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TOPICAL AGENTS

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Definition

The topical agents" are those substances, which applied to body surface including applications within the body cavities that open outside .

(e.g. the oral vaginal) ,

- These are the compound that act locally with skin or mucous membrane mainly by mechanical or physical manner.
- Topical agents does not absorbed directly into the circulation.
- Compounds have little pharmacological effect.

- The facts of compounds are that when they are applied produces variety of effects like adsorbent, astringent, demulcent , emollient or protective
- Some compounds also exhibit antimicrobial, astringent activity topically.
- Some inorganic compounds are having topical local activity .



- The inorganic compounds used topically are broadly
- * categorized on the basis of their usual action or use e.g.
- * (i) protective's and adsorbents,
- * (ii) antimicrobial,
- * (iii) astringent and
- * (iv) Sulphur and its compounds
- * (v) miscellaneous compounds.

ANTIMICROBIAL AGENT

- Is a broad terminology describing activity against microbes.
- Antimicrobials are the chemical agents used to destroy or inhibit the growth of pathogenic micro-organism.
- They are normally ineffective in the sporing state of microorganism.

Disinfectants -are substances that are applied to non-living/inanimate objects to destroy microorganisms that are living on the objects.

E.g. Chlorinated lime, potassium permanganate, formaldehyde, phenol etc.

Antiseptic: They are antimicrobial substances that are applied to living tissue/skin to reduce the possibility of infection, sepsis.

e.g. Hydrogen peroxide, potassium permanganate, Iodine, Povidone iodine etc.

Sterilization:-the complete destruction living microorganism including bacterial spores .it can be achieved by physical methods or by chemical means.

Germicide:-the agents which are employed to kill M.O. it can be broad form germicidal, virucide, fungicide etc.

Static:-stops the growth of M.O.

Bacteriostatic:- The agent which primarily function by inhibiting the growth of bacteria. Thus, bacteriostatic drugs or agents do not kill but arrest the growth of bacteria.

PROPERTIES

1. It should have **antiseptic or germicide** activity & not bacteriostatic activity because if M.O are not killed, they may grow & cause infection.
2. To reduce incidence of resistance it should have **rapid onset of action** & sustain activity.
3. Have good **therapeutic index**.
4. Should not produce **local cellular damage** or should not interfere with **body defense**.
5. It should show no **systemic toxicity** from topical application.
6. It should have in general **broad spectrum of activity** against bacteria, fungi, protozoa, virus etc.

Hydrogen Peroxide:-

1) Chemical formula:- H_2O_2

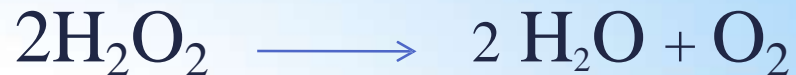
Properties:-

- Colour: colorless
- Odour:- odourless.
- Nature:- Clear liquid
- Taste :- slightly acidic
- Solubility:-. practically soluble in water, & in dil mineral acid it dissolves slowly in Hot H_2SO_4



The Solution usually deteriorate upon standing upon agitation

Rapidly decomposes when in contact with many oxidizing or reducing sub.



Solution is stabilized by

- 1) By addition of small qty of acid & by adjusting the pH between 2 to 3.
- 2) Some Stabilizers like acetanilide, quinine, sulphate, 8-hydroxyquinoline & others complexing /chelating agents are used in 0.02 to 0.05% con range.

Principle:

- This assay is based on Oxidation Reduction (Permanganate) type of titration in which solution of **potassium permanganate** acts as an **oxidizing agent** and **hydrogen peroxide** also acts as an oxidizing agent **But** in presence of **strong oxidizing agent** like potassium permanganate hydrogen peroxide acts as **reducing agent**.
- The ability of potassium permanganate solution to oxidize is due to conversion of the MnO_4^- ion to Mn^{++} in acidic solution but MnO_4^- ion is reduced by reducing agent like hydrogen peroxide.
- Solution containing MnO_4^- ion are purple in color, solution of salt containing Mn^{++} ions are colorless, hence permanganate solution is decolorized by reducing agent as long as MnO_4^- is present in the solution.

