UNIT-III

TOPICAL AGENTS:

Topical means pertaining to a particular locality or place or simply it means “local”. Therefore the drugs dealt with in this chapter may be substances which are applied directly on the skin or mucous membrane or any other surface.

PROTECTIVE AND ADSORBENTS

Protective and adsorbents are drugs which adsorb intestinal toxins, bacteria etc, and give a protective coating to the inflamed mucosal walls.

ACTIVATED CHARCOAL, C

Test for Purity

1. Acidity or alkalinity
2. Acid-soluble substances
3. Ethanol-soluble substances
4. Alkali-soluble colored matter
5. Chloride
6. Sulphate
7. Sulphide
8. Uncarbonised constituents
9. Copper
10. Lead
11. Zinc
12. Sulphated ash
13. Loss on drying
14. Adsorbing power

Storage:

Store in well closed containers.

Medicinal and Pharmaceutical Uses:

Adsorbent. Charcoal is of great value in the purification of chemicals and the adsorption of gases.
BISMUTH SUBCARBONATE:

Bismuth subcarbonate is also known as bismuth carbonate. It is a basic salt of variable composition.

**Preparation:** for preparing bismuth subcarbonate an acid solution of bismuth nitrate is added with constant stirring to a warm solution to a warm solution of sodium carbonate. The precipitated bismuth subcarbonate is washed with a small quantity of cold water to remove the nitrate and dried at a temperature below 60 C. The precipitate should not be washed repeatedly with water as the subcarbonate will be decomposed and bismuth hydroxide will be formed.

\[
4\text{Bi(NO}_3\text{)}_3 + 6\text{Na}_2\text{CO}_3 + \text{H}_2\text{O} = [(\text{BiO})_2\text{CO}_3]_2\text{H}_2\text{O} + 12\text{Na}_2\text{CO}_3 + 4\text{CO}_2
\]

Bismuth subcarbonate

The bismuth nitrate itself may be prepared by dissolving metallic bismuth in 50 % nitric acid. The solution is evaporated to a low volume.

\[
2\text{Bi} + 8\text{HNO}_3 = 2\text{Bi(NO}_3\text{)}_3 + 2\text{NO} + 4\text{H}_2\text{O}
\]

**Assay:**

It is assayed by complexometric method. It is dissolved in nitric acid, diluted with water and titrated with 0.1M disodium edetate using xylene orange as indicator. The colour change at the end point is from pinkish violet to lemon yellow.

**Test for Purity**

1. Clarity and colour of solution
2. Alkalies and alkaline earth metals
3. Arsenic
4. Copper
5. Lead
6. Silver
7. Chloride
8. Loss on drying

**Storage:**

Since it may discoloured by the hydrogen sulphide in the atmosphere and since it is affected by light, store it in well closed containers produced from light.

**Medicinal and Pharmaceutical Uses:**

Antacid. It can also be used as a protective, mild astringent, antiseptic and dusting powder.
TALC (TALCUM, FRENCH CHALK, PURIFIED TALC), 3MgO, 4SiO$_2$, H$_2$O

Test for Purity

1. Acidity or alkalinity
2. Water-Soluble substances
3. Acid-Soluble substances
4. Iron
5. Carbonates
6. Loss on drying
7. Organic compounds
8. Chloride

Storage:

Talc is an inert substance not affected by acids or bases or other chemicals. So store in a well closed container.

Medicinal and pharmaceutical Uses:

Pharmaceutical aid (dusting powder). It is used as a filtering and distributing medium in the preparation of aromatic waters etc. it is the main ingredient in talcum powders and dusting powders.
ZINC OXIDE, ZnO

Preparation

1. Zinc oxide is prepared on a large scale by burning zinc metal in a current of air.

\[ \text{Zn} + \text{O}_2 = 2\text{ZnO} \]

2. In this method, Zinc carbonate is prepared first by reacting zinc sulphate with a boiling solution of sodium carbonate. The precipitated basic carbonate of zinc is collected, washed to remove sulphate, dried and finally gently ignited. It loses carbon dioxide and water, leaving zinc oxide as the residue

\[ 2\text{ZnCO}_3, 2\text{Zn(OH)}_2 = 4\text{ZnO} + 2\text{CO}_2 + 2\text{H}_2\text{O} \]

Basic Zinc carbonate.

