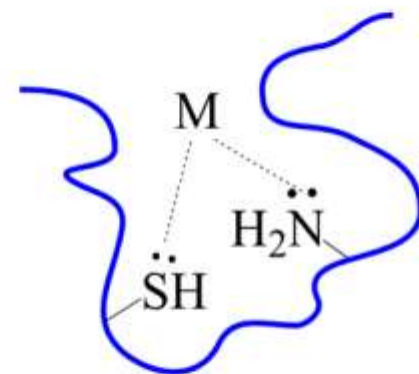


# TOPICAL AGENTS

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Amit Z Chaudhari

# Flow

**TOPICAL means**

**PROTECTIVES**

**ASTRINGENTS**

**ANTIMICROBIAL AGENTS**

---

# TOPICAL means

**Topical agents:** Agents which are *applied on* skin or mucous membrane or in the body cavities and give their local effect (or systemic effect).

[win14, win13, win12, sum15, sum13]

**Sites of applications:**

- Skin, eye, ear, nose, vagina, urethra, rectum

**Types of formulations:**

- Powder, ointments, creams, lotion, spray, past, transdermal patches etc...

**Categories :**

[win14, win14, win13, win12, sum15, sum13]

- (1) Protectives
- (2) Astringents
- (3) Antimicrobial agents (Anti- infectives)
- (4) Miscellaneous agents

# PROTECTIVES

**Protectives:** are the agents that exert their action by *covering the skin* or mucus membrane and prevents inflammation at the site of application.

[win15, win11]

- Forms a coat or a film on the site of application (like ulcer, wound, burned skin) and prevent contact of harmful causes (like bacteria, moisture, dust).

## Ideal properties:

- Agents are insoluble in water,
- Chemically as well as biologically inert
- Appearance is as fine particle form



# PROTECTIVES

## Agents:

(1) Talc

(2)  $\text{TiO}_2$

(3) Silicone polymers

(4) Dimethicone

(5)  $\text{ZnO}$

(6) Calamine



# PROTECTIVES

## (1) TALC

**Chemical formula :**  $3\text{MgO} \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$

[win12]

**Synonyms:** Purified talc, Talcum, Soapstone

**Properties:**

[win12]

Very fine white powder, odorless, tasteless, adhere to skin on touch

**Preparation:**

- Purifying of native talc by boiling with dil. HCl
- Supernatant is removed
- insoluble talc is washed thoroughly with water (remove acid residue)
- Dried and crushed to form a power



# PROTECTIVES

## (1) TALC

### Uses:

- Protective (protects the skin from irritation due to friction)
- Pharmaceutical aid
  - Lubricant in preparations of tablets
  - Filtering aid

[win12]

### Storage:

- Well closed container



# PROTECTIVES

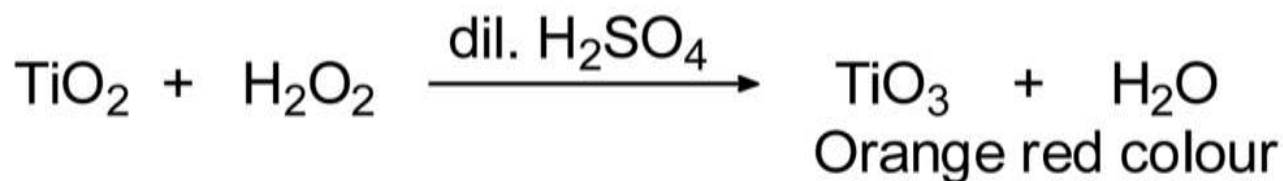
## (2) TITANIUM DIOXIDE

Chemical formula :  $\text{TiO}_2$

Physical Properties :

- Insoluble in water, soluble in aq. alkaline solution

Chemical properties :



**Use:** protective action against *ultra violate* radiation

- Used in skin protective creams and pastes
- Dental products

Protective action raised from high refractive index of  $\text{TiO}_2$



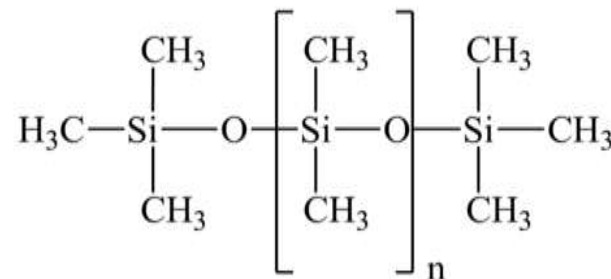


# PROTECTIVES

## (3) SILICONE POLYMERS

**Synonym:** Silicone oil

- Used in antacid preparations



## (4) SIMETHICONE

- Light gray, translucent liquid
- Greasy consistency
- Prepared from dimethyl polysilicone ether
- Used in antacid preparations,  
**Antiflatulent** (remove gas from intestine)

## (5) ZnO & CALAMINE

- Will see in Astringent class



# ASTRINGENTS

## Astringents :

↗ agents which are applied locally and gives protein precipitant action.

[win15, win11] [ sum15]

- Cause contraction and wrinkling of the tissue
- Reduces the cell permeability
- Constrict the local blood vessels
- Inhibit the transcapillary movement of plasma-pr.

## The *net effects*

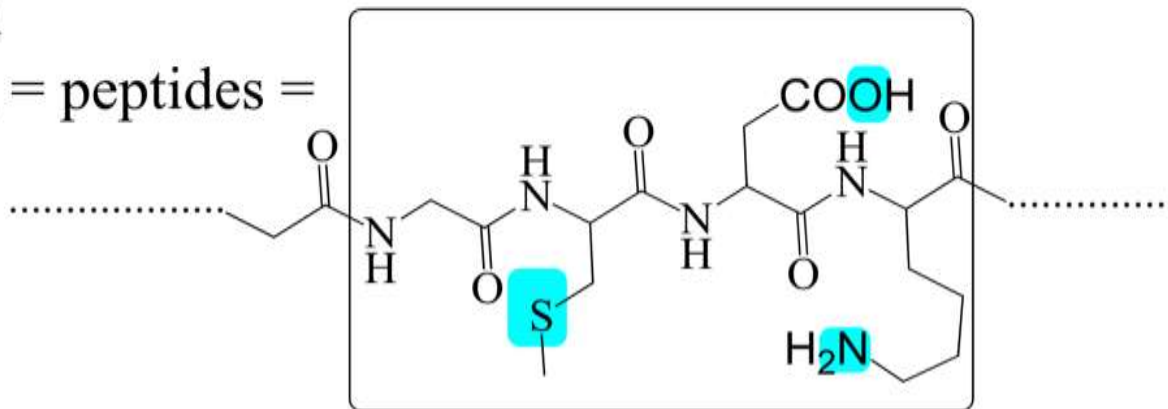
- Anti-inflammatory effect (by ↓ blood supply to site of injury)
- Decrease blood lose by coagulating plasma-pr.
- Antiperspirant effect (by ↓ secretion of sweating by ↓ pore size of skin)
- Antimicrobial (by pr. pptn in microbes)

# ASTRINGENTS

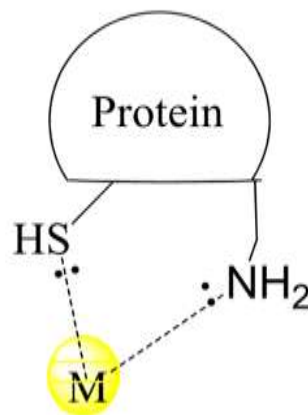
## Mechanism of Protein Precipitation

Skin = Lipid + Protein

Protein = peptides =



Atoms which are capable to form metallic bonds  
i.e. Chelation of metal with pr.



# ASTRINGENTS

## Uses:

- To reduce pain ( as Anti-inflammatory agents)
- To arrest hemorrhages
- Promote healing of wound
- To reduce sweating (as Antiperspirants)

## Agents:

Zinc Oxide

Zinc sulphate

Calamine

Zinc chloride (will be explained on the topic 'Dental preparation')

Aluminium sulphate

Aluminium Chloride

Alum

# ASTRINGENTS

## (1) ZINC OXIDE

**Synonym:** Philosopheriwool

**Properties:**

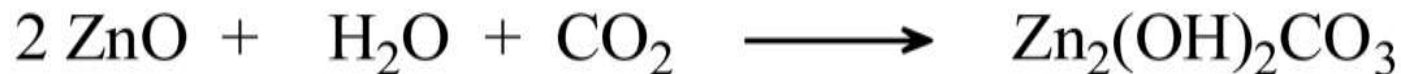
[win14, win12, sum15]

**Physical properties:**

- soft, white or faintly white, very fine powder, colorless, tasteless
- Insoluble in water, soluble in aq. soln of alkali and acid.

