Limit Test for Heavy Metal

Principle:

Limit test of heavy metals is based on the reaction of metallic impurities with hydrogen sulfide in acidic medium to form brownish colour solution. Metals that response to this test are lead, mercury, bismuth, arsenic, antimony, tin, cadmium, silver, copper, and molybdenum. The metallic impurities in substances are expressed as parts of lead per million parts of the substance. The usual limit as per Indian Pharmacopoeia is 20 ppm

Procedure:

The Indian Pharmacopoeia has adopted three methods for the limit test of heavy metals.

• Method I: Use for the substance which gives clear colorless solution under the specific condition.

Test sample	Standard compound
Solution is prepared as per the monograph and	Take 2 ml of standard lead solution and dilute to
25 ml is transferred in Nessler's cylinder	25 ml with water
Adjust the pH between 3 to 4 by adding dilute	Adjust the pH between 3 to 4 by adding dilute
acetic acid 'Sp' or dilute ammonia solution 'Sp'	acetic acid 'Sp' or dilute ammonia solution 'Sp'
Dilute with water to 35 ml	Dilute with water to 35 ml
Add freshly prepared 10 ml of hydrogen	Add freshly prepared 10 ml of hydrogen sulphide
sulphide solution	solution
Dilute with water to 50 ml	Dilute with water to 50 ml
Allow to stand for five minutes	Allow to stand for five minutes
View downwards over a white surface	View downwards over a white surface

Observation:

The color produce in sample solution should not be greater than standard solution. If color produces in sample solution is less than the standard solution, the sample will pass the limit test of heavy metals and vice versa.

• Method II: Use for the substance which gives clear colorless solution in sodium hydroxide solution.

Test sample	Standard compound
Solution is prepared as per the monograph and	Take 2 ml of standard lead solution
25 ml is transferred in Nessler's cylinder or	
weigh specific amount of substance and	
dissolve in 20 ml of water and add 5 ml of	
dilute sodium hydroxide solution	
Make up the volume to 50 ml with water	Add 5 ml of dilute sodium hydroxide solution
	and make up the volume to 50 ml with water
Add 5 drops of sodium sulphide solution	Add 5 drops of sodium sulphide solution
Mix and set aside for 5 min	Mix and set aside for 5 min
View downwards over a white surface	View downwards over a white surface

Observation:

The color produce in sample solution should not be greater than standard solution. If color produces in sample solution is less than the standard solution, the sample will pass the limit test of heavy metals and vice versa.

• Method III:	Use for the substance	which do not give clear	colorless solution und	ler the specific
condition.				

Test sample	Standard compound
Weigh specific quantity of test substance, moisten with	Take 2 ml of standard lead solution and
sulphuric acid and ignite on a low flame till completely	dilute to 25 ml with water
charred	
Add few drops of nitric acid and heat to 500 °C	
Allow to cool and add 4 ml of hydrochloric acid and	
evaporate to dryness	
Moisten the residue with 10 ml of hydrochloric acid	
and digest for two minutes	
Neutralize with ammonia solution and make just acid	
with acetic acid	
Adjust the pH between 3 to 4 and filter if necessary	Adjust the pH between 3 to 4 by adding
	dilute acetic acid 'Sp' or dilute ammonia
	solution 'Sp'
Dilute with water to 35 ml	Dilute with water to 35 ml
Add freshly prepared 10 ml of hydrogen sulphide	Add freshly prepared 10 ml of hydrogen
solution	sulphide solution
Dilute with water to 50 ml	Dilute with water to 50 ml
Allow to stand for five minutes	Allow to stand for five minutes
View downwards over a white surface	View downwards over a white surface

Observation:

The color produce in sample solution should not be greater than standard solution. If color produces in sample solution is less than the standard solution, the sample will pass the limit test of heavy metals and vice versa.

Limit test for sulphate

Principle:

Limit test for Sulphate is based upon simple reaction between BaCl₂ and dil.HCl or CH₃COOH. This results the formation of BaSO₄. The extent of turbidity of test solution compared with std. turbidity which depends upon amount of Sulphate impurity.

Procedure:

- Wash a pair of nessler cylinder distilled water & dry it.
- Lable as std. and test solution.
- Then prepare solution as follows.
- Stir both the solution. Immediately by glass rod.
- Allow both the cylinder to stand for 5min. protect from sunlight
- Compare turbidity of test & std. sol. by viewing in front of dark background.