Assay:

The sample is dissolved in 2M acetic acid and diluted with water. Xylenol orange titrurate and sufficient hexamine to produce violet pink colour are added. A further quantity of hexamine is added and titrated with 0.1M disodium edetate until the solution becomes yellow.

In this complexometric titration hexamine is added to raise the pH to the alkaline side and the zinc oxide converted to zinc acetate by dissolving in acetic acid and titrated with 0.1M disodium edetate using xylenol orange as indicator. Zinc is complexed by the disodium edetate and the indicator changes colour from violet-pink to yellow at the end point.

Test for Purity

1. Alkalinity
2. Carbonates and substances insoluble in acids.
3. Arsenic
4. Iron
5. Lead
6. Loss or ignition

Storage:

Since it absorbs carbon dioxide from the air, store it in a well closed container.

Medicinal Use:

Astringent and topical protective. Zonic oxide is a mild antiseptic and astringent. In the form of zinc oxide ointment or dusting powder, it is used in the treatment of eczema, ringworm, pruritus and psoriasis. It is also widely used in the manufacture of plasters.


**CALAMINE**

According to B.P. calamine is basic Zinc carbonate suitably coloured with ferric oxide. According to the I.P. Calamine is Zinc oxide coloured with Ferric oxide. It is an amorphous, reddish brown powder and the colour depends on the variety and amount of ferric oxide present and the method by which it is incorporated. It is practically insoluble in water and completely soluble in mineral acids. Since there is a possibility of adulteration with dyes, there are tests for water soluble dyes and alcohol soluble dyes.

**Test for Purity**

1. Acid-insoluble substances
2. Alkaline substances
3. Arsenic
4. Calcium
5. Lead
6. Water-soluble dyes
7. Alcohol-soluble dyes
8. Loss on ignition

**Storage:**

Store in well closed containers.

**Medicinal and Pharmaceutical Uses:**

Topical protective. Widely used in lotions, ointments and dusting powders as a soothing agent. It is used in sunburns, eczema and urticaria and some other skin conditions. Calamine lotion (Lotio Calaminae) is very popular.
**ZINC STEARATE, \((\text{C}_{17}\text{H}_{35}\text{COO})_2\text{Zn}\)**

Zinc stearate is mixture of Zinc salts obtained from commercial stearic acid which itself is prepared from the hydrolysis of fats. It consists mainly of variable proportions of Zinc stearate and Zinc palmitate.

**Test for Purity**

1. Acidity or alkalinity
2. Alkalis and alkaline earths
3. Chloride
4. Arsenic
5. Heavy metals
6. Sulphate

**Storage:**

Store in well closed containers.

**Medicinal and Pharmaceutical Uses:**

Dusting powder. Since zinc stearate is a mild antiseptic and astringent, it is used in the form of dusting powder or ointment in several skin conditions. Sometimes it is used as solid diluents.
**TITANIUM DIOXIDE, TiO₂**

Titanium dioxide occurs in nature in the mineral rutile, brookite and ilmenite. Magnetic iron ores usually contain titanium.

**Preparation:** Titanium dioxide is prepared by heating ilmenite FeTiO₃ with hydrogen chloride and chlorine.

\[
2\text{FeTiO}_3 + 4\text{HCl} + \text{Cl}_2 = 2\text{FeCl}_3 + 2\text{TiO}_2 + 2\text{H}_2\text{O}.
\]

**Assay:** It is assayed by dissolving it in sulphuric acid with the aid of anhydrous sodium sulphate to form a soluble double salt of titanium and sodium. The titanium sulphate solution is then passed through a reducing column containing zinc amalgam so that the titanic sulphate reduced to titanous sulphate. The titanous sulphate is oxidized back to titanic sulphate by running the solution into ferric ammonium sulphate solution. The ferrous sulphate formed in this reaction by the reduction of ferric ammonium sulphate is titrated with 0.1M ceric ammonium nitrate using ferroin sulphate as indicator.