**Chemical properties :**

- It slowly adsorbs  $\text{CO}_2$  from the air.
- Absorbs of moisture and  $\text{CO}_2$  from air and forms basic zinc carbonate





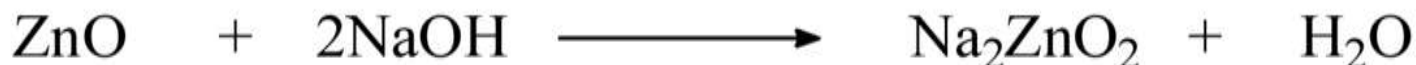
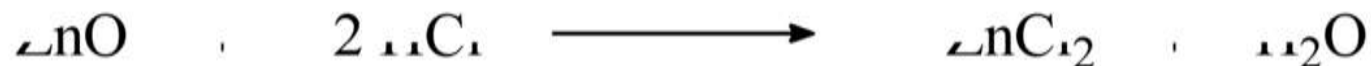
# ASTRINGENTS

## (1) ZINC OXIDE

- Reaction with strong aq. soln of zinc chloride gives zinc oxychloride



- ZnO is amphoteric in nature, reacts with both acid and base



- Reaction with hydrogen gas or carbon



# ASTRINGENTS

## (1) ZINC OXIDE

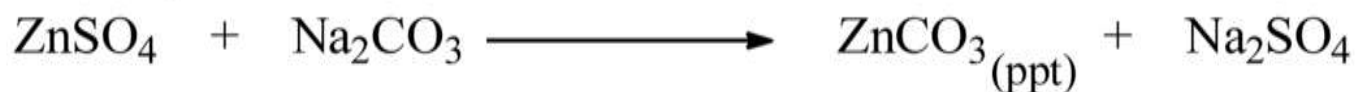
### Preparation:

[win14, win12, sum15]

1. Heating of zinc metal in current of air. Vapour form of zinc forms zinc oxide (pdct is not as pure as need of pharmaceutical)



2. From Zinc sulphate



- Ppt of zinc carbonate are purified and gently ignited to form ZnO



# ASTRINGENTS

## (1) ZINC OXIDE

### Assay:

[win14, win12, sum15]

Principle: Acidimetric back titration

- ZnO is dissolved in excess amt of std  $\text{H}_2\text{SO}_4$
- Excess acid is back titrated with std NaOH
- Indicator – methyl orange

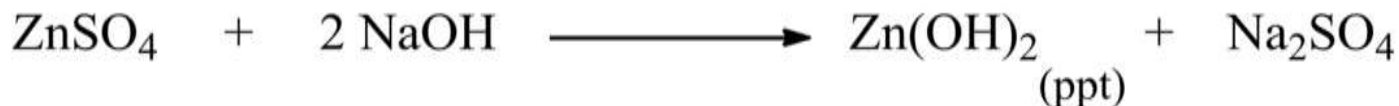
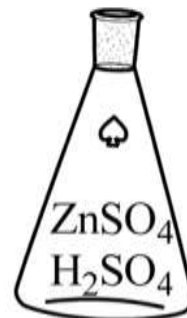


- Titer factor : Each ml of 1 N  $\text{H}_2\text{SO}_4 \equiv 0.04069$  g of ZnO

# ASTRINGENTS

## (1) ZINC OXIDE

- Side reactions during titration-formation of zinc hydroxide ppt.



- Ppt of zinc hydroxide interfere in the end point detection.
- Thus *Ammonium chloride* is use to prevent the pptn of zinc hydroxide by dissolving the ppt.



# ASTRINGENTS

## (1) ZINC OXIDE

### Use:

[win14, win12, sum15]

- Astringent
- Protective
- Antiseptic *or* antimicrobial (used in skin disease)



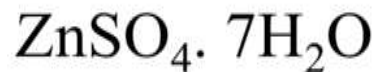
### Storage:

- Well closed container,
- Prevent from air explosion (as chances of degradation by CO<sub>2</sub> and moisture)



# ASTRINGENTS

## (2) ZINC SULPHATE



### Properties:

#### Physical properties:

- Colorless crystals, efflorescent in dry air, odourless
- Water soluble, aq. soln is acidic

#### Chemical properties :

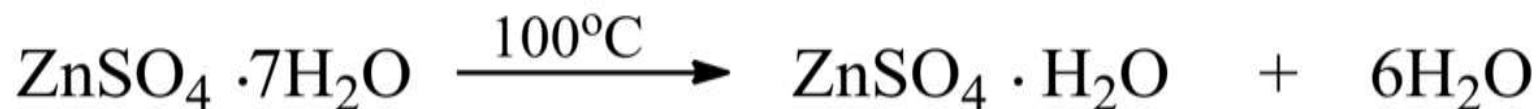
- Loss of *water of crystallization* at boiling water temperature

[win11, sum15]



# ASTRINGENTS

## (2) ZINC SULPHATE



- Decomposition at higher temperature



# ASTRINGENTS

## (2) ZINC SULPHATE

### Preparation:

- a. From zinc blend (zinc sulphide) – Oxidation in air at high temperature



- b. From zinc metal



- After completion of reaction, reaction mixture is treated with chloride water to remove impurity of iron.

# ASTRINGENTS

## (2) ZINC SULPHATE

### Assay:

- Principle: Complexometric titration [win11, sum15]
- Titrant: Disodium EDTA
- Indicator: eriochrome black T solution
- Titer factor: Each ml of 0.05 M disodium EDTA  $\equiv$  0.01438 g of  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$

# ASTRINGENTS

## (2) ZINC SULPHATE

### Uses:

- Astringent (Ophthalmic astringent)
- Zinc supplements
- Emetic
- Antiseptic



### Storage:

- Well closed container, non-metallic container



# ASTRINGENTS

## (3) CALAMINE



⇒ Calamine is zinc oxide with small amt of ferric oxide.

*in old days*

Purified Zinc carbonate is used as calamine

### Properties:

#### Physical properties:

- Pink or reddish brown (due to presence of iron) powder, odourless, tasteless
- Water insoluble, soluble in mineral acids

#### Chemical properties :

- It is chemically Zinc oxide with small amt of ferric oxide.

# ASTRINGENTS

## (3) CALAMINE

### Preparation:

- Prepared by mixing Zinc oxide and ferric oxide (0.5 to 1 %).
- Zinc oxide is prepared ..... Given in previous slide

[win15]

### ASTRINGENTS

#### (1) ZINC OXIDE

##### Preparation:

[win14, win12, sum15]

1. Heating of zinc metal in current of air. Vapour form of zinc forms zinc oxide (pdct is not as pure as need of pharmaceutical)



2. From Zinc sulphate



- Ppt of zinc carbonate are purified and gently ignited to form ZnO



# ASTRINGENTS

## (3) CALAMINE

### Assay:

- Same as assay of ZnO

### ASTRINGENTS

#### (1) ZINC OXIDE

##### Assay:

[win14, win12, sum15]

Principle: Acidimetric back titration

- ZnO is dissolved in excess amt of std  $\text{H}_2\text{SO}_4$
- Excess acid is back titrated with std NaOH
- Indicator – methyl orange



- Titer factor : Each ml of 1 N  $\text{H}_2\text{SO}_4 \equiv 0.04069$  g of ZnO

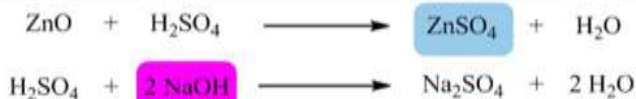
Inorganic Chemistry\_ AZC\_2016 \_Topical Agents

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### ASTRINGENTS

#### (1) ZINC OXIDE

- Side reactions during titration-formation of zinc hydroxide ppt.



- Ppt of zinc hydroxide interfere in the end point detection.
- Thus *Ammonium chloride* is use to prevent the pptn of zinc hydroxide by dissolving the ppt



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# ASTRINGENTS

## (3) CALAMINE

### Uses:

- Astringent
- Protective

[win15] [sum14]



# ASTRINGENTS

## (4) ALUMINIUM SULPHATE

$\text{Al}_2(\text{SO}_4)_3 \cdot X \text{H}_2\text{O}$       It contains varying amount of water of crystallization

$X = \text{number of water of crystallization}$

### Physical properties:

- White crystalline powder or shining plates.
- Very soluble in water and insoluble in alcohol.
- Aq. soln is acidic due to hydrolysis



### Chemical properties:

- Dehydrated at high temperature





# ASTRINGENTS

## (4) ALUMINIUM SULPHATE

### Preparation:

a. From aluminium hydroxide



b. By heating aluminum metal in a sulfuric acid solution



# ASTRINGENTS

## (4) ALUMINIUM SULPHATE

### Uses:

- Astringent
- Local antiperspirant
- Used for water purification

NDC 51224-162-12



Soothing, Effective Relief of Minor Skin Irritations due to:

Poison Ivy  
Athlete's Foot  
Insect Bites  
Rashes

Compares to the  
Active Ingredients  
in Domeboro®

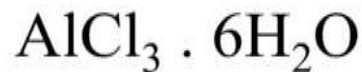


12 POWDER PACKETS

**Storage:** well closed container

# ASTRINGENTS

## (5) ALUMINIUM CHLORIDE



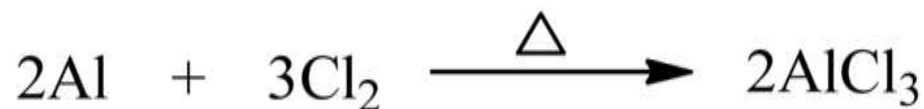
### Properties:

[sum15]

- White-deliquescent, crystalline powder
- Sweat astringent test
- Very soluble in water
- In *non polar* solvents it exist ad Dimer ( $\text{Al}_2\text{Cl}_6$ )

### Preparations:

a. Heating of aluminium in a current of chlorine



# ASTRINGENTS

## (5) ALUMINIUM CHLORIDE

b. From aluminium hydroxide

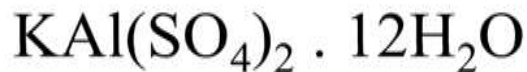


**Use:**

- Antiseptic
- (Bc of tissue irritation and staining of clothes, agents is not used now-a-days)

# ASTRINGENTS

## (6) ALUM



**Synonym:** Potassium Aluminium sulphate [win12]

**Properties:**

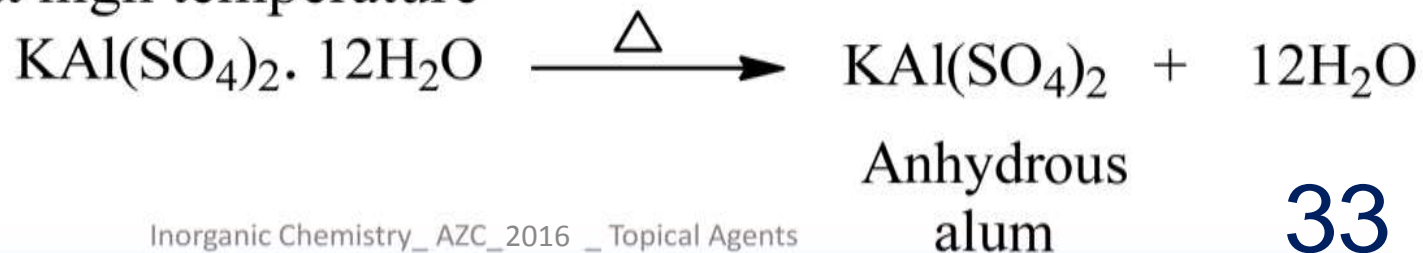
Physical properties:

- Colorless transparent crystals,
- sweet astringent taste
- water soluble- gives acidic solution,
- insoluble in alcohol



Chemical properties:

- Dehydrated at high temperature





# ASTRINGENTS

## (6) ALUM

### Preparation:

- Addition of hot conc. soln of potassium sulphate to a hot soln of aluminium sulphate



### Assay:

- Principle: gravimetric method
- Aq. soln of sample is added in soln of ammonia and ammonium chloride solution.
- Ppt of aluminium oxide ( $\text{Al}_2\text{O}_3$ ) is formed
- Ppt are filtered, washed with ammonium nitrate soln, and then dried and weighed.
- factor: 1.0g residue  $\equiv$  9.307 g of alum

# ASTRINGENTS

## (6) ALUM

### Use:

- Astringent
- Pharmaceutical aid
- As a styptic for minor cuts and abrasions
- Preparation of diphtheria and tetanus toxoids



### Storage:

- Well closed container

styptic - A drug that causes contraction of body tissues

# **ANTIMICROBIAL AGENTS**

**ANTIMICROBIAL  
AGENTS**

*Or*

**ANTI-INFECTIVES**

# ANTIMICROBIAL AGENTS

## Defination:

⇒ Any agents which either kills or inhibits the growth of microbes, i.e. bacteria, fungi, protozoans etc.

[win14, win14, sum14]

## Classification of agents:

[win14, sum14]

- Antiseptic
- Disinfectants
- Germicides
- Keratolytic

# ANTIMICROBIAL

## ANTISEPTIC

⇒ Agents which prevents Infection, by killing or inhibiting the growth of micro-organisms when applied topically at damaged tissue.

[win12, sum13]



## DISINFECTANTS

⇒ Any agents which either kill or inhibit the growth of microbes upon applied on objects like equipments, rooms etc.

[win15]

- Are more potent than antiseptics



# ANTIMICROBIAL

## GERMICIDES

⇒ Agents which kills microbes

Sub classification:

(1) **Bactericidal agents** – Agents those kill bacteria

[win15] [sum14]

(1) **Fungicidal** – Agents those kill fungus

- **Bacteriostatic** : drug which inhibit the grow of bacteria but does not kill bacteria

[win14]

- **Sterilization**: A process that kills or removes microbes (a process of conversion of microbial contaminated material to microorganism free material.

# ANTIMICROBIAL KERATOLYTIC AGENT

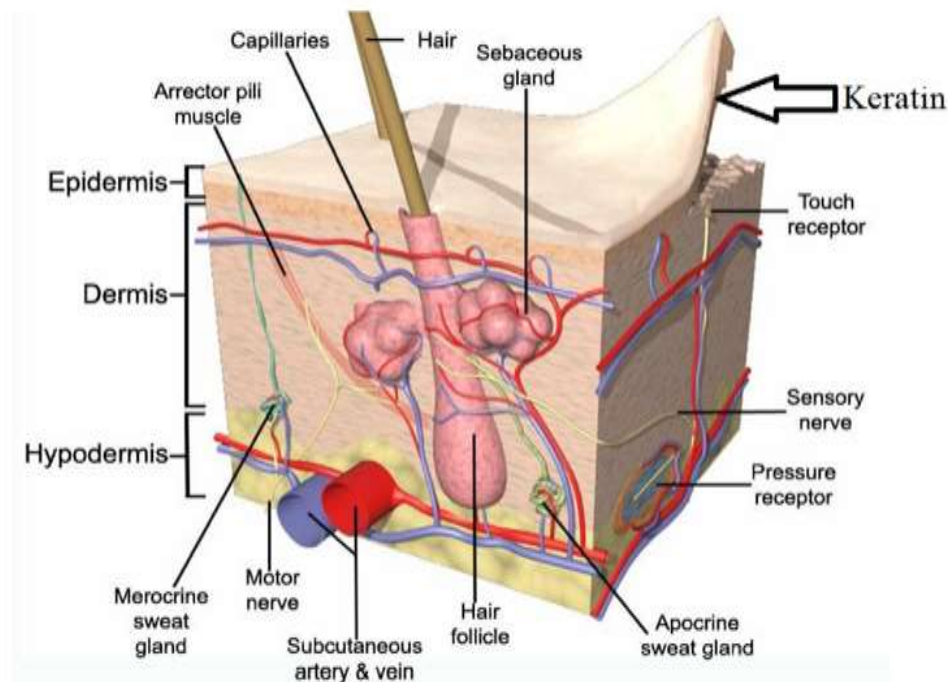
[sum15]

⇒ Agents those are applied on the skin to soften the keratin.

E.g. Sulphur, Aluminium oxide

M/A

- Remove surface oils
- Increase moisture binding capacity – useful in treating dry skin conditions.
- Removes scar fragments of keratin

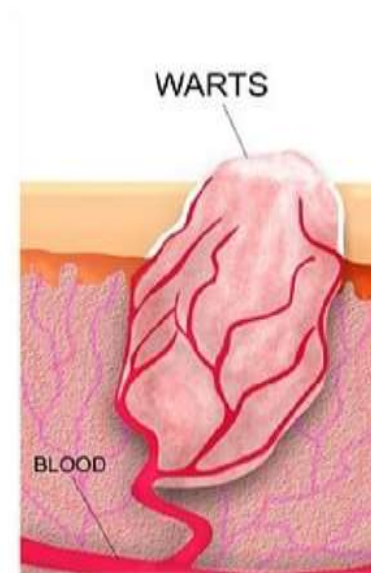


# ANTIMICROBIAL

## KERATOLYTIC AGENT

### Use :

- They used to treat psoriasis, acne (ખીલ, મુઠાસે), warts and other forms of keratosis.



# ANTIMICROBIAL

## Mechanism of action: of Antimicrobial agents

[win14, win14, sum14, win12]

- Microorganisms contain many important 'protein structure' (e.g. enzymes) to survive.
- If there is minute change in protein structure, (may lead to change in conformation and ) the protein becomes non functioning and microbes die.

3 type of mechanism for changing in protein structure are observes in antimicrobial agents

- (1) Oxidation
- (2) Halogenation
- (3) Precipitation of proteins



# ANTIMICROBIAL

## (1) Oxidation:

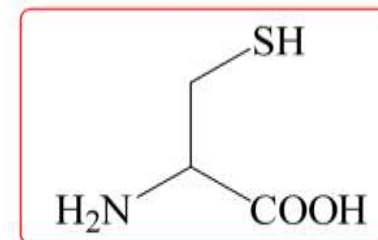
- Oxygen liberating compounds (oxidizing agents) give action by this mechanism.
- Antimicrobial agents cause oxidation of active functional groups present in protein or enzymes and inactivate them.

E.g.

- Sulfhydryl functional group of cysteine (amino acid) is important for many protein and enzymes of microbes.