TEST	STANDARD
Ø Take 1ml of 25%W/V	Ø Take 1ml of 25%W/V
BaCl ₂ sol. in nessler cylinder.	BaCl ₂ sol. in nessler cylinder.
Ø Add 1.5ml ethanolic Sulphate	Ø Add 1.5ml ethanolic Sulphate
std. solution.	std. solution.
Ø Mix well & allow it to stand for	Ø Mix well & allow it to stand for
1min.	1min.
Ø Add 15ml test solution.	Ø Add 15ml std. solution.
Ø Add 0.15ml of 5M acetic acid.	Ø Add 0.15ml of 5M acetic acid.
Ø Make up the vol. upto 50ml	Ø Make up the vol. upto 50ml
with distilled water.	with distilled water.

Observation:

The intensity of the turbidity is depends on the amount of sulfate present in the solution. The turbidity developed in test and standard solution is compared by viewing over dark background. The extent of turbidity of the test solution is **more**/ **less** then the standard solution.

Conclusion

The extent of turbidity of the test solution is **more/less** then the standard solution.therefore it is concluded that impurities of sulfate in given sample is **over/under** the limit.

• Limit test for chloride

Principle:

Limit test of Chloride is based upon simple reaction between AgNO₃ and soluble chloride to obtain AgCl which is insoluble in dil.HNO₃ which makes the solution turbid. The extent of turbidity depends upon the amount of chloride present in substance and compared with std. turbidity produced by addition of AgNO₃ to std. sol. of known amount of NaCl in presence of dil. HNO₃.

$$Cl + AgNO_3 \rightarrow AgCl + NO_3$$
-
NaCl + AgNO₃ $\rightarrow AgCl + NaNO_3$

Procedure:

- Wash a pair of nessler cylinder distilled water & dry it.
- Lable as std. and test solution.
- Then prepare solution as follows.
- Stir both the solution immediately by glass rod.
- Allow both the cylinder to stand for 5min.
- Compare turbidity of test & std. sol. by viewing in front of dark background.

Observation:

The intensity of the turbidity is depends on the amount of chloride present in the solution. The turbidity developed in test and standard solution is compared by viewing over dark background. The extent of turbidity of the test solution is **more**/ **less** than the standard solution

Conclusion

The extent of turbidity of the test solution is **more/less** than the standard solution.therefore it is concluded that impurities of chloride in given sample is **over/under** the limit

Limit test for iron

Principle:

Limit test for iron is based upon simple reaction between thioglycolic acid and iron in the presence of citric acid and Ammonical alkaline medium.

This results the formation of purple coloured ferrous salt of thioglycolic acid (ferrous thioglycolate complex)

Procedure:

- Wash a pair of nessler cylinder distilled water & dry it.
- Lable as std. and test solution.
- Then prepare solution as follows.
- Stir both the solution immediately by glass rod.
- Allow both the cylinder to stand for 5min
- Compare intensity of colour of both the solution

TEST	STANDARD
Ø Take 2ml of given sample of	Ø Take 2ml of given sample of
test solution and 20 ml of distilled	Std solution and 20 ml of distilled
water in nessler cylinder	water in nessler cylinder
Ø Add 2ml 20 % iron free citric	Ø Add 2ml 20 % iron free citric
acid	acid
Ø Add 0.1 ml of thioglycolic acid	Ø Add 0.1 ml of thioglycolic acid
Ø Make the solution alkaline	
with iron free ammonia solution	Ø Make the solution alkaline with
(about 15 ml)	iron free ammonia solution (about
Ø Dilute it with 50 ml with	15 ml)
distilled water	Ø Dilute it with 50 ml with
	distilled water

Observation:

The intensity of the colour of complex, is depends on the amount of iron present in the solution. The intensity developed in test and standard solution is compared by viewing over a white tile through the solution The intensity of pale pink to purple colour of the test solution is **more/less** then the standard solution

Conclusion

The intensity of pale pink to purple colour of the test solution is **more/less** then the standard solution. Therefore it is concluded that impurities of iron in given sample is **over/under** the limit.

Unit-Acid base and buffers

Acids, Bases are defined by Four main theories, a)Traditional theory / concept b)Arrhenius theory c)Bronsted and Lowry theory d) Lewis theory

Traditional theory / concept :

i)Acid: are the substance which converts blue litmus paper to red. Having the PH <7, Sour taste, React with bases to form salts and water

Eg : Hydrochloric acid (HCl)

ii) Base: are the substance which converts red litmus paper to blue, Having the PH >7, Bitter taste, React with Acids to form salts and water Eg: Sodium Hydroxide (NaOH).

Arrhenius theory:

In 1884 of Svante Arrhenius Also known as, a)Arrhenius theory of ionization b)Electron dissociation theory This theory define acids & bases according to there formation of ions when dissolved in water.

Acids "An Acid is a substance that can release hydrogen ion (H+) when dissolved in water" (OR) "A substance which when dissolved in water gives hydrogen ions (H+) is known as acid" Eg: Hydrochloric acid. HCl gives H+ and Cl-.