The moment there is an excess addition of potassium permanganate solution becomes purple, thus potassium permanganate acts as a **self indicator**.

Reactions:

In this assay dilute sulfuric acid is used for conversion of MnO_4^- to Mn^{++}



Chemical reaction for assay:



Uses

- 1) The primary use is a mild oxidizing antiseptic. This action comes when it comes in contact with abraded tissue. It is a mild oxidizing antiseptic action the antiseptic action is associated with mechanical cleansing provides by rapid foaming release of oxygen. Helps in removal of dirt, bacteria from cuts & wounds & acts as cleaning antiseptic.
- 2) It destroy most pathogenic bacteria.
- 3) Its 1.6% solution is used as **deodorant, gargle and mouth wash.**
- 4) It is used as an **antidote in phosphorous and cyanide poisoning.**
- 5) It is used for **bleaching the hair.**
- 6) It is used in treatment as ear wash & vaginal douches.

Storage:-

- It is stored in container protected from light, in bottles closed with glass stoppered or plastic caps provided with vent for the escape of oxygen.
- Keep in cool place.
- The label should indicate whether it contains stabilizing agent or not.

2) Potassium Permanganate

Chemical Formula:- KMnO_4

Physical Properties:-

- **Colour:** Dark Purple
- **Odour:**- odourless.
- **Nature:**- metallic prisms, almost opaque with blue metallic lustered
- **Taste** :- sweet
- **Solubility:**- practically soluble in water, & more in boiling water.



Chemical properties:-

- When heated it decomposes at high temp (240°C)



- It is a powerful oxidizing agent
in **acidic solution** it is reduced from Mn+7 to Manganous ion Mn+2 with evolution of O₂.



- In neutral or alkaline media also O₂ is liberated .It brings bleaching Action.
- KMnO₄ oxidize alcohol to Aldehyde
- Sulphide to Sulphur
- Ferrous Salt to Ferric
- Nitrites to nitrates
- Iodide to free iodine in acidic condition

Assay:- Oxidation Reduction Reaction

- known Wt of sample is dissolved in water & vol made to 250ml.
- To 25ml of 0.1N oxalic acid added 5ml H_2SO_4 & warms to 70°C & titrated with prepared solution of KMnO_4
(*temp is not maintained at 70°C the reaction will be slow*)
- The permanganate should be taken in the burette and the end point is appearance of a pale pink color.

- Incompatibility It is incompatible with **iodides, reducing agents** and most organic matter.
- Storage:- It should be stored in **tightly-closed container** & should **handled with care** since **explosion** may occur when it comes in contact with **oxidisable substance**

Uses:-

1.It is a topical anti-infective (antibacterial and anti-fungal). (*anti-infective due to the oxidizing property.*)

2.It stains the skin & tissues.

Sol in 1:5000-1:15000 conc. it is used in cleaning wounds & ulcers for skin infection caused by bacteria & fungi.

3.It is also used as an **antidote in barbiturate & alkaloidal** poisoning. (*A sol of 1: 5000 when used as gastric wash, oxidises poison & prevents their absorption.*)

1.CHLORINATED LIME:-

Chemical formula $\text{Ca}(\text{ClO})_2$

Synonym Bleaching Powder, Chloride of Lime.

Physical Properties:

Colour:- white powder

Odour:- characteristic odour

Solubility:- slightly soluble in water and in alcohol.

Storage: It should be stored in tightly closed containers. It is affected by moisture & heat.

➤ Preparation:-

It is manufactured by the action of **chlorine on calcium hydroxide**

i.e.. The slaked lime is spread on shelves in suitable container

Chlorine gas is introduced at the top of chamber & passed through the contents of the shelves.

this is usually done at 25° thus minimizing the formation of calcium chloride. when abs of chlorine is completed, powdered lime is blown into the chamber to absorb the excess of chlorine.