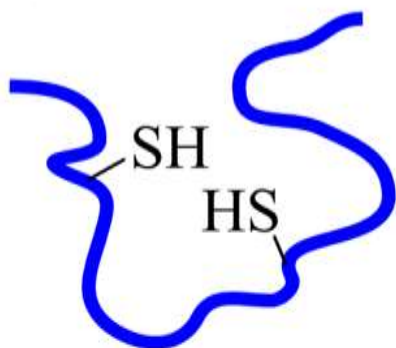


# ANTIMICROBIAL

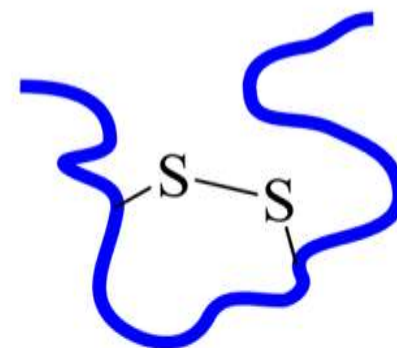


## (1) Oxidation:

- Antimicrobial agents convert this sulfhydryl group to disulfide bond. Hence inactivate the protein as restrict the conformational change needed to work



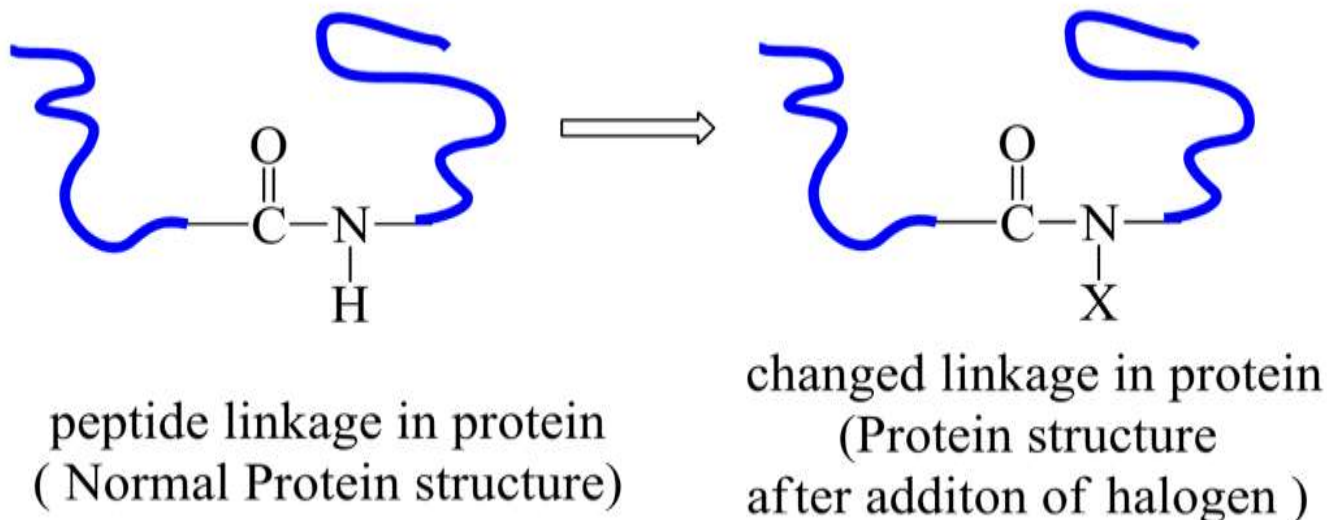
Sulfhydryl groups in protein  
( Normal Protein structure)



Disulfide bond in protein  
(Protein structure  
after oxidation)

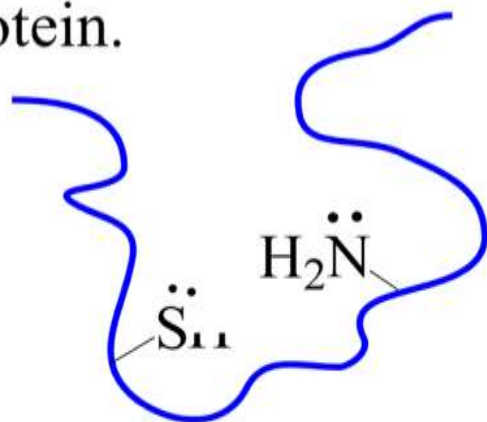
## (2) Halogenation:

- The halide and hypohalide liberating compounds give action by this mechanism.
- Agents add halide atom to nitrogen present at peptide linkage of the protein, and thereby change the conformation of the protein

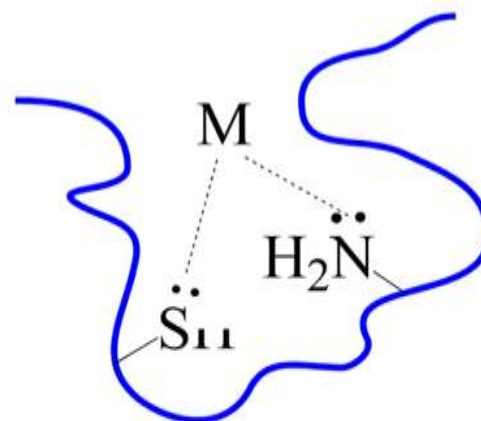


## (3) Precipitation of proteins:

- Metal containing compounds give action by this mechanism.
- Metal binds with important group present in protein. This protein-metal complexation (chelation of protein) inactivates the protein.



Normal Protein structure



Protein-metal  
complexation

# ANTIMICROBIAL AGENTS

## Category by mechanism

### Oxidation mechanism

- (1) Hydrogen Peroxide
- (2) Potassium permanganate
- (3) Sodium perborate

### Halogenation mechanism

- (1) Iodine and its various official preparations
- (2) Povidone-iodine solution
- (3) Potassium iodide - will be covered in expectorant
- (4) Calcium oxychloride

### Precipitation of proteins

- (1) Boric acid
- (2) Borax
- (3) Silver nitrate
- (4) Mercury oxide
- (5) Antimony sodium tartate
- (6) Ammoniated mercury



# ANTIMICROBIAL

## (1) HYDROGEN PEROXIDE

### Physical properties:

- Clear, colorless, odourless liquid, slightly acidic taste

### Chemical properties :

- It slowly decompose at ordinary temp. and readily at higher temp.



- Hydrogen peroxide reacts as either oxidising or reducing agent depending upon chemical environment
- E.g. of oxidation reaction
  - a.  $\text{H}_2\text{O}_2$  oxidises potassium iodide to iodine in acidic medium





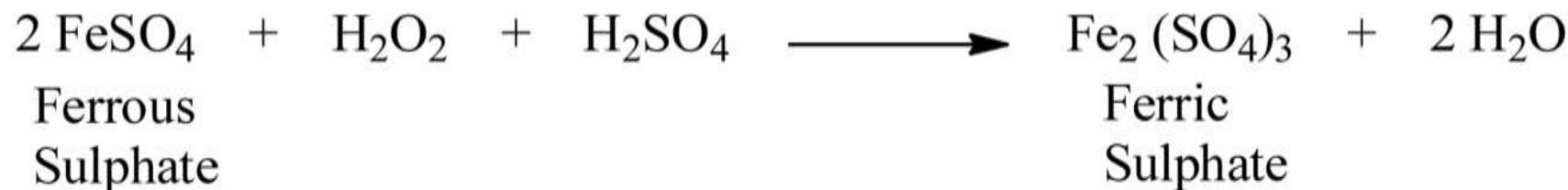
# ANTIMICROBIAL

## (1) HYDROGEN PEROXIDE

b.  $\text{H}_2\text{O}_2$  oxidises lead sulphide to lead sulphate



c.  $\text{H}_2\text{O}_2$  oxidises ferrous to ferric ion



# ANTIMICROBIAL

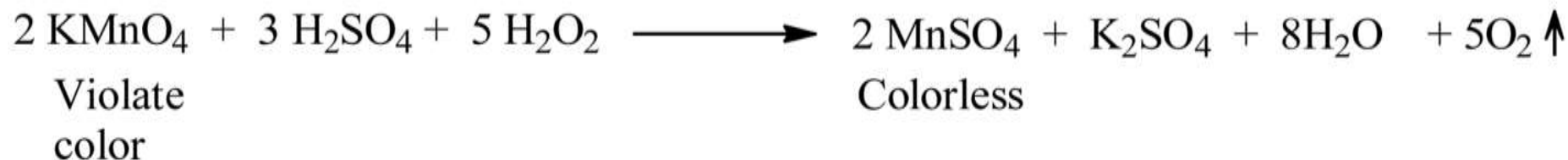
## (1) HYDROGEN PEROXIDE

- E.g. of reduction reaction

a.  $\text{H}_2\text{O}_2$  reduces silver oxide to metallic silver



b.  $\text{H}_2\text{O}_2$  reduces potassium permanganate to colorless form.



c.  $\text{H}_2\text{O}_2$  reduces halides



# ANTIMICROBIAL

## (1) HYDROGEN PEROXIDE

### Preparation:

[win14]

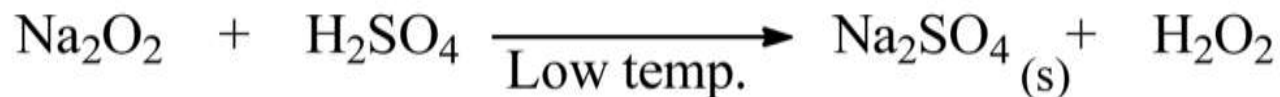
#### a. From barium peroxide:

- Addition of ice cold barium peroxide aq. solution and ice cold dil. Sulphuric acid (or phosphoric acid).