Base "A Base is a substance that can release a Hydroxyl ion (OH-) when dissolved in water" (OR) "A substance which when dissolved in water gives Hydroxyl ion (OH-)is known as acid" Eg : Sodium Hydroxide NaOH gives Na+ and OH-

Bronsted-Lowry theory:

The Bronsted-Lowry theory classifies a substance as an acid if it acts as a proton donor, and as a base if it acts as a proton acceptor. Other ways of classifying substances as acids or bases are the Arrhenius concept and the Lewis concept.

Lewis theory

The Lewis theory classifies a substance as an acid if it acts as an electron-pair acceptor and as a base if it acts as an electron-pair donor. Other ways of classifying substances as acids or bases are the Arrhenius concept and the Bronsted-Lowry concept.

Boric Acid H3BO3 / 61.83

Syn: Orthoboric Acid, Aecidium boricum

MOP:- Borax with Sulphuric acid in presence of water

Properties :- a) Physical Properties:

White crystalline powder, Odorless, Soluble in water, Soluble in Ethanol, Soluble in glycerin **b)Chemical Properties:**

a) Reaction with turmeric paper: Boric acid turn into brown color b) Reaction with glycerin: Boric acid + glycerin dissolve Glyceroboric acid.

c) Action on heating :- Boric acid (H3BO3) 1000 C Metaboric acid (HBO2) 1600 C Tetra boric acid (H2B4O7) Up to red hot Boron trioxide (B2O3)

Uses: Local anti-infective

To maintain acidic pH medium in Medicament

Preparation of buffer solution In ophthalmic preparation

Dusting powder

Preparation of ointement.

Storage "It should be stored in well closed container at a cool Place.

Hydrochloric Acid HCl / 36.46

Syn: spirit of salt, muriatic acid, acidium hydrochloricum

MOP:- Conc.Sulphuric acid react with sodium chloride

NaCl + H2SO4 — HCl + NaHSO4

Properties :-

- a) **Physical Properties:** Clear colorless liquid, Pungent odour, Miscible with water, Miscible with alcohol, fuming liquid
- b) b) Chemical Properties:-

i)Reaction with metals : hydrochloric acid react with sodium gives sodium chloride & evolution of hydrogen gas. 2Na + 2HCl 2NaCl + H2

ii)Reaction with alkali : hydrochloric acid react with sodium hydroxide gives sodium chloride & water

HCl + NaOH — NaCl+ H2O

Uses: 1)As a pharmaceutical aid (acidifying agent)

2)Solvent in industry

3)For manufacturing of basic pharmaceuticals

4)Reagent in Laboratory

Storage " It should be stored in well closed container of glass at a temperature not exceeding 300 C"

Strong ammonium hydroxide NH3 / 17.03

Syn: Ammonia solution, ammonium hydroxide, strong ammonium water, liquor ammoniae forties **MOP:-** By mixing ammonium chloride with slaked lime

NH4Cl + Ca(OH)2-----NH4OH + CaCl2

Properties :-

a)Physical Properties: Clear colorless liquid, Pungent odour, Characteristic taste, Miscible with water, Aqueous solution is strongly alkaline in nature.

Chemical Properties:-

i) Reaction with acid : React with acid it form salts and water

NH4OH + HCl — NH4Cl + H2O

ii) Reaction with cations : React with acid it form complex.

Uses: Alkalizing agent

Reflux stimulant (fainted person)

Vaso constrictor

Strong base

Antacid

Reagent in Laboratory

Storage "It should be stored in well closed amber colored container with a rubber stopper at a cool Place." Incompatibility - With iodine (Explosive compound) - heavy metals, silver salts and tannins.

Buffers

A buffer is an aqueous solution containing a weak acid and its conjugate base or a weak base and its conjugate acid. A buffer's pH changes very little when a small amount of strong acid or base is added to it. It is used to prevent any change in the pH of a solution, regardless of solute. Buffer solutions are used as a means of keeping pH at a nearly constant value in a wide variety of chemical applications. For example, blood in the human body is a buffer solution.