USES:-

- It is used as **disinfectant & bleaching agent**.
- It shows **bactericidal action**.
- It is used to disinfect faeces, urine , sputum& other organic material.
- It is employed for disinfecting drainages.
- It is a powerful bleaching agent .Its powerful bleaching action must be considered while disinfecting coloured materials.
- it is used as 1-2 g/l for sterilization of water.
The treated water should be exposed to air & allowed to settle before use.
- Chlorinated lime is used in the preparation of surgical chlorinated soda solution, employed as a wound disinfectant.

Properties of Boric acid-

1. It is a white, colorless crystalline powder, odorless, unctuous to touch.
2. It has bitter, sweetish after taste
3. It is soluble in alcohol, freely soluble in glycerin, propylene glycol and boiling water
4. Stable in air
5. On heating at 1000°C it is converted in to Metaboric acid, at 1600°C in to tetra boric acid and at more than 1600°C boric acid is converted in to boron trioxide.
6. Boric acid is very weak acid, so it cannot be titrated accurately with standard alkali.

Hence glycerin is added in its titration.

Storage of Boric acid- It should be stored in air-tight, well closed container.

Uses of Boric acid-

1. It has weak bacteriostatic and fungistatic action
2. It is used as local anti-infective drug in the form of cream, ointment and lotion
3. Buffer in topical preparations
4. Vehicle for ophthalmic solution
5. Boric acid is useful as Suppositories base
6. It is also used to impregnate surgical dressings

BORAX

- Chemical formula $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10 \text{H}_2\text{O}$
- Synonym:- Sodium Borate
- Properties:-
- Colour:-Colourless transparent crystals
- Odour:-odourless,
- Taste:- saline and alkaline taste
- Solubility:- It is soluble in water and glycerin but insoluble in alcohol.
- Chemical Properties:-
- On heating loses all its water of hydration & swells to a white porous powder.
- When heated to red hot & on cooling , forms a transparent mass known as borax bead



- An aqueous sol of Na borate is alkaline to litmus .
- Alkali borate are water soluble.
- Borates of other metals undergo hydrolysis & forms insoluble , hydroxides or oxides.

Action & Uses:- It has been used externally in solutions containing 1 to 2% of borax as an eyewash, gargle in mouthwashes and as a wet dressing used in food preservative

- cosmetics, it is used as emulsifier & also in lotions. germicide & bacteriostatic.

Iodine

- **Chemical formula :-** I_2
- **Mol wt :** 253.8

Properties:-

- **Colour:-**grayish-violet or bluish-black
- **Nature:-**brittle plates or small crystals with a metallic luster.
- **Odour:-**It possesses a distinctive penetrating irritant
- **Taste:-**bitterly pungent taste.
- **Solubility:-**It is very slightly soluble in water, soluble in alcohol and dissolves freely in ether, chloroform and carbon disulphide.

It dissolves readily in sol of KI & other iodides forming compound as KI_3 .



Chemical Properties:-

- 1.It melts at 140°C but sublimes freely at temp below its MP.
- 2.It is volatile at R.T & its vapours attack both cork & rubber.
- 3.The imp chemical property of iodine in aqueous sol is that a mild oxidizing action mediated through the formation of hypoiodous acid.

Storage:- Should be stored in well- closed bottles fitted with glass stoppers **because I_2 is volatile & its vapors attack both cork & rubber.**

Incompatibility:- with **alkalis and alkali carbonates.**

Uses:-

- 1) Topical **anti-infective** iodine has a powerful **bactericidal** action and is used for disinfecting unbroken skin before operation.
- 2) Iodine ointments are applied as counter-irritants.
- 3) Its 2% solution in glycerol is used for application to mucous membrane
- 4) **compound iodine paint** is used as a throat paint in **pharyngitis** and **follicular tonsillitis**.
- 5) Iodine is an essential trace element in **human diet**.
Deficiency of iodine leads to development of **goiter** and in many countries, common salt which is used for food purposes is iodized mainly with iodides.

