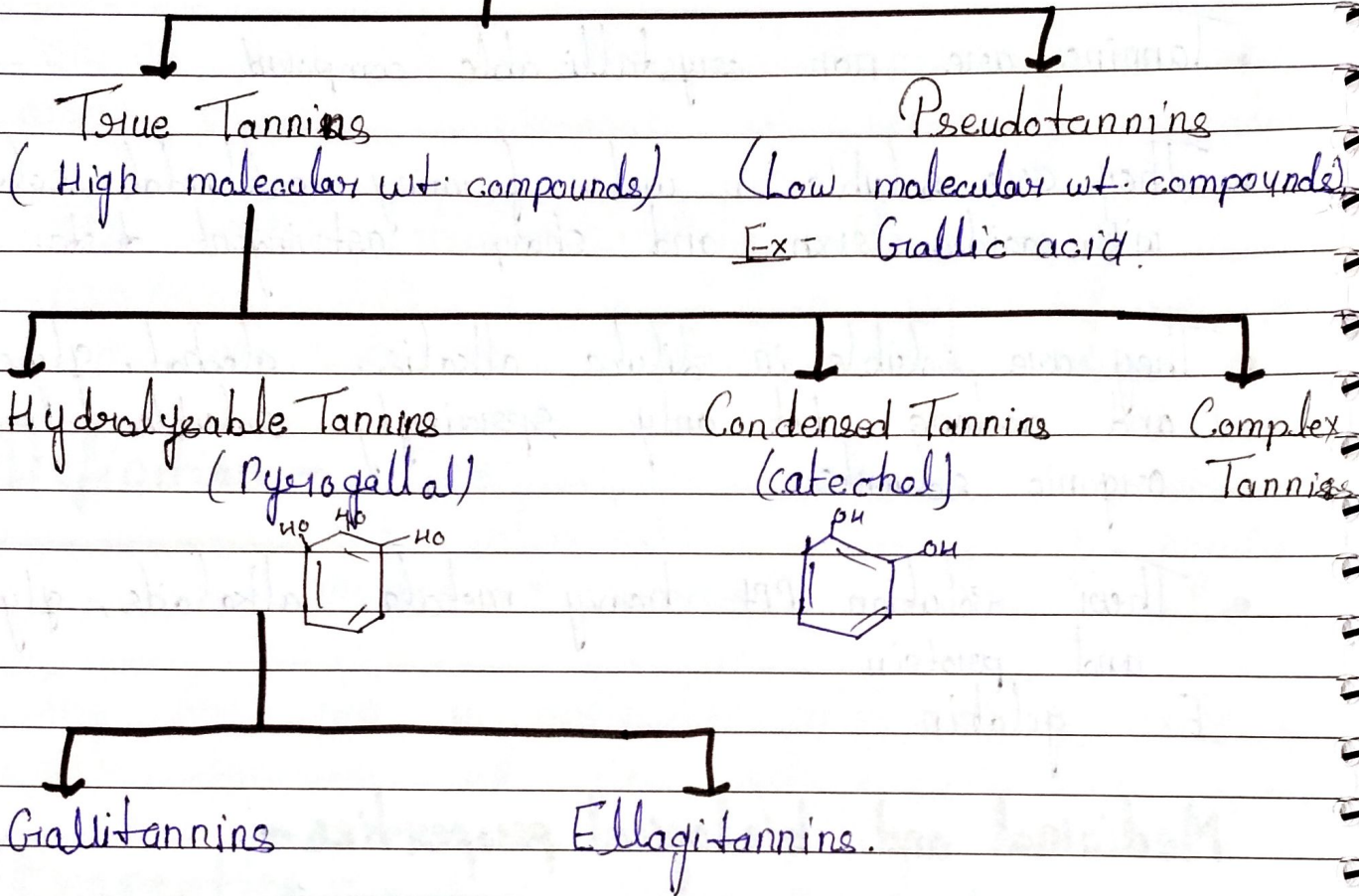
- Tannins are non-crystallizable compound.
- They are soluble in water forming colloidal solutions with acidic rxn and sharp astringent taste.
- They are soluble in dilute alkalis, alcohol, glycerol, and acetone, but only sparingly soluble in organic solvents.
- Their solution ppt heavy metals, alkaloids, glycosides and protein.
Ex- gelatin.

Medicinal and biological properties -

- Protection of inflamed surface of mouth and throat.
- They act as anti-diarrheals, usually delay elimination of bacterial toxins from the body.
- Act as antidote in poisoning by heavy metals.
- Recently tannins as most polyphenols were proved to have a potent antioxidant effect.

Uses - Dyes, Fibers, Glues, oil, waxes, flavoring agents, Drugs, Perfumes, antibiotics, insecticides.

Classification of Tannins



Identification Test -

Q1 Gelatin Test- To a solution of tannin, aqueous solⁿ of 1% gelatine and 10% NaCl are added. A white ~~ppt~~ buff colored ppt is formed. Confirms the presence of tannins and pseudo tannins.

Q2 Phenazone Test- A 10ml of aqueous extract of a tannin and sodium acid phosphate is heated and cooled and filtered.

A 2% Sol of Phenazone is added to the filtrate.
A bulky colored ppt is formed.

57 Match Stick test (Catechin test) -

A Match stick is dipped in aqueous plant extract, dried near burner and moistened with concentrated HCl acid.

On warming near flame, the matchstick wood turns pink or red due to formation of Phloroglucinol.

58 Test with ferric chloride -

To the solution of tannins add ferric chloride solⁿ.

A blue, black, violet or green ppt or color confirms the presence of tannins.

Volatile oils

They evaporate when exposed to the air at ordinary temp. so they are called volatile oils, or essential oils.

They are called essential oil because volatile oil represent the essences of plants.

Significance of Volatile oil

- As speci Spices and condiments.
- Flavoring agents
- As carminative. - हल्ला
- Manufacture of perfumes, soaps, cosmetics etc.

Role of Volatile oils in Plants

- Due to disagreeable taste and odor, they protect the plant from grazing animals.
- In flowers, they attract the insects of pollination.

Properties of Volatile oils -

- Characteristic odour
- High refractive index.

- Optically active.
- Immiscible with water.
- Soluble in ethers, alcohol and most organic solvents.

Classification of Volatile oils

1. Hydrocarbon Volatile oils.
2. Alcoholic Volatile oils.
3. Aldehydic Volatile oils.
4. Ketonic volatile oils.
5. Phenolic Volatile oils.
6. Phenolic ether volatile oils.
7. Oxide Volatile oils.
8. Ester Volatile oils.
9. Miscellaneous Volatile oils.

RESINS - जीट

The word resin comes from -

French - RESINE

Greek - RHETINE

Latin - RESIN

Plant resins have a very long history that was documented in ancient Greece by -

"Theophrastus" and in ancient Rome by "Pliny the Elder"

Defination - Resin is solid or highly viscous organic substance taken by various trees or can be produced synthetically.

• Synonym - ROSIN.

Properties -

• Physically - Resins are usually hard, transparent or translucent. When heated, they soften and finally melt.

• Chemically - They are complex mixtures of resin acids, resin alcohols, resin phenols.

• Solubility- Insoluble in water and petrol petroleum spirit. Soluble in alcohol chloroform and ether.

Classification

Classified under 2 major categories -