Buffer solutions are resistant to pH change because of the presence of an equilibrium between the acid (HA) and its conjugate base (A⁻). The balanced equation for this reaction is:

 $HA \rightleftharpoons H++A-$

Henderson–Hasselbalch Equation

The Henderson–Hasselbalch equation was developed independently by the American biological chemist L. J. Henderson and the Swedish physiologist K. A. Hasselbalch, for relating the pH to the bicarbonate buffer system of the blood (see below). In its general form, the Henderson–Hasselbalch equation is a useful expression for buffer calculations. It can be derived from the equilibrium constant expression for a dissociation reaction of the general weak acid (HA) in Equation (1.4)

$$K=rac{\left[\mathrm{H}^{+}
ight]\left[\mathrm{A}^{-}
ight]}{\left[\mathrm{HA}
ight]}$$

where K is the equilibrium constant at a given temperature. For a defined set of experimental conditions, this equilibrium constant is designated as K' (K prime) and referred to as an apparent dissociation constant. The higher the value of K', the greater the number of H+ ions liberated per mole of acid in solution and hence the stronger the acid. K' is thus a measure of the strength of an acid. Rearrangement of Equation

$$\left[\mathrm{H}^{+}\right] = \frac{K'[\mathrm{HA}]}{\mathrm{A}^{-}} \tag{1.5}$$

Taking logarithms of both sides of Equation (1.5) and multiplying throughout by -1 gives

$$-\log[\mathrm{H}^{+}] = -\log K' - \log[\mathrm{HA}] + \log[\mathrm{A}^{-}]$$
(1.6)

Substituting pH for -log[H⁺] and pK' for - log K' yields

$$pH = pK' + \log \frac{[A^-]}{[HA]}$$
(1.7)

or

$$pH = pK' + \log \frac{[conjucate base]}{[acid]}$$
 (1.8)

This relationship is represented by the Henderson–Hasselbalch equation.

<u>Unit- Antioxidants</u>

- AntioxidantsAntioxidants Definition: "Agents which inhibit oxidation and are commonly used to prevent rancidity of oils and fats or deterioration of other materials through oxidative process." e.g. Ascorbic acid, Butylated hydroxyanisole (BHA) Butylated hydroxytoluene (BHT), α tocopherol & ascorbyl- palmitate An antioxidant is a molecule that inhibits the oxidation of other molecules. Oxidation is a chemical reaction that can produce free radicals, leading to chain reactions that may damage cells. Antioxidants such as thiols or ascorbic acid terminate these chain reactions.
- AntioxidantsAntioxidants Agents which prevents atmospheric oxidation. They have the capability of functioning chemically as reducing agents. Are added to pharmaceutical preparations containing easily oxidizable substances. To prevent oxidation and subsequent deterioration of the formulation. To prevent oxidative decomposition of pharmaceutically active components. Used in pharmaceutical preparations containing easily oxidized substances (e.g., iodide or Fe++) in order to maintain these substances in their reduced form.
- Chemically they are reducing agents which prevent oxidation of other species by either -by getting oxidised themselves in place of active component as they under go oxidation more readily than the active component OR -by reducing the already oxidized active component back to the normal oxidation state. Action is based upon oxidation-reduction (Redox) reaction in which the antioxidant itself gets oxidized. In redox reaction there is transfer of electrons from one compound to the other, therefore the loss or gain of electrons is used to balance the oxidation states on both sides of the half-reaction. Mechanism of antioxidant action .e.g. OxA is the oxidised form of compound A RedA is the reduced form of compound B then the half reaction can be written as, Ox A+ e⁻ RedA RedB OxB+ e- The overall redox reaction can be given by OxA+ RedB RedA+ OxB
- Half-reactions: Ox1 + e ↔ Red1 Red2 ↔ Ox2 + e Total redox reaction: Ox1 (Easily oxidized substance) + Red2 (Acting as antioxidant) ↔ Red1 + Ox2

Selection Criteria of Antioxidants

- 1. Able to produce desired redox reaction, when used in pharmaceutical preparations.
- 2. physiologically and chemically compatible.
- 3. Physiologically inert.
- 4. Non-toxic both in the reduced and oxidized forms.
- 5. It should not create any solubility problem for various components of the formulation.
- 6. Effective in low concentration and should provide prolonged stability to the formulation.
- 7. Safe and nontoxic.

Sodium Metabisulfite Na2 S2 O5 Mol.Wt. 190.10

- White crystal or white to yellowish crystalline powder having the odor of sulfur dioxide.
- It should contain an amount of sodium matabisulfite (Na2 S2 O5) equivalent to not less than 66.0% and not more than 67.4% of SO2.
- It is a strong reducing agent and like sulfur dioxide contains S in the +4 oxidation state.

• Exclusively used as an antioxidant in solutions of drugs that contain the phenol or catechol nucleus (e.g., phenylephrine hydrochloride and epinephrine hydrochloride solutions) to prevent oxidation of these compounds to quinones or like substances. It is also used as a reducing agent in ascorbic acid injection.

Hypophosphorous acid (HPHHypophosphorous acid (HPH22OO22; Mol.Wt. 66.00); Mol.Wt. 66.00)

It is a colorless or slightly yellow, odorless liquid containing not less than 30.0% It is a colorless or slightly yellow, odorless liquid containing not less than 30.0% and not more than 32.0% HPHand not more than 32.0% HPH22OO22.