Solution Of Iodine:-

- The germicidal activity of free iodine is about six times that of hypoiodous acid.
- Preparations providing free iodine are bactericidal, fungicidal, amoebicidal and virucidal.
- Iodine is effective in very dilutions.
- Iodine Solutions and Iodine Tincture are most effective topical agents available.
- They have been used as antiseptics on the skin prior to surgery.

Some of the well-established solutions are:

■ 1) Aqueous Iodine Solution B.P./I.P. (1966) (Strong Iodine U.S.P.)

- It is also known as Lugol's solution.
- It does not contain any alcohol. It contains 5.0% w/v of Iodine and 10.0% w/v of Potassium Iodide.
- The relative proportion of potassium iodide to iodine is much higher than in weak solution.
- Uses: Source of Iodine.

2)Strong Iodine Solution I.P. (1966)

It contains 10.0% w/v of Iodine and 6.0% w/v of Potassium Iodide in alcoholic solution, composition: Iodine 100 g, Potassium Iodide 60 g, Purified water 100 ml; Alcohol (90%) sufficient to produce 1000 ml'

Uses: Antiseptic.

3) Weak Iodine Solution B.P/I.P. (1966):-

It contains

2.0% w/v of Iodine

2.5% w/v of Potassium Iodide in water.

This solution is identical in composition with Tinctura
iodi Mitis B.P. 1914. es.

Uses: Antiseptic.

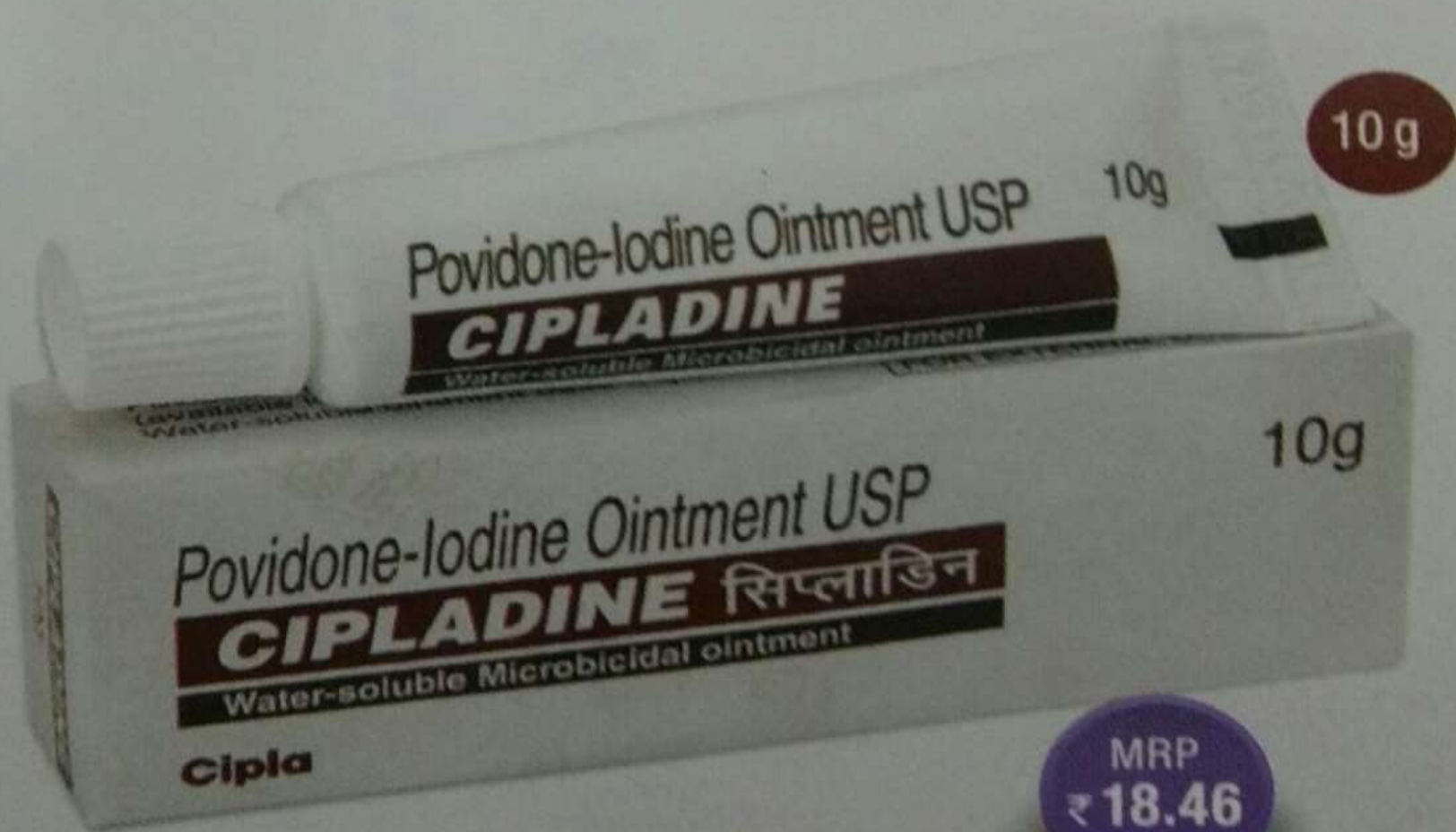
4) Iodine Tincture U.S.P. :

