

**SRI AKILANDESWARI WOMEN'S COLLEGE,
WANDIWASH**

PHARMACEUTICAL CHEMISTRY

Class : I PG CHEMISTRY

Mrs.A. FIROSE

Assistant Professor

Department of Chemistry

**SWAMY ABEDHANADHA EDUCATIONAL TRUST,
WANDIWASH**

Pharmaceutical Chemistry

- Organic Chemistry
- Inorganic Chemistry
- Physical Chemistry
- Biochemistry
- Analytical Chemistry

What is pharmaceutical chemistry

- Pharmaceutical chemistry is a branch of chemistry that deal with chemical biochemical and pharmacological aspect of drug.
- It include Synthesis, isolation, identification, structural elucidation, structural modification, structural activity relationship (SAR).
- Study of chemical characteristics, biochemical change after drug administration and their pharmacological effect.
- Pharmaceutical chemistry is the large part of field of medicinal chemistry.

- Pharmaceutical chemist develop and evaluate new and better drug for healthcare industry.
- This medicinal chemist focus on drug development and discovery by concentrating on creating new synthetic drug compound.
- Pharmaceutical chemistry comprise drug development and is the study of drug. This include drug discovery, metabolism, absorbance, delivery and so on.
- This are element of pharmacology and biomedical analysis.

Pharmaceutical chemistry

- Acid base and buffers
- Antioxidants
- Gastrointestinal agents
- Topical agents
- Antimicrobial and Astringents
- Dental product
- Respiratory stimulants
- Expectorants and Emetics
- Antidotes
- Major intra and extra cellular electrolyte
- Inorganic official compound
- Radio pharmaceutical and contrast media
- Quality control of drug and pharmaceutical
- Identification test

Acid, Base and Buffers

- There are various theories given on acid and base. But the 3 theories are given in pharmaceutical chemistry.
- Acid : acid is a substance which give hydronium ion (H^+) in aqueous solution called as Acid.
PH of acid is always less than 7.
Litmus paper test is use in that Blue litmus turn in RED.
Taste of acid is sour.

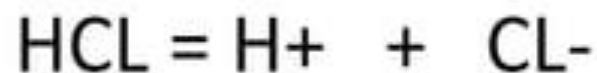
Base : Base is a substance which give hydroxyl (OH^-) ion in aqueous solution.
Red litmus paper turn in the blue. Taste of base is Bitter.

Theories of acid and base

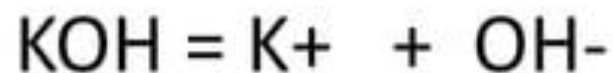
- **Arhenius Theories:**

According to arhenius theory

Acid is substance which when dissolve in water give hydronium ion (H⁺)



Base is substance which when dissolve in water give hydroxyl (OH⁻) ion



- **Bronsted lawry:**

According to lawry theories, Reaction of an acid with base produce another Acid and Base.

Acid is a proton donor and Base is a proton acceptor.

- **Lewis Theory :**

Acid is a molecule and ion that accept a lone pair of electron.

- **Buffer solution**

The buffer is defined as the solution which resists the change in pH.

Acidic Buffer : A weak acid and its salt with strong base.

Eg : Acetic acid, sod. Acetate.

Basic Buffer : A weak base and its salt with strong acid

Eg ammonium hydroxide. And ammonium chloride.

Having constant pH, does not change on dilution.

Boric acid, HCl, strong ammonium Hydroxide, sod.hydroxide, official buffer.

Anti oxidant

- The antioxidant is the substance which prevent the oxidation of medically active compounds.
- Oxidation causes changes in chemical structure and behaviour of the drug and compound
- There are 2 type of oxidant
 - organic oxidant: having antimicrobial property
Eg thocopherol (vit e), phenol , Paraben (Gallic acid)
 - inorganic oxidant: reducing agent which oxidise in reaction
Eg sulphur dioxide, nitrogen, sod. Nitrite, sodium meta bisulphate.

It should be prevent oxidation of drug product

Effective in low concentration

Non toxic and non irritant

Not affect colour odour taste of product

Gastrointestinal Agents

- Gastrointestinal tract (GIT) is a series of hollow organ from mouth to anus
- GIT agent is the agent which prevent the GIT from harmful substance.

- The four type of GIT agent

Antacid and acidifying agent

Protective

Adsorbant

Laxative

- Antacid and acidifying agent
- **acidifying agent** : the agent Which increase acidity in stomach

Achlohydria : Absent of HCL in gastric secretion.

diluted HCL = concentrated HCL + Water

molecular weight of hcl is 36.5

Antacid : prevent the acidity.

Antacid are defined as the alkaline substance which neutralise excess acidic in stomach and lower the acidity of gastric PH

boost 1.2 TO 2 PH to increase ph at 4

Antacid are weak base and raise the gsstric PH above 4 by neutralising excess gastric HCL.

- Neutralising capacity of antacid is expressed in milliequivalent (mEq)
- Ideal capacity must be at least 5mEq of HCL per dose unit
- Absorbable/ systemic water soluble – sod.bicarbonate
- Non absorbable/ non systemic – non water soluble – aluminium phosphate cal.carbonate.