The oxidation state of the central phosphorous atom is +1, making the compound a very powerful reducing agent.

It can function in dilute solution as a very effective reducing agent.

Uses:uses as antioxidants

It is mostly used as reducing agent in syrup of ferrous sulphate.

Its salt is good source of phosphorous.

Sodium nitrite NaNO2

Sodium nitrite is the inorganic compound with the chemical formula NaNO2.

It is a white to slightly yellowish crystalline powder that is very soluble in

water and is hygroscopic.

It is a useful precursor to a variety of organic compounds, such as pharmaceuticals, dyes and pesticides. Not used as such as antioxidant but food preservative.

Nitrogen:N2 Mol wt 28

It is colourless, odourless, tasteless gas.

Non flammable, non poisonous.

It does not support life and combustion. Slightly soluble in water Slightly lighter than air. **Uses**:

It is inert gas so can be used to protect chemical, drugs, p'cals e.g. Vit, oil (Cod liver, shark liver, castor and olive oil) from air oxidation by displacing air from container. Addition of such agents must be declared on label. Also used in assay of CO to retard it's oxidation Storage: Under compression in metal cylinder (Grey color with black nek and shoulder)

Unit- dental products

• Dental productsThe substances used to produce effect on teeth and in dental cavity is called as dental products. E.g. Sodium fluoride.

Types

- 1. Anti caries agent : sodium fluoride
- 2. Cleaning agent : Dibasic calcium phosphate
- 3. Polishing agent : sodium metaphosphate
- 4. Desensitization agents : Zinc chloride

Sodium Fluoride NaF

MOP: By passing hydrogen fluoride into solution o sodium carbonate. Na2CO3 + 2HF - - 2NaF + CO2 + H2O VPC, KALYAN

Physical Properties

- 1.Colorless powder
- 2.Odourless
- 3.Salty taste
- 4.Soluble in water
- 5.Insoluble in alcohol.

Uses

- 1. Anticaries agent
- 2. Prophylaxis of dental caries.
- 3. Manufacturing of dental products.
- 4.Used for preparation of insecticides and rodenticides.
- Storage "It should be stored in well closed container at a cool place.

Stannous Fluoride SnF2

Syn: Tin fluoride
MOP : By mixing stannous oxide with hydrofluoric acid
SnO + 2HF - -SnF2 + H2O
Physical Properties 1.Colorless powder
2.Odorless
3.Salty taste
4.Soluble in water
5.Insoluble in alcohol
6.Insoluble in ether.
Uses 1.Anti caries agent
2.Prophylaxis of dental caries.
3.Manufacturing of dental products.
Storage " It should be stored in well closed container at a cool place."

Calcium Carbonate CaCO3

Syn: Calc. carb., calci carbonas, ppt calcium carbonate, precipitated chalk.
MOP Prepared by passing Carbon dioxide gas through lime water.
Ca(OH)2 + CO2 - CaCO3 + H2O
Physical Properties 1.Colorless powder
2.Odorless
3.Tasteless

4.Insoluble in water

5.Insoluble in alcohol

Chemical Properties 1. When it react with hydrochloric acid it gives salt and water. CaCO3 + HCl - CaCl2 + CO2 + H2O

2. When it react with sulphuric acid it gives salt & water. CaCO3 + H2SO4 CaSO4 + CO2 + H2O

USES 1. As dental product (polishing agent)

- 2. Manufacturing of dental products.
- 3. Antacid
- 4. Manufacturing of quick lime
- 5. In agricultural field for neutralization of acid
- 6. Used as dentifrice

Sodium Meta-phosphate NaPO3

Syn: Madder's salt, grahams salt MOP: By dehydration of sodium phosphate

Physical Properties 1. Colorless powder

- 2. Odorless
- 3. Tasteless
- 4. Insoluble in water
- 5. Soluble in mineral salts solution
- 6. Hygroscopic in nature

Uses 1.As dental product (polishing agent)

2. Manufacturing of dental products.

3.Used in detergent

Storage "It should be stored in well closed container at a cool place.

Dicalcium Phosphate CaHPO4. 2H2O

Syn: Dibasic calcium phosphate, calcium monohydrogen phosphate, secondary calcium phosphate, calcium hydrogen phosphate

MOP By using calcium chloride and disodium hydrogen phosphate

Physical Properties 1. Colorless powder

- 2. Odorless 3. Tasteless
- 4. Insoluble in water
- 5. Insoluble in alcohol
- 6. Soluble in dilute hydrochloric acid solution

Uses 1.As dental product (Cleansing agent)

2.Manufacturing of dental products.

3.Used as source of calcium and phosphate

Storage "It should be stored in well closed container at a cool place."