It contains 2.0% w/v of Iodine and 2.4% w/v of Sodium Iodide in much diluted alcoholic solution.

Note-Iodine preparations of any type are contraindicated in patients who have exhibited prior allergy or hypersensitivity to iodine.

Cipladine Ointment

Povidone-Iodine I.P. 5% w/w (available Iodine 0.5% w/w)
Water-soluble ointment base q.s.



Properties

- Colour:- Yellowish brown
- Odour:- slight characteristic odour
- Nature:- amorphous powder
- Solubility:- It is soluble in water and in alcohol, but practically insoluble in organic solvents.
- Chemical properties :- Aqueous solution is acidic to litmus.
- The Povidone-Iodine solution is reddish Brown colour, and a pH of not more than 6.0.
- Its non-irritating effects on tissue, comparatively low oral toxicity, its water solubility and its low iodine vapour pressure making it stable to possible iodine loss makes it superior to Iodine Solutions.
- Solution in most of the applications. Solutions are nonstaining and can be washed clear from skin and clothing.

Storage :- It should be stored in air-tight containers (tightly closed containers), the materials of which⁶¹ are resistant to iodine.

Uses

- Antiseptics for surgical scrubs and pre-operative antisepsis of the skin.
- It is also used in gargles and mouthwashes for the treatment of infections in the oral cavity.
- Various preparations include an aerosol (0.5%), solutions (usually 1%), a surgical scrub (0.75%), a vaginal douche (1%) and a vaginal gel (0.1%).

Protein precipitant Antimicrobial

SILVER NITRATE

Chemical formula:- AgNO_3

Mol wt : 169.89



preparation:-

- It is prepared by the action of hot nearly concentrated nitric acid on pure silver.
- 3 parts of silver are added to a sol 25% nitric acid (about 10 parts) heated to expel the nitrous fumes, filtered & evaporated until it is dry.
- then the mass is fused to convert the copper nitrate into insoluble oxide. So obtained product is dissolved in hot water, filtered it & kept aside in dark place for crystallization.
- crystals are collected on sintered glass crucible & dried at 50°C in dark.
- Purified of AgNO_3 is costly therefore pure silver & nitric acid free from halogen & sulphur is used. ⁶³

Properties

- Colour:-White
- Odour:- odourless
- Nature:-Rhombic crystals
- Taste:- Bitter taste
- Solubility:-Very soluble in water
- Sparingly soluble in alcohol, freely soluble in boiling alcohol It becomes grey/greyish black .
- On exposure to light in presence of organic matter, due to liberated silver.