- Product obtained is very poor (10-20% w/w )
- Product is purified by filtration or distillation.

#### b. From sodium peroxide:

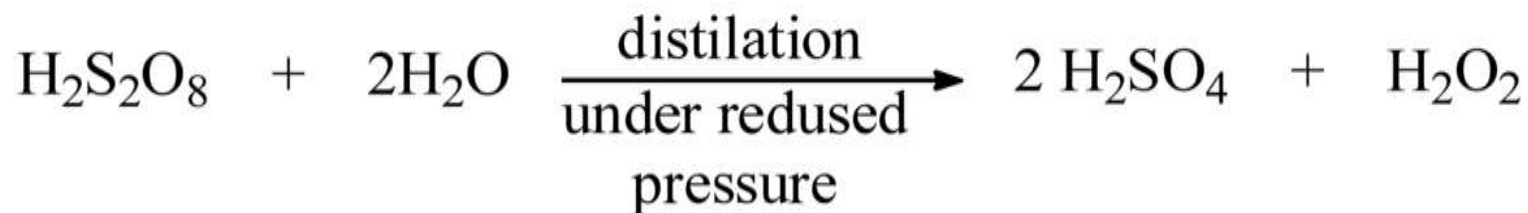
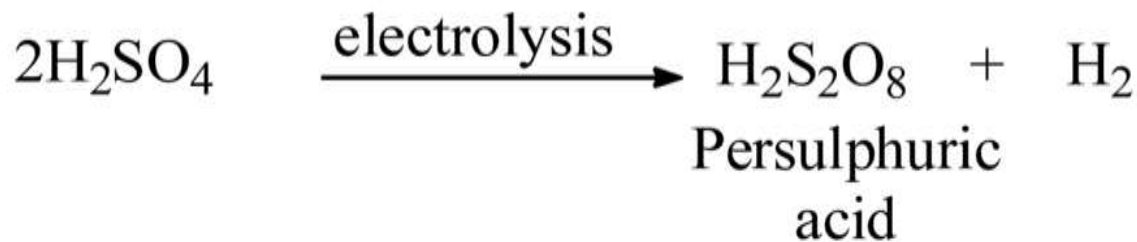


# ANTIMICROBIAL

## (1) HYDROGEN PEROXIDE

### c. From sulphuric electrolysis

- Electrolysis of 50% ice cold solution of sulphuric acid gives persulphuric acid.
- Distillation process produced about 30% of product



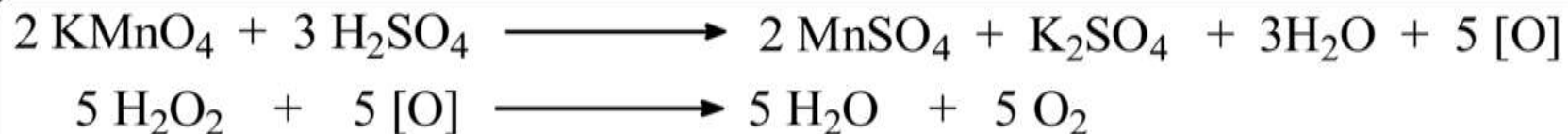
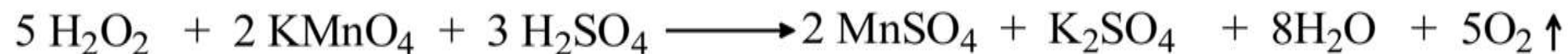
# ANTIMICROBIAL

## (1) HYDROGEN PEROXIDE

### Assay:

[win15, win14, win13]

- Principle: Oxidation titration
- Aq. soln of  $\text{H}_2\text{O}_2$
- 5 N  $\text{H}_2\text{SO}_4$  is added
- Titrant: std.  $\text{KMnO}_4$  solution
- Color change: colorless to pink



- Factor: Each ml of 0.1 N  $\text{KMnO}_4 \equiv 0.001701\text{g}$  of  $\text{H}_2\text{O}_2$

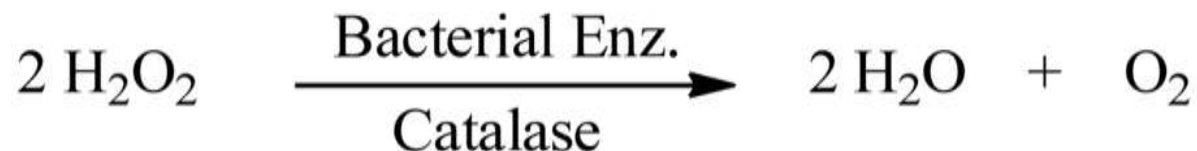


# ANTIMICROBIAL

## (1) HYDROGEN PEROXIDE

### Uses:

- Antiseptic (Oxidising action – achieved by liberation of Oxygen) [win15, win14]



- Dilute soln is used for gargle, mouthwash, earwash and throat infection.



# ANTIMICROBIAL

## (1) HYDROGEN PEROXIDE

- Antidote for phosphorus and cyanide poisoning.

### Storage:

[win15, win14]

- Stored in light resistant (black) stopper containers, in cool place.

# ANTIMICROBIAL

## (2) POTASSIUM PERMANGANATE



### Physical properties:

- dark purple crystals, odourless, sweet astringent taste
- Soluble in water

### Chemical properties:

- Decompose at higher temp.



[win11]



E.g. of oxidation reaction

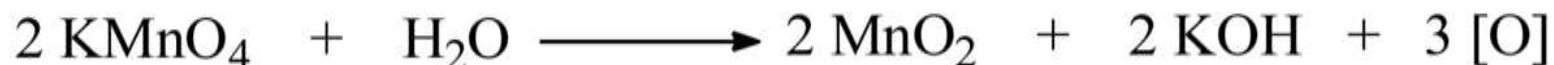
a.  $\text{KMnO}_4$  oxidises potassium iodide to iodine in acidic medium



# ANTIMICROBIAL

## (2) POTASSIUM PERMANGANATE

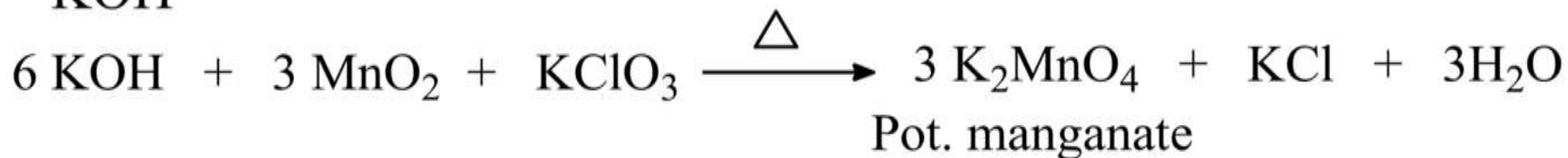
b.  $\text{KMnO}_4$  liberates oxygen species in aqueous or acidic solution



### Preparation:

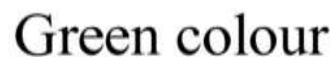
[win14, win14]

**Step 1.** Heating of manganese dioxide and pot. chlorate in solution of  $\text{KOH}$



- Potassium manganate obtained as green mass

## (2) POTASSIUM PERMANGANATE

$$2 \text{K}_2\text{MnO}_4 + \text{Cl}_2 \longrightarrow 2 \text{KCl} + 2 \text{KMnO}_4$$


Dark purple  
colour



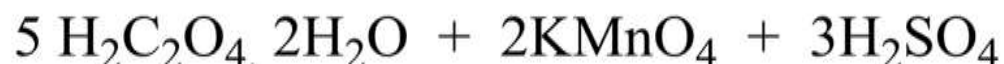
# ANTIMICROBIAL

## (2) POTASSIUM PERMANGANATE

### Assay:

[win15, win14, win11] [sum15, sum14]

- Principle: redox titration
- Prepare 0.1 N oxalic acid.
- Add dil.  $\text{H}_2\text{SO}_4$
- Solution is warmed to  $70^\circ\text{C}$  and is titrated with the prepared solution of  $\text{KMnO}_4$
- *During titration the temp. is maintained  $70^\circ\text{C}$  throughout the titration.*



- At room temp. reaction is slow, thus solution is warmed.