Zinc Chloride ZnCl2.6H2O

Syn: Butter of zinc

MOP By heating metallic zinc with hydrochloric acid

Physical Properties 1. White colored powder

- 2. Odorless
- 3. Tasteless
- 4. Soluble in water
- 5. Soluble in alcohol
- 6. Soluble in glycerin
- 7. Aqueous solution is acidic in nature.

Uses 1. As dental product (desensitizing agent)

- 2. Manufacturing of dental products.
- 3. As a astringents
- 4. Mild antiseptics
- 5. In manufacturing of fire proof wood

Storage "It should be stored in well closed container at a cool place.

Unit- gastrointestinal agents

Gastric Antacids

- Antacids (anti - against; acidus - acid) are weak alkaline compounds used to neutralize hydrochloric acid in the

stomach.

- Antacids are the substances which reduce gastric acidity resulting in an increase in the pH of stomach and duodenum.

Gastric acidity occurs due to excessive secretion of HCI in stomach due to various reasons.

- The pH of the stomach is 1.5-2.5 when empty and raises to 5-6 when food is ingested.

- Low pH is due to the presence of endogenous HCl, which is always present under physiological conditions.

- When hyperacidity occurs the result can range from:

- i. Gastritis (a general inflammation of gastric mucosa)
- ii. Peptic ulcer or oesophageal ulcer (lower end of oesophagus)
- iii. Gastric ulcer (stomach)
- iv. Duodenum ulcers
- Symptom of hyperacidity:

• Hydrochloric acid is secreted by the stomach to kill harmful organisms, aid digestion and activate digestive

enzymes.

• Excess secretion of acid into stomach or impaired resistance by the lining of the stomach or reflux into the

oesophagus may produce symptoms.

- Hyperacidity cause gastric reflux, gastritis, upset stomach and heartburn.
- Criteria of an ideal antacid preparation:
- The antacid should not be absorbable or cause systemic alkalosis
- The antacid should not be a laxative or causes constipation
- The antacid should exert its effect rapidly and over a long period of time
- The antacid should buffer in the pH 4-6 range
- The reaction of the antacid with gastric HCl acid should not cause a large evolution of gas
- The antacid should probably inhibit pepsin.

Classification of antacids

Antacids can be classified into two main category:

Based on chemical nature of Antacid properties.

i. Absorbable Antacids

o The absorbable antacids (chemical antacids) show the most rapid onset of action and provide faster relief of symptoms.

o However they may cause an "acid rebound".

o Absorbable Antacids inappropriate for patients afflicted with hypertension or kidney failure.

ii. Non-Absorbable Antacids

o The non-absorbable antacids though less prone to cause a rebound effect

o Moreover as these antacids are more potent and effective in a semi liquid or liquid form than in a capsule or table o The usually high presence of aluminum and magnesium hydroxides in non-absorbable antacids can be effectively used to prevent significant stress ulcer bleeding in post-operative patients or those with severe burns.

Based on pharmacological properties of Antacid.

i. Non-systemic antacids

- Non-systemic antacids are compounds that are not absorbed into the systemic circulation.
- Their anionic group neutralizes the H+ ions in gastric acid. This releases their cationic group which combines with HCO3– from the pancreas to form an insoluble basic compound that is excreted in feces.

ii.Systemic antacids

- Systemic antacids are absorbed into the systemic circulation.
- They have a cationic group that does not form insoluble basic compounds with HCO3-. Thus the HCO3- can be absorbed producing a metabolic alkalosis.

Sodium bicarbonate

Molecular formula NaHCO3 Molar mass 84.01 g/mol Synonym Baking soda; Bread soda, Cooking soda, Bicarbonate of soda

Properties

Appearance : White crystalline power or granules Odor : Odourless Taste : Saline taste Density : 1.1 to 1.3 g/cm3 Melting point : Decomposes to sodium carbonate starting at 500 C Solubility in water : Freely soluble in water: 69 g/L (00C); 96 g/L (200C); 165 g/L (600C); 236 g/L (1000 C) Refractive index : 1.583

Preparation

NaHCO3 may be obtained by the reaction of carbon dioxide with an aqueous solution of sodium hydroxide. The initial reaction produces sodium carbonate. Further addition of carbon dioxide produces sodium bicarbonate
CO2 + 2 NaOH → Na2CO3 + H2O
Na2CO3 + CO2 + H2O → 2 NaHCO3
On an industrial scale it is obtained by Solvay process:
CO2 + H2O → H2CO3
NH3 + H2CO3 → NH4HCO3
NaCl + NH4HCO3 → NaHCO3 + NH4CI

Uses

• It is used as Systemic antacid and in electrolyte replacement.