\[
\text{TiO}_2 + 2\text{H}_2\text{SO}_4 + \text{Na}_2\text{SO}_4 = \text{Ti} (\text{SO}_4)_2 \cdot \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}
\]

Titanium sodium sulphate

\[
2\text{Ti} (\text{SO}_4)_2 + \text{H}_2 = \text{Ti}_2 (\text{SO}_4)_3 + \text{H}_2\text{SO}_4
\]

Titanic sulphate Titanous sulphate

\[
\text{Ti}_2 (\text{SO}_4)_3 + 2\text{FeNH}_4(\text{SO}_4)_2 = 2\text{Ti} (\text{SO}_4)_2 + (\text{NH}_4)_2\text{SO}_4 + 2\text{FeSO}_4
\]

Ferric ammonium sulphate

Ceric ammonium nitrate oxidizes ferrous sulphate to ferric sulphate.

**Test for Purity**

1. Clarity and colour of solution
2. Acidity or alkalinity
3. Water-soluble substances
4. Arsenic
5. Barium
6. Heavy metals
7. Iron

**Storage:**

Store in well closed containers made of glass or any metal other than aluminium.

**Medicinal and Pharmaceutical Uses:**

Pharmaceutical Aid and Topical Protective. Since it spreads well, it is used as a white pigment in paints. Because of its high refractive index it is used in sun-tan preparations.
HEAVY KAOLIN, Al₂O₃·2SiO₂·2H₂O

Kaolin is a native, hydrated aluminum silicate, powered and freed from gritty particles by elutriation. It is insoluble in water, in cold dilute acids and in solutions of alkali hydroxides. It may contain a suitable dispersing agent.

Test for Purity

1. Acidity and alkalinity
2. Arsenic
3. Heavy metals
4. Chloride
5. Sulphate
6. Substances soluble in mineral acids
7. Organic impurities
8. Adsorption power
9. Swelling power
10. Loss on ignition

Storage:

Store in well closed containers.

Medicinal and Pharmaceutical Uses:

Pharmaceutical aid. Anti-inflammatory and counter irritant (Kaolin Poultice, I.P.’66 contains 50.5% of Heavy Kaolin).

LIGHT KAOLIN, Al₂O₃·2SiO₂·2H₂O

Test for Purity

1. Coarse particles
2. Fine particles
3. Arsenic
4. Heavy metals
5. Chloride
6. Soluble matter
7. Loss on drying
8. Loss on ignition

Storage:

Store in well-closed containers.

Medicinal and Pharmaceutical Uses:

Adsorbent (in the treatment of diarrhea). It is used both for its adsorptive property and also for its ability to coat the mucosa. It is used in diarrhea due to food poisoning or due to bacteria. It provides relief by adsorbing gases, toxins and bacteria.
SILICONE POLYMERS

Compounds that are formed as a result of the bonding of silicon, oxygen and carbon by condensation are known as silicones. One of the building blocks of silicones is dimethyldihydroxysilane, (CH₃)₂Si(OH)₂

Two dimethyldihydroxysilane molecules undergo condensation with elimination of molecule of water. Repeated condensation of the molecules results in the formation of macro molecules (big molecules) or polymers. These are known as silicones. The Si-O-Si linkage in these molecules is very strong.

The general formula of silicones may be given as [(CH₃)₂SiO-]n. Silicones obtained by starting with dimethyldihydroxysilane are known as silicones oils.

The silicones are stable even at very high and very low temperatures and are water repellent. Silicones are used for making water-proof cloth and lubricants which do not freeze even at very low temperatures. Activated Dimethicone is official in I.P

ACTIVATED DIMETHICONE

Activated Dimethicone is activated polydimethylsiloxane. It is also known as Simethicone. It has the formula (CH₃)₂Si-[OSi(CH₃)₂]-CH₃.