# ANTIMICROBIAL

## (2) POTASSIUM PERMANGANATE

### Uses:

- As antiseptic it is used in mouth wash preparation  
ulcer disorder [win14]
- dil. solution is used in wounds and skin infection
- As oxidizing agent
- In poisoning like barbiturates, chloral hydrate,  
alkaloids



# ANTIMICROBIAL

## (2) POTASSIUM PERMANGANATE

### Storage:

[win14]

- in well closed container
- While handling, care must be taken as it is powerful oxidizing agent (may create dangerous explosions upon contact with readily oxidized substance)

# ANTIMICROBIAL

## (3) IODINE



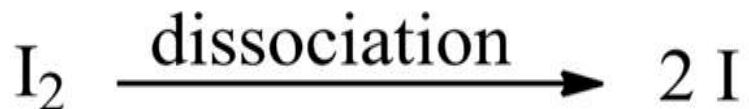
### Physical properties:

- Grey black colour, brittle, irritant odour
- Volatile at room temp.
- Very slightly soluble in water but highly soluble in conc. iodide soln.



### Chemical properties:

- Melts at 114°C and dissociates at 700°C, gives vapors



# ANTIMICROBIAL

## (3) IODINE

E.g. of oxidation reaction





# ANTIMICROBIAL

## (3) IODINE

### Preparation:

- From sea weed's ash
- Sea water contains iodine as salts forms.
- These salts are absorbed by seaweeds (e.g. *Lominaria digitata*)
- These sea weeds are dried, burnt and ash is collected which is called as **Kelp**.
- Aqueous solution of kept is prepared and concentrated (where the sulphates and chlorides of sodium and potassium crystallize out).
- Crystals are removed by filtration. The solution contains only salts of iodides of sodium and potassium.



# ANTIMICROBIAL

## (3) IODINE

- the solution is treated with sulphuric acid  
and then with manganese dioxide and heated.
- Synthesized iodine is purified and collected



### Assay:

- Principle: direct iodimetric type redox titration
- Iodine is added in aq. solution of KI + 2 M acetic acid
- Titrant: 0.1 N sodium thiosulphate
- Indicator : starch



- Factor: Each ml 0.1 M  $\text{Na}_2\text{S}_2\text{O}_4 \cong 0.01263$  g of iodine

# ANTIMICROBIAL

## (3) IODINE

Potassium iodide is added in aqueous iodine solution.

[win12, sum14]

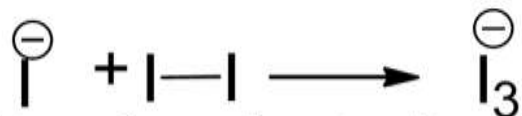
- Iodine is a non-polar molecule, it does not ionize in water.



- KI is a polar, ionic compound, will ionize and dissolve in water.



- The iodide salt will react with  $\text{I}_2$  to form the complex ion  $\text{I}_3^-$
- $\text{I}_3^-$  being negatively charged will **dissolve in water**.



- *KI is used to dissolve the iodine in water.*

# ANTIMICROBIAL

## (3) IODINE

### Use:

[win12]

- Antiseptic – act by formation of hypoiodous acid (HIO).
- Iodine is supplied externally (e.g. iodized salt) for proper functioning of thyroid gland.
- Used for the preparation various iodine solution or official preparations

| various official preparations of Iodine

- | 1. Aq. iodine soln (Lugol's solution)
- | 2. Weak iodine solution ( tincture of iodine)
- | 3. Strong iodine solution

### Storage:

- In a glass stoppered bottle or well closed ceramic containers



## various official preparations of Iodine

[win13] [win14, win12]

Aq. Iodine soln (Lugol's solution)

Weak iodine solution ( tincture of iodine)

Strong Iodine solution

M/A = Antiseptic action by Halogenation mechanism

[sum13]



# ANTIMICROBIAL

## (4) AQUEOUS IODINE SOLUTION

**Synonym:** Lugol's solution

- Aqueous iodine soln contains 5% w/w of Iodine,  $I_2$  and 10% w/w of KI in water

### Ingredients:

Iodine.....	50g
Potassium Iodide.....	100g
Purified water.....	q.s.1000ml

### Physical properties:

- transparent, brown liquid with smell of iodine

# ANTIMICROBIAL

## (4) AQUEOUS IODINE SOLUTION

### Preparation:

- KI and iodine are dissolved in 100ml of water and volume is made up to 1000ml

### Assay:

- Assay carried out both for iodine and KI content in preparation.

### Use:

- As a germicide and fungicide agent.  
It does not cause irritation to -  
cuts like tincture of iodine.
- As a source of iodine



# ANTIMICROBIAL

## (5) WEAK IODINE SOLUTION

**Synonym:** Iodine tincture

- Weak iodine soln contains 2% w/w of Iodine,  $I_2$  and 2.5% w/w of KI in 50% alcohol

### Ingredients:

Iodine.....	20g
Potassium Iodide.....	25g
Alcohol (50%).....	q.s.1000ml

### Physical properties:

- transparent, brown liquid with smell of iodine and alcohol

# ANTIMICROBIAL

## (5) WEAK IODINE SOLUTION

### Preparation:

- KI and iodine are dissolved in sufficient quantity of alcohol and volume is made up to 1000ml with alcohol

### Assay:

- Assay carried out both for iodine and KI content in preparation.

### Use:

- Is a popular antiseptic agent





# ANTIMICROBIAL

## (6) STRONG IODINE SOLUTION

- Strong iodine soln contains 10% w/w of Iodine,  $I_2$  and 6% w/w of KI in alcohol-water mixture

### Ingredients:

Iodine.....	100g
Potassium Iodide.....	60g
Purified water.....	100g
Alcohol (90%).....	q.s.1000ml

### Physical properties:

- transparent, brown liquid with smell of iodine and alcohol



# ANTIMICROBIAL

## (6) STRONG IODINE SOLUTION

### Preparation:

- KI and iodine are dissolved in 100ml of water and volume is made up to 1000ml with alcohol

### Assay:

- Assay carried out both for iodine and KI content in preparation.

### Use:

- Antiseptic agent



# ANTIMICROBIAL

## (7) POVIDONE-IODINE SOLUTION

- It is aq. solution of povidone-iodine complex which contains up to 10% w/v of free iodine.
- Povidone = polyvinyl pyrrolidone

### Physical properties:

- povidone-iodine is yellowish brown amorphous powder
- Soluble in water and alcohol, aq. solution is acidic.

Providone iodine is better than tincture of iodine

- More water soluble, non-irritant, non staining nature, it can easily removed from skin and clothes by washing.

[win15]

# ANTIMICROBIAL

## (7) POVIDONE-IODINE SOLUTION

### Use:

- Antiseptic – skin, throat infection or wounds, burns and cuts.
- Solution is diluted up to 1%, thus free iodine content is increases and increase in the antiseptic action

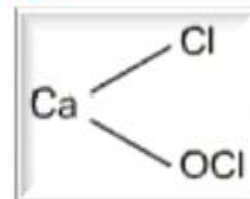
### Storage:

- Well closed iodine resistant container.



# ANTIMICROBIAL

## (8) CALCIUM OXYCHLORIDE



[sum14]

**Synonym:**

**Bleaching powder**, Calcium chloro hypochloride, Chlorinated lime

[win14, win11]

**Physical properties:**

- dry, dull white powder, hygroscopic in nature

**Chemical properties:**

- a. Decomposed in air.



- b. Decomposed on prolonged storage





# ANTIMICROBIAL

## (8) CALCIUM OXYCHLORIDE

c. Decomposed by dil. acid



### Preparation:

- Passing current of chlorine gas over calcium hydroxide (slaked lime) in lead container. [win14]