Chemical Properties:-

- 1% sol has PH between 4.5- 6
- 4% sol has bet 5.4- to 6.4
- at 212° C it melts to a slightly yellow liquid which on cooling congeals to a white crystalline mass.
- At high temp is slowly decomposes evolving oxides of nitrogen. it produces chemical reaction of silver ion & nitrate ion.

➤ Sol of AgNO_3 gives white- yellow –white ppt with HCL & other halogen containing salts.

➤ The silver halide ppt is insoluble in dil acids but dissolve in ammonia.

Storage :-

➤ Should be stores in tightly closed light **resistant non metallic containers** .

➤ Sol should be freshly prepared & supplied in amber Coloured bottles.

Incompatibility:-incompatible with reducing agent, Tartarates, Sugar, Tannins, Alkali halogen acids & their salts.

Uses:-

- 1) Antibacterial in conc. from 0.01 to 0.5%
- 2) In higher conc 1% above it has astringent, irritant property on tissues .
- 3) AgNO_3 ophthalmic sol 1% is used in eyewash, 0.5% aq sol for treating burns injuries & in wet dressings.
- 4) Its effective against coccol infections

Mild Silver Protein

Chemical formula :-Variable

It is a silver rendered colloidal by the presence of, or in combination with protein .

Properties:-

Colour:- dark brown or almost black

Odour:- odourless

Nature:- shining scales or granules

Solubility:-It is freely soluble in water, but almost insoluble in alcohol, chloroform and ether.

Storage:-It is affected by light therefore should be protected from light.

Action & uses:-

1) 0.5% to 20% sol is used as antibacterial. the release of Ag^+ ions tends to increase with dilution & therefore more dilute sol becomes irritating. on aging sol becomes more irritant & a ppt is formed. therefore sol of mild silver protein should be always prepared freshly which contain suitable stabilizers.

Uses:-

Uses:-

- The Solution due to its low irritability usually employed as local antibacterial on mucous membranes in nose, throat, & conjunctiva of eye.
- for irrigation of urethra & bladder.
- its major effectiveness in the treatment of gonococcal infection. Also used in respiratory tract infections & also as prophylactic against respiratory infection.
- Mercury with chalk act as purgative due to irritant action of Hg ion.
- As it is toxic it is not used medicinally.
- best bacteriostatic.

note:- Prolonged use of mild silver protein may result in darkening of skin due to the deposit of free silver below epidermis.

Mercury

Synonym:-Hydragyrum , quick silver (Hg)

- Colour:- bright shiny silvery White
- Odour:- odourless
- Nature:-liquid at room temp

Storage :-

- Should be stores in tightly closed containers .
- **Action & uses:-**
- Cathartic & parasiticide
- Also used in the treatment of syphilis & as diuretic
- But it is extremely poisonous & prolonged **inhalation** in minute quantity may be **fatal**.



wiseGEEK

Yellow Mercuric Oxide

Chemical Formula:-HgO

Mol.Wt: 216.6

- Colour:- Yellow to orange according to temp at time of preparation
- Odour:- odourless
- Solubility:- in Soluble in water& alcohol but soluble in acids

Storage :-

- Should be stores in tightly closed containers .protected fro light
- Chemical properties:-
- Stable in air
- form red oxide slowly develops on exposure to light.

Action & Uses:-

- local antibacterial.
- also mild antiseptic action used in ophthalmology for treating no. of inflammatory conditions.
- also used for the treatment of fungal infection of the skin & infestations of body lice.

Ammoniated Mercury

Chemical formula:- $\text{NH}_2 \cdot \text{HgCl}$

Synonym:- Amminochloride of mercury, white precipitate

- Mol.wt- 252.1
- Colour:- White
- Solubility:- Insoluble In water, alcohol, ether.

Storage :-

- Should be the amber colored container (*on exposure to light it darkens*).