Test for Purity

1. Acidity
2. Heavy metals
3. Defoaming activity

Storage:

Store in tightly closed containers.

Medicinal and Pharmaceutical Use:

Protective and Defoaming agent. Dimethicone is used for preparing Dimethicone cream (formerly official in B.P.C). This cream is used to protect the skin against colostomy and discharges and to prevent bed sores and napkin-rash. (Colostomy is an operation to make an artificial opening so that the colon opens on to the anterior abdominal wall. This operation is done when there is an obstruction in the colon). Dimethicone is also included in antacid mixtures to treat cases of flatulence.
ASTRINGENT

ALUM (PO TASH ALUM, ALUMINIUM POTASSIUM SULPHATE), KAl(SO₄)₂·H₂O

Alum is both a specific chemical compound and a class of chemical compounds. The specific compound is the hydrated potassium aluminium sulfate (potassium alum) with the formula KAl(SO₄)₂·12H₂O. More widely, alums are double sulphate salts, with the formula AM(SO₄)₂·12H₂O, where A is a monovalent cation such as potassium or ammonium and M is a trivalent metal ion such as aluminium or chromium(III).

Test for Purity:

1. Arsenic
2. Heavy metals
3. Iron
4. Zinc
5. Ammonium salts

Storage:

Alum should be stored in well-closed container.

Medicinal and Pharmaceutical Uses:

- Alum is used in many subunit vaccines as an adjuvant to enhance the body's response to immunogens. Such vaccines include hepatitis A, hepatitis B, and DTaP.
- Alum in powder or crystal form, or in styptic pencils, is sometimes applied to cuts to prevent or treat infection.
- Powdered alum is commonly cited as a home remedy for canker sores.
- Preparations containing alum are used by pet owners to stem bleeding associated with animal injuries caused by improper nail clipping.
- Alum is listed as an ingredient of some brands of toothpaste or toothpowder.
- Alum powder dissolved in five parts water has been used to shrink hemorrhoids and stop them from bleeding.
**ZINC SULPHATE, ZnSO$_4$$\cdot$7H$_2$O**

**Test for Purity:**

1. Clarity and colour of the solution
2. pH
3. Arsenic
4. Iron
5. Chloride

**Storage:**

Since it is efflorescent, store in a well closed, non-metallic container.

**Medicinal and Pharmaceutical Use:**

Emetic (induces vomiting) and astringent.
ANTIMICROBIALS:

An antimicrobial is a substance that kills or inhibits the growth of microorganisms such as bacteria, fungi, or protozoans. Antimicrobial drugs either kill microbes (microbicidal) or prevent the growth of microbes (microbiostatic). Disinfectants are antimicrobial substances used on non-living objects or outside the body.

HYDROGEN PEROXIDE, $\text{H}_2\text{O}_2$

Hydrogen peroxide ($\text{H}_2\text{O}_2$) was discovered by French chemist Thenard.

Preparation: It is prepared by

(i) Laboratory method:

In laboratory, $\text{H}_2\text{O}_2$ is prepared by Merck’s process. It is prepared by adding calculated amounts of sodium peroxide to ice cold dilute (20%) solution of $\text{H}_2\text{SO}_4$.

$$\text{Na}_2\text{O}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}_2$$

(ii) By the action of sulphuric acid or phosphoric acid on hydrated barium peroxide $\text{BaO}_2\cdot8\text{H}_2\text{O}$

(a) $\text{BaO}_2\cdot8\text{H}_2\text{O} + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 \downarrow + \text{H}_2\text{O}_2 + 8\text{H}_2\text{O}$

It must be noted that anhydrous barium peroxide does not react readily with sulphuric acid (because a coating of insoluble barium sulphate is formed on its surface which stops further action of the acid). Therefore, hydrated barium peroxide, $\text{BaO}_2\cdot8\text{H}_2\text{O}$ must be used.