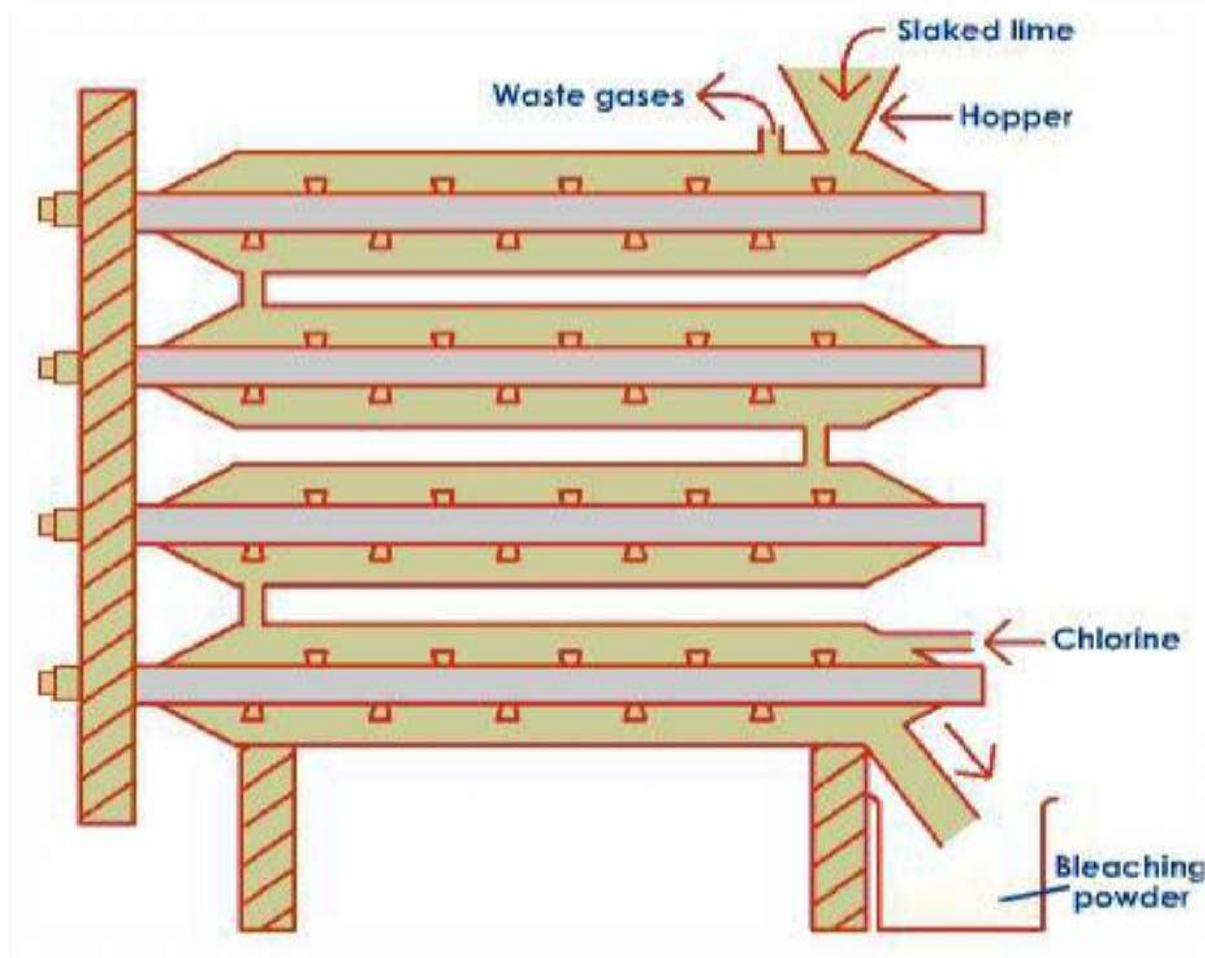




# ANTIMICROBIAL

## (8) CALCIUM OXYCHLORIDE

Hasen Clever Plant for the preparation of Bleaching Powder



# ANTIMICROBIAL

## (8) CALCIUM OXYCHLORIDE

### Assay:

[win14]

- Principle: Direct iodometric redox type titration
- To the aq. soln of sample, add KI
- Then add acetic acid
- mixture is kept aside in dark for 10 minutes.
- Titrate against Sod. thiosulphate
- Indicator: starch



# ANTIMICROBIAL

## (8) CALCIUM OXYCHLORIDE

### Use:

[sum14]

- as Antiseptic – wounds
- as Disinfectant – sterile rooms, drains
- for Chlorination of water (treatment of swimming pools)
- as Bleaching agent

### Storage:

- Well-closed container, in cool place

# ANTIMICROBIAL

## (9) BORIC ACID



**Synonym:** Boracic acid

**Physical properties:**

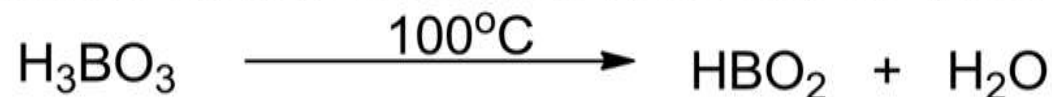
- White crystalline , odourless
- Soluble in glycerin and water

**Chemical properties:**

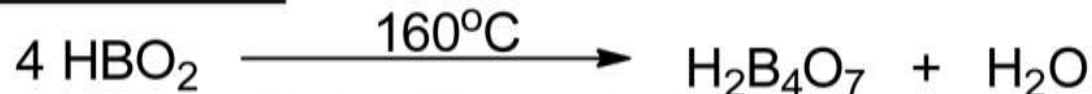
[win12, sum15]

**a. Degradation** ( by dehydration) upon heating

- At 100 °C, metaboric acid is obtained with loss of water



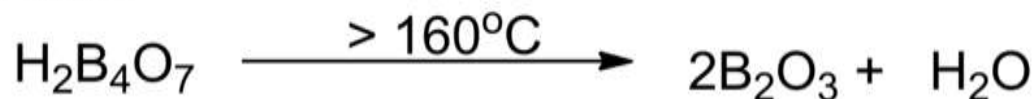
- At 160 °C, tetraboric acid is formed from metaboric acid.



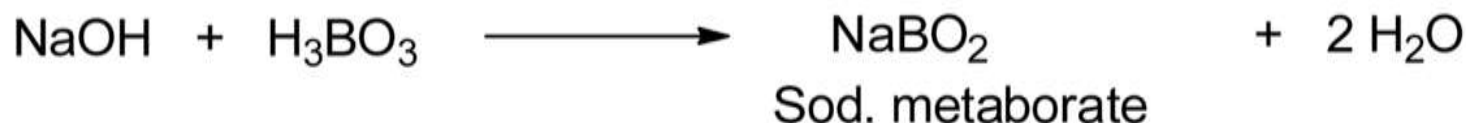
# ANTIMICROBIAL

## (9) BORIC ACID

- At temp. higher than 160 °C boron trioxide is formed from tetra boric acid



### b. React with alkali,



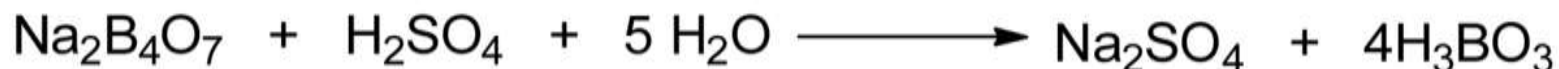


# ANTIMICROBIAL

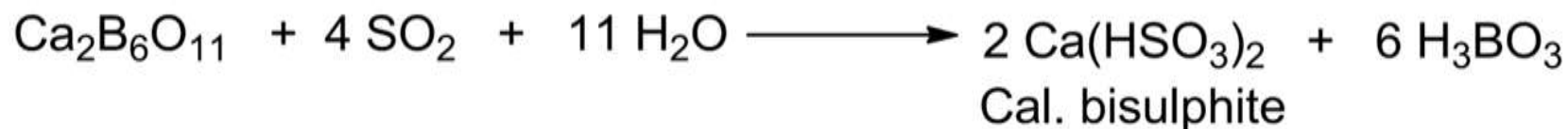
## (9) BORIC ACID

### Preparation:

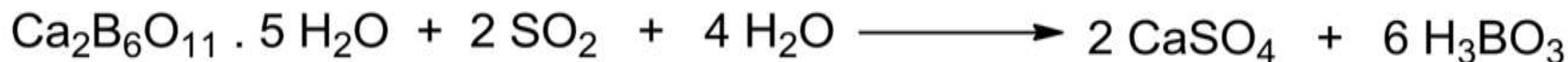
- *Lab synthesis:* addition of aq. soln of sulfuric acid to boiling solution of borax.



- *Large scale synthesis:* passing the current of sulphur dioxide gas on the aq. soln of colemanite.



Or



# ANTIMICROBIAL

## (9) BORIC ACID

### Assay:

[win13, win12, sum15] [sum14]

- Principle: direct acid-base titration
- aq. slon of boric acid
- *Add glycerin*
- Titrated with std. soln of NaOH
- Indicator: phenolphthalein



### - comment:

Poly hydroxy alcohol is used in assay of boric acid.

[win14, sum14]

Glycerin is added in assay of Boric acid

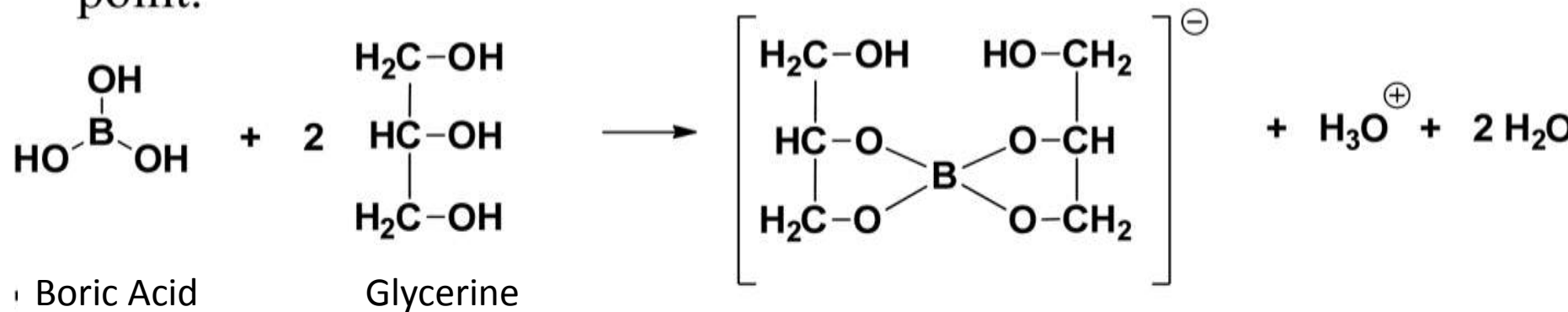
[win12, win11, sum14]

# ANTIMICROBIAL

## (9) BORIC ACID

Answer- Yes,

- Boric acid in aq. soln is weak acid and hence can not titrated accurately with std. alkali.
- In presence of glycerin it forms glyceroboric acid, a strong monoprotic acid which is strong enough to give a satisfactory end point.