- It is used as systemic alkalinising agent used in the treatment of metabolic acidosis (increase in acidity).

- Bicarbonate of soda can also be useful in removing splinters from the skin.

- Sodium bicarbonate can be added to local anaesthetics, to speed up the onset of their effects and make their

injection less painful.

- Sodium bicarbonate may be used as a buffering agent, combined with table salt, when creating a solution for nasal

irrigation.

- 0.1% to 1% Sodium bicarbonate solution used as eye lotion.
- Used removed ear wax and lubricating fluid for contact lenses.
- 5% to 10% Sodium bicarbonate solution used as local applicants for burn, insect bites etc.
- Used in preparation of effervescent formulation.

Aluminium hydroxide gel

It is an aqueous white viscous suspension of hydrated aluminium oxide having varying amounts of basic aluminium carbonate. The preparation may sometimes have methyl oil, peppermint oil, glycerine, sucrose or saccharin as flavouring and sweetening agents and upto 0.05% sodium benzoate as preservative.

Preparation: It is prepared by adding hot solution of potash alum slowly with constant stirring to a hot solution of sodium carbonate. After complete removal of CO2, the precipitated aluminium hydroxide is filtered. It is washed properly with hot water until it gets free from sulphate ion and the precipitate is suspended in distilled water to the required strength.

3Na2CO3 + 2KAI(SO4)2 +3H2O------3Na2SO4+ K2SO4 + 2AI (OH)3 + 3CO2

sodium carbonate potash alum aluminium hydroxide Precaution: Alum solution is added to solution of sodium carbonate and not vice versa.

Properties: It is a white viscous suspension. Aluminium hydroxide gel gives astringent aluminium chloride when it reacts with gastric hydrochloric acid. This results in nausea, vomiting and constipation.

Unit- Radiopharmaceuticals

The substances which emit radiation and which are used in medicine are called Radiopharmaceuticals. The term Radio-Isotopes', Radioactive Isotopes, 'Radio Nuclide and isotopes are

used generally for substances which emit ionizing radiations.

These are used in medicine for the following two purposes:

- (I) as source of radiation for radiotherapy, for example in cases of cancer.
- (ii) As radioactive tracers for diagnostic purposes.

Structure of Atom:

Atoms contain many subatomic particles. However, for this chapter the following three.

- 1. Protons. These are positively charged heavy particles, found in the nucleus of an atom.
- 2. Electrons. These arc negatively charged light particles, orbiting around the nucleus. Each the charge of a proton.
- 3. Neutrons. These are heavy particles around in the nucleus. These do not possess any charge. The mass of a neutron is almost equal to the mass of a proton.

Atomic Number

1. Atomic number of an element is equal to number of protons present in the nucleus of its atom.

2. As the atom as a whole is neutral, therefore the number of electrons outside the nucleus must be equal to the number of protons inside the nucleus. Atomic number of an element

1S the serial number of its position in the periodic table and determined its chemical properties.

Mass Number

It is the sum of the number of protons and the number of neutrons in the nucleus. Mass of an atom of a clement is due to the mass contributed by protons and neutrons present in its nucleus: mass of an electron is negligible.

Isotopes; Atoms of an element which have the same atomic number but which have different mass numbers are called Isotopes. In other words, 1sotopes are atoms or the same element whose

nuclei contain the same number of protons but different number of neutrons. Isotopes

of any clement contain the same number of protons and the same number of electrons and, therefore,

these exhibit the same chemical properties and occupy the same position in the periodic table.

Isotopes are classified into the following two types:

(1) Stable isotopes. These are stable and do not emit radiations such as Carbon-12,

Chlorine-35. Hydrogen-1 (podium), Hydrogen-2 (deuterium) etc.

(2) Radioactive isotopes. These are unstable and emit radiations. These may be naturally

Occurring radioactive isotopes (Uranium, Radium etc.) or may be produced artificially. The phenomenon of emitting radiations by these 1Sotopes is known as radioactivity and such isotopes

are called radioactive isotopes.

Types of Radionuclides

Radioisotopes are of two kinds, namely: (I) natural radionuclides, and (ii) artificial radionuclides, produced in nuclear reactors in controlled manner by reactor radiation or cyclotron irradiation. There are about 40 natural radionuclides, e.g., U-235, Ra-226, Rb-87, K-40, etc.

Nature of Radiation

three different kinds of radiations with different types of behavior are observed atom radioactive substances. These are named as alpha particles (alpha-particles), beta particles (particles).

And gamma rays (Y-rays). In a radioactive change a nucleus usually loses just one particle. Alpha or beta, and it is frequently accompanied by a gamma ray. During this process of radiation is

unstable nucleus of a radioactive isotope gives out energy and gets converted in form. Alpha particles (-particles), these particles arc composed of two protons neutrons and arc identical to the nucleus of a helium atom. Hence atomic number of alpha P 1s2 and its mass number is 4. These are heavy but slow and are least penetrate in to the skin.