Action & uses:-

- 1) acts as mild antiseptic (*slow release of mercuric ions.*)
- 2) topically used in treatment of various skin infections caused by fungi, lice & other infestations.
- 3) Commonly employed in 5% strength as ointment & also as dusting powder.

Sulphur & its compound

- * Elemental Sulphur exist in various allotropic forms including several solid and two liquid states namely:
 - * It occurs in free form & also sulphides & Sulphate Sulphur & its compound have many use p,'ceutical & medicinal fields.
 - * Solid as Rhombic (α -Sulphur, $S\alpha$, Sublimed Sulphur or Flower of Sulphur), and Monoclinic (β -Sulphur, $S\beta$); Liquid as λ -Sulphur Plastic Sulphur and Amorphous Sulphur (formed on aging of "plastic" sulphur).
 - * Elemental Sulphur is little use internally

MOA:-but it is use topically as antibacterial. elemental sulphur acts either due to the oxidation-reduction products of the element [e.g. sulphides)

- * The sulphur "candles" when burned, give off sulphur dioxide for fumigation or insecticide purposes.
- * Sulphides are used as depilatories, due to the ability of sulphides in highly alkaline solution (pH 10) to reduce the disulphide linkage in the amino acid cysteine in hair. The reduction and softening of the hair help in its removal.

medicinally used Sulphur compound are

PRECIPITATED SULPHUR

- Chemical symbol S Atomic wt. : 32.6
- Synonym:- flower of Sulphur, milk of sulphur

Preparation:-

- By Sublimation process

(Any form of Sulphur is heated vapors produced which are condensed.)

- In refinery the molten Sulphur is placed in iron retorts which communicate with the stone chambers.
- When Sulphur vapors enters the stone chambers they ignite & convert into Sulphur dioxide.
- The subsequent vapor pass through relative cold gas & condenses on walls & floors of the chambers in fine crystalline form.



Properties:-

- Colour:- Yellow
- nature:- Fine crystalline powder
- Odour :- Odourless
- Tasteless
- Solubility:- insoluble in water and in alcohol.

Uses:-

- Used as an ingredient in sulphur ointment & used as scabicide.
- Used in the treatment of acne, pimples and psoriasis
- Act as keratolytic agent

Precipitated Sulphur U.S.P (Solid allotropic form of Sulphur)

- properties:
- Colour:-pale yellow
- Odour:-odoureless
- Taste;- Tasteless
- nature:- very fine
- Solubility;- very slightly soluble in alcohol & slightly soluble in olive oil.

Uses:-

1. Sulphur is a mild antiseptic and Parasiticide and has been widely in the of lotions and 10% ointments for treatment of scabies & acne . employed as fungicides in the treatment of superficial fungal infections.
- 2) Sulphur is also used mainly as a dermatological agent to treat seborrhea s , psoriasis.
- 3) It may be used alone or in conjunction with other keratolytics .
- 4) Precipitated Sulphur is converted in the small intestines into alkali sulphides which produce a mild laxative effect due to their irritant action.
- 5) also used in homoeopathic medicines.

Note-Some patients may be hypersensitive to sulphur and should be observed for any allergic manifestations.

Selenium Sulphide

Chemical formula - SeS_2

Synonym Selenium Disulphide

Mol.wt-143.09

Preparation;-

Prepared by passing H_2S into selenious acid. by adding selenious acid to a saturated solution of H_2S PPT is collected & dry.

Properties.

colour;-orange to reddish brown

odour:- faint odour of hydrogen sulphide

nature:- powder

solubility:-in water & inorganic solvents in HNO_3 with formation of selenious & sulphuric acid

- 1 Selenium sulphide is used as antidandruff.
2. Selenium Sulphide used in 1 to 2.5 % as anti seborrheic
- 3.5-10ml of 2.5% suspension to be applied on scalp. after application it is allowed to remain in contact for 5 min & it is washed off.
4. Longer exposure produce irritation care should be taken ,not to introduce in eyes or mouth as it is highly toxic.