- Hence glycerin or other *polyhydroxy alcohol* compounds like mannitol can also be used to enhance the acidity of boric acid.

# ANTIMICROBIAL

## (9) BORIC ACID

### Use:

- Antiseptic – cream, ointments mouth wash, dusting powder
- Preparation of buffer



### Storage:

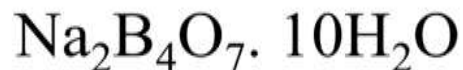
- Well closed container





# ANTIMICROBIAL

## (10) BORAX



[sum14]

**Synonym:** Sodium borate

### Physical properties:

- Colourless crystalline powder, odourless, alkaline taste
- Soluble in glycerin and water
- Aqueous solution of borax is alkaline- comment

[sum14]

### Chemical properties:

[sum14]

#### a. Heating

- It loses water of crystallization on heating

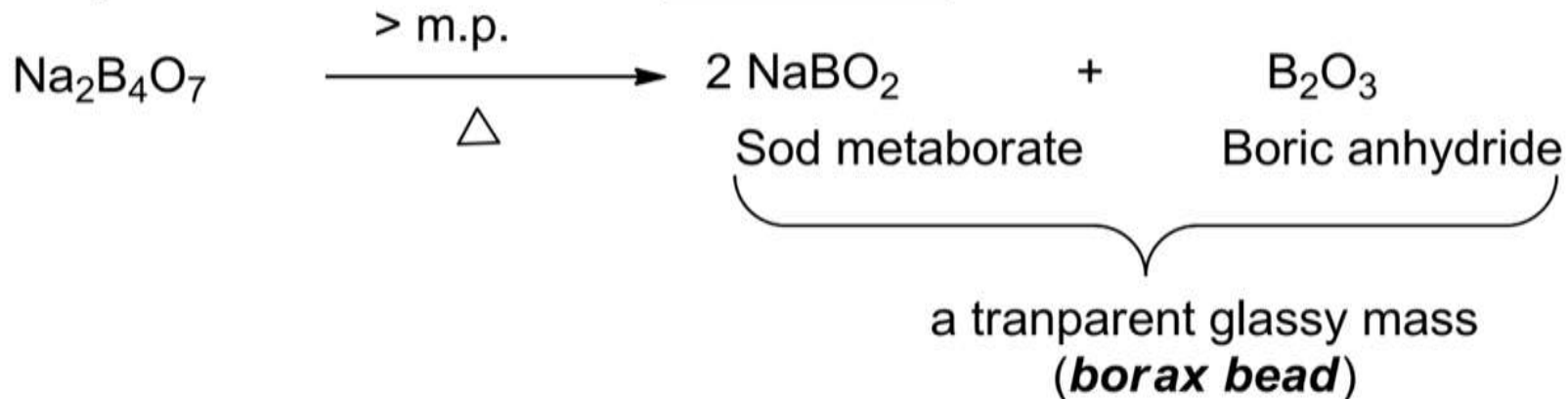




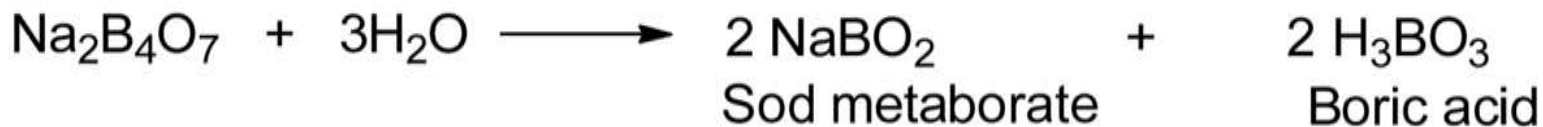
# ANTIMICROBIAL

## (10) BORAX

- Further heating to above the m.p. and then cooling gives transparent mass called as 'borax bead'



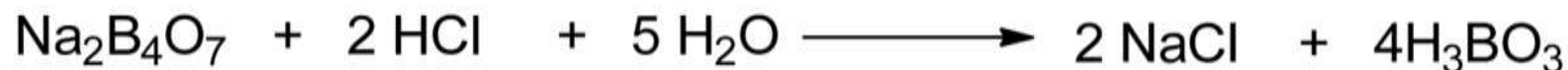
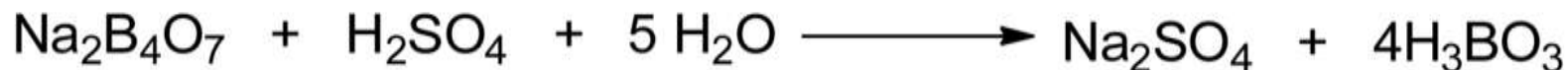
- b. Water hydrolysis** gives **alkaline solution** and boric acid



# ANTIMICROBIAL

## (10) BORAX

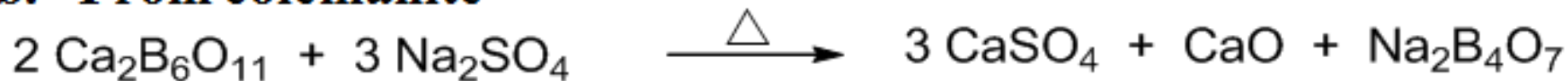
**c. Reaction with mineral acid** gives boric acid



**Preparation:**

**a. Obtain naturally** from lakes of tibbet and India by simple crystallization in kunit water.

**b. From colemanite**



**c. From borocalcite**



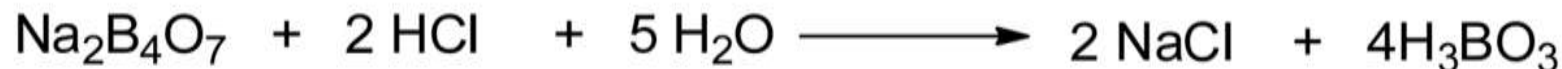
# ANTIMICROBIAL

## (10) BORAX

### Assay:

[win11]

- Principle: direct acid-base titration
- aq. soln of borax
- Titrated with std soln of HCl
- Indicator: methyl red



- Factor: Each ml of 0.5 N HCl  $\cong$  0.09536 of borax

# ANTIMICROBIAL

## (10) BORAX

### Use:

[win11, sum14]

- Bacteriostatic (Antiseptic) – eye wash, mouthwash and gargles
- Pharmaceutical aid
- Emulsifying agent

### Storage:

- Well closed container, in cool place

# ANTIMICROBIAL

## (11) SILVER NITRATE

**Synonym:** Lunar caustic

[win14, win12]

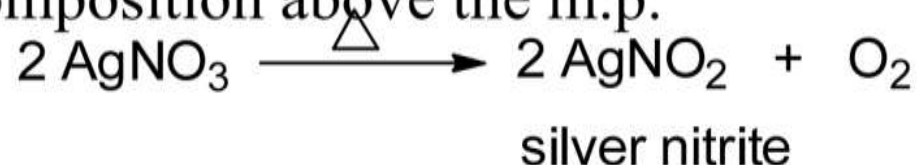
**Physical properties:**

- Colourless crystals, odourless, bitter taste
- Freely soluble in water and alcohol

**Chemical properties:**

### a. Heating

- Decomposition above the m.p.



- Further heating



- ### b. Light catalysis the degradation by reduction of silver nitrate
- ( the reaction is  $\text{AgNO}_3 \rightarrow \text{Ag}_{(s)}$ )



# ANTIMICROBIAL

## (11) SILVER NITRATE

c. **Reaction with ammonia** gives ppt of silver oxide



### Preparation:

[win15, win11]

- Adding silver metal in hot conc. nitric acid



# ANTIMICROBIAL

## (11) SILVER NITRATE

### Assay:

[win15]

Principle: Argentometric titration

- Prepare aq. soln
- Add dil nitric acid
- Titrate with std soln of ammonium thiocyanate
- Indicator: ferric ammonium sulphate



- Factor: Each ml of 0.1 N  $\text{NH}_4\text{SCN} \cong 0.001699$  of  $\text{AgNO}_3$

# ANTIMICROBIAL

## (11) SILVER NITRATE

### Use:

- Antiseptic – have very broad spectrum activity [win15]
  - ophthalmic solutions, burn injuries category - [win11]
  - used to prevent gonococcal infections of new borns



### Storage:

- Well closed containers
- Stored in amber- coloured bottles ( it is light sensitive)
- In cool and dark place

[sum15, sum14]

# End of topic

## Reference:

In. Ph'cal & Med Che. – Dr. J.S. Quadry

In. Ph'cal Che. – Dr. K.G. Bothara

Ph'cal In. Che. – Dr. A.V. Kasture

Ph'cal Che. – I - Dr. Anil Bhandari

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