EXPECTORANTS, EMETICS AND ANTIDOTES

Expectorants are helpful in eliminating bronchial secretions by inducing cough. They may be cause this by irritating the gastric mucosa. The inorganic expectorant are ammonium chloride potassium iodide, sodium iodide and related substances.

These are classified according to their action (directly or reflex).

(i) Volatile oils, e.g. ecucalyptus oil when administered orally by steam inhalation increase the respiratory secretion. They are direct expectorant.

(ii) Iodides liquefy the mucous and aid its expulsion.

(iii) Ammonium chloride and ammonium bicarbonate are reflex saline expectorants. These agent irritate the gastric mucosa and stimulate respiratory tract secretion.

(iv) Alkaloid, vaccine (isolated from Adhatoda vasaca leaves) is expectorant due to broncho dilation action.

Emetics are compounds which cause emesis to expel out the contents of the stomach.

They may act by stimulation of the chemoreceptor trigger zone (e.g., morphine) or act peripherally (e.g... antimony potassium tartrate) ammonium chloride). Emetics are useful in the treatment of poisoning and in low devices, it may be added in cough preparation. Mild emetic response stimulates flow of respiratory tract secretion Ammonium Chloride mostly and antimony potassium tartrate to a limited intent are added in cough preparation.

Antidotes react specifically with an ingested poison or toxic substances or an overdose a potent drug. They cither neutralised the poison or its toxic effect. Pharmacologically (antagonistic

or chemically by converting them to non-toxic or less toxic forms (eg. chelates. acid, insoluble derivatives). Sodium thiosulphate act as chemical antidote for the poison, cyanide. It con very thi-cyanide into non-toxic

thiocyanale. Sodium nitrite act as physiological antidote. It convert haemoglobin into methahaemoglobin in order to bind cyanide.

TOPICAL AGENTS

Topical drugs are the compounds which are applied to the skin and mucous membrane of their local effects. Sometimes they penetrate into the deeper tissues, absorb into the blood, for example antiseptic penetrate into the tissues to help in healing of deep infection. Topical agents are also applied with in body cavities that open outside (oral, vaginal and colonic cavies) exerts its local action.

Topical agents are broadly classified as follows:

- 1. Protective and adsorbents (talc, bentonite, zinc oxide).
- 2. Antimicrobial (potassium permangnate, iodine. boric acid. povidone 1odine).
- 3. Astringent (alum and zinc sulfate).
- 4. Demulcents (benzoin).
- 5. Emollients (castor oil. coconut oil).
- 6. Cleansing agent (henzalkonium chloride, sodium laury sulfate).

Protective: These are the inert substances applied to the skin to cover and protect epithelial surfaces, ulcer and wounds or prevent the irritation due to rubbing or friction. Protective are generally applied as dusting powders, suspension or ointments.

The compound used as protectives should have the following ideal properties.

(i) Insolubility. Protectives due to insolubility are not absorbed through the skin hence, they are not easily washed out.

(ii) Inertness. They should be biologically inactive to avoid interaction with tissue.

(iii) Paricle Size. These agents are usually applied to the areas of the skin which are under constant imitation due to moisture or friction. Protectives must be subdivided to provide larger surface area. So that particle can adhere to each other, adhere better to the surface of the skin for quick moisture absorption. A line particle also a smooth surface which helps in preventing irritation due to rubbing or friction. And zinc commonly used tropical astringents. They have 10llOwing actions

and constriction of small capillaries.

Astringent: Astringents are the compound which precipitate the proteins. A salt of aluminum.

(a) Styptic. These agents pre vent blending iron minor Cuts by enhancing blood coagulation.

(b) Antiperspirant. These agents decrease ne pespirauon rate due to constriction of pores at the skin surface.

(c) Miscellaneous. Astringents reduce inammauon die restricting the supply of blood to the

surface of mucous membrane. Astringent agent concentration can also remove the unwanted tissue on the skin. They are also beneficial in diarrhea due to its precipitant action.

Antimicrobials: The term microbial are the compound which act against the microbes. Let includes antiseptic, germicide, disinfectant.

Antiseptic: This is a chemical used to prevent Sepsis but the term is generally used for an applied to the tissues of humans or animals to inhibit or destroy invading organisms. Germicide. It is a chemical substance used to kill bacteria. The corresponding terms of Viruses and fungi arc viroid and fungicide respectively.

Disinfectant: It is a chemical, used to destroy the microbes that cause diseases animals or plants. The term is commonly applied when destruction lakes place in or on inanimate objects