Astringent

- Astringents are locally applied protein precipitants which have a low cell permeability so that the action is limited essentially to the cell surface and the interstitial spaces.
- The action does not result in the death of the cell, only the permeability of the cell membrane is reduced.



Astringents are therapeutically used as

- (i)** Styptic, to arrest haemorrhage (to stop bleeding from small cuts) by promoting coagulation of blood and constricting small capillaries;
- (ii)** antiperspirant to decrease sweating by constricting pores at the surface of the skin;
- (iii)** to reduce inflammation by restriction of the blood supply to the surface of mucous membranes;
- (iv)** promote healing and toughen the skin;
- (v)** deodorant by virtue of interaction with odorous fatty acids liberated or produced by the action of bacteria on lipids in sweat and by an action suppressing bacterial growth, partly due to a decrease in pH; and
- (vi)** direct action on skin to remove unwanted tissue (this requires a higher concentration or a stronger protein precipitant, often termed as corrosive).

Most topical astringents are salts of aluminium, zinc & to some extent Zirconium.

Alum :- $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$

Mol wt :- 474.33

(Aluminium Potassium Sulphate) Mol wt. 453.33

(Aluminium Ammonium Sulphate), Mol Wt:- 474.39

Alum can be either the ammonium or the potassium salt & should be labeled on container which salt is present.

Preparation:-

official alums are prepared by adding a hot, concentrated solution of either potassium or ammonium sulphate to a hot solution of an equimolecular proportion of aluminium sulphate.

The alums separate out as crystals on cooling.

Properties:-

Colour:- colourless

Nature:- large crystals, crystalline fragments or as a white powder.

odour:- odourless

taste:-with a sweetish strongly astringent taste.

Solubility:- Alums are freely soluble in water, but slowly dissolve in glycerin, and insoluble in alcohol.

Chemical properties:-

Acidic to litmus

When heated, it melts and at about 200°C loses its water of crystallization with the formation of the anhydrous salt.

Storage:-To be stored in airtight containers.

Uses:-

- Alum precipitates proteins and is a powerful astringent.
- Dilute solutions (1 to 4%) have been used as astringent mouthwashes and gargles but they have a destructive action on teeth.
- A 2% solution has been used for application to the skin to reduce excessive perspiration.
- Stronger solutions (5 to 10%) are used to harden skin by athletes, especially as footbath to toughen the skin of the feet.
- strong solution is used as a styptic for minor cuts and abrasions.
- (0.5 to 5%), lotions and douches, some vulvovaginal cleansing and deodorant preparations.

ZINC SULPHATE

Chemical formula :- $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$

Synonym:- White Vitriol

Preparations

- For industrial scale, zinc sulphide is heated in presence of air under specified conditions. the heated mass is dissolved in hot water, filter the solution concentrated for crystallization.
 - metallic zinc granules are digested with H_2SO_4 .
 - The sol is filtered & treated with chlorine to oxidize any ferrous impurity into ferric sulphate which is then ppted by hydroxide & removed.
- the filtrate is concentrated & crystallized



Properties:-

- Colour:- colorless,
- Nature:-transparent crystals or as crystalline powder.
- Odour:- is odourless
- taste:- metallic and astringent.
- Solubility:- very soluble in water. It is freely soluble in glycerin, but is insoluble in alcohol it
- Chemical Properties:-
- Aqueous solutions of zinc sulphate are acid to litmus
- It forms double salts with ammonium & Potassium Sulphate
- When strongly heated it decomposes
- Storage It should be stored in tightly closed containers.
- Incompatibility :-It is incompatible with alkali carbonates and hydroxides and with astringent infusions and decoctions.

uses:-

- Zinc ions exhibit mild germicidal astringent & styptic action
- (the action is dependent due to slow release of zinc ions from salt or sol.)
- Insoluble zinc ions used in topical agents as protectives.
- ZnSO₄ sol 0.1-1% used ophthalmic
- Internally it is used as an emetic
- Insoluble Zn complex are mainly used in bandages, adhesive, tapes etc.