Ideal property

Able to neutralise excess acidity

Not interfere with the digestion process

Non irritant and non toxic

Not cause constipation

Quick and prolonged action

- **Protective** : protect from intestinal inflammation and protect from intestinal toxicity
- This are chemically inert substance which are use in treatment of Diarrhoeal condition or dysentry of GIT beacuase of their ability to adsorb gases toxin and bacteria.
- Dysentry : Diarrhoea with blood

Cause by infection of small protozoa amoeba

Bismuth subcarbonate, kaoline.

Saline cathartics : the drug which cause defecation(removal of faecal matter)

Mg.hydroxide sod. Pot tertarate

Beneficial for removal of intestinal parasite

TOPICAL agent

- The agent which are applied on skin or mucous memb for their local effect are called topical agent
- Protective and Adsorbant : Protect from external atmosphere or harmful substances,
- Absorb the microbial contamination or toxin from wound or skin.

Eg talc, zinc oxide, calamine, zinc sterate, titanium dioxide, silicone polymer.

Antimicrobial and astringent

- The substances which prevent the growth of microorganism

Disinfectant : are applied on non living cell or tissue (inanimate). Eg phenol, lysol etc.

Antiseptic : are applied on living cell or tissue

Bacteriosidal: kill the bacteria

Bacteriostatic: prevent growth of bacteria.

Eg mercuric oxide, povidone iodine, boric acid etc

Astringent : water base skin care product use to remove excess oil from skin, tighten pore and remove leftover makeup. Eg alum and zinc sulphate

Dental product

- The dental product which are prevent the tooth from cavity and tooth decay.
- Anti cavities agent : sodium fluoride, stannous fluoride
- Polishing agent : calc.carbonate
- Cleaning agent :
- Desensitising agent: Zinc chloride

Inhalant : A solvent or other material producing vapour that is inhaled by drug abuses.

it is volatile vapour or pressurise gas can be concentrated and breath in via the nose or mouth to produce in toxication

Respiratory stimulant

- The drug which use to stimulate the respiratory system or restore the normal respiration.
- Eg Ammonium carbonate

Expectorant : the drug or substance which are stimulate removal of sputum from lung.

Emetics : the drug or substance which cause the vomiting

Eg . Ammonium chloride, pot.iodide, Antimony, pot. Titrate.

- **Antidotes :**

The drug or substance which are given in case of toxicity

Antidotes are the substance which react specially with the ingested poison or toxin substances or also with potent drug in case of overdose.

Ac to WHO : a therapeutic substances use to counteract the toxic affect of a specific xenobiotic (foreign to the body or to the ecological system)

Major intra and extra cellular electrolyte

- Electrolyte are chemical dissociated into cation (+ ve) ion and anion(- ve) ion when they dissolve in the body fluid.
- Cation are positively charge electrolyte eg Ca^{++}
- Anion are negatively charge electrolyte eg Cl^-

Intracellular electrolyte : present in the cell

Eg. K^+ , Mg^+ and P

Extracellular electrolyte : present in interstitial and vascular compartment. Eg. Na^+ Ca^+ Cl^-

Sodium chloride, potassium chloride and their preparation , sodium acetate, potassium acetate, sodium lactate inj, ammonium chloride and its inj.

Combination of ORS electrolyte powder and sol.

Inorganic official compound

- There are various official compound of **iron** like
- Ferrous fumarate
- Ferrous gluconate
- Ferrous succinate
- Iron dextran inj
- Iron sorbitol inj
- **Ferrous sulphate** $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$
- Iodine and calcium
- Calcium gluconate

Radio pharmaceuticals and contrast media

- Radio pharmaceutical are the pharmaceutical preparation consisting of radioactive substance (radio isotopes and molecule lable with radio isotope) which are intended for use either in diagnosis or therapy
- Radioactivity : is the spontaneous emmission of energe and particle due to the breaking down of the nuclei of unstable atom.

During radioactivity particle are emitted that are

Alpha ray

Beta ray

Gamma ray

Quality control of drug and pharmaceutical

- Quality control is use for achieving high quality product
- Qc is a set of activities for ensuring quality in the products.
The activities focus on identifying defects in the actual product produced.
- It identify the defect in the finished products.
- Qc is relative process.
- The goal of qc is to identify after a product is developed and before its release
- Significant error
- Method used for qc
- Sources of impurities in pharmaceutical
- Limit test of arsenic, chloride, sulphate, iron and heavy metal.

- **Identification test as per pharmacopoeia.**

Acetate

Aluminium

Ammonium salt

Antimony

And other..

Scope

- Pharmaceutical chemistry is focused on quality aspect of medicines and aims to assure fitness for purpose of medicinal product by analysing and evaluating them as per the quality control standerts.
- Pharmaceutical chemistry is **majorly in the research and development of new medicines for pharmaceutical companies or government agencies**
- Pharmaceutical chemistry is the discipline at the intersection of chemistry, especially synthetic organic chemistry, and pharmacology and various other biological specialties, where they are involved with design, chemical synthesis and development for market of pharmaceutical agents, or bio-active molecules (drugs).
- Practically speaking, it involves chemical aspects of identification, and then systematic, thorough synthetic alteration of new chemical entities to make them suitable for therapeutic use.

- **Application**

Pharmaceutical chemistry is concerned with the design and synthesis of biologically active molecules.

The aim is to gain new chemical molecules that could enable the discovery of new pharmaceuticals or optimize already known drug structures.

Thereby to expand the portfolio of chemical drugs.