(b) $3\text{BaO}_2 + 2\text{H}_3\text{PO}_4 \rightarrow \text{Ba}_3(\text{PO}_4)_2 + 3\text{H}_2\text{O}_2$

$\text{Ba}_3(\text{PO}_4)_2 + 3\text{H}_2\text{SO}_4 \rightarrow 3\text{BaSO}_4 + 2\text{H}_3\text{PO}_4$

Phosphoric acid is preferred to $\text{H}_2\text{SO}_4$ because soluble impurities like barium persulphate (from $\text{BaO}_2\cdot8\text{H}_2\text{O} + \text{H}_2\text{SO}_4$) tends to decompose $\text{H}_2\text{O}_2$ while $\text{H}_3\text{PO}_4$ acts as preservative (negative catalyst) for $\text{H}_2\text{O}_2$.

(iii) Industrial method: On a commercial scale, $\text{H}_2\text{O}_2$ can be prepared by the electrolysis of 50% $\text{H}_2\text{SO}_4$ solution. In a cell, peroxy disulphuric acid is formed at the anode.

$2\text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{S}_2\text{O}_8 (\text{aq.}) + \text{H}_2$

Electrolysis Peroxy disulphuric acid

This is drawn off from the cell and hydrolysed with water to give $\text{H}_2\text{O}_2$.

$$\text{H}_2\text{S}_2\text{O}_8 + 2\text{H}_2\text{O} \rightarrow 2\text{H}_2\text{SO}_4 + \text{H}_2\text{O}_2$$

The resulting solution is distilled under reduced pressure when $\text{H}_2\text{O}_2$ gets distilled while $\text{H}_2\text{SO}_4$ with high boiling point, remains undistilled.

(iv) By redox process: Industrially $\text{H}_2\text{O}_2$ is prepared by the auto-oxidation of 2-alkylanthraquinols. The process involves a cycle of reactions. The net reaction is the catalytic union of and to give
The \( \text{H}_2\text{O}_2 \) formed (about 1\%) is extracted with water and concentrated.

**Assay:**

It is acidified with dilute sulphuric acid and titrated against N/10 potassium permanganate.

\[
2\text{KMnO}_4 + 3\text{H}_2\text{SO}_4 + 5\text{H}_2\text{O}_2 = \text{K}_2\text{SO}_4 + \text{MnSO}_4 + 8\text{H}_2\text{O} + 5\text{O}_2
\]

(OR) \( \text{O} + \text{H}_2\text{O}_2 = \text{H}_2\text{O} + \text{O}_2 \)

**Test for purity:**

1. Acidity
2. Organic stabilizers
3. Non-volatile matter

**Storage:**

\( \text{H}_2\text{O}_2 \) is not stored in glass bottles since the alkali metal oxides present in glass catalyse its decomposition. It is, therefore, stored in paraffin wax coated glass, plastic or teflon bottles. Small amounts of acid, glycerol, alcohol, acetanilide and \( \text{H}_3\text{PO}_4 \) are often used as stabilizers to check its decomposition.

**Uses:**

(i) For bleaching delicate articles like wool, hair, feather, ivory, etc.
(ii) For restoring colour of old lead paintings whose white lead has blackened due to formation of \( \text{PbS} \) by \( \text{H}_2\text{S} \) of atmosphere. Hydrogen peroxide converts the black lead sulphide to white lead sulphate.
(iii) As an aerating agent in production of spong rubber.
(iv) As an antiseptic and germicide for washing wounds, teeth and ears, under the name of perhydrol.
(v) In the manufacture of sodium perborate, sodium percarbonate. These are used in high quality detergents.
(vi) As an antichlor.
(vii) As an oxidant for rocket fuel.
(viii) In the detection of Ti, V and Cr ions with which it forms peroxides of characteristics colours.
(ix) In the production of epoxides, propylene oxide and polyurethanes.
(x) In the synthesis of hydroquinone, pharmaceuticals (cephalosporin) and food products like tartaric acid.
(xi) For pollution control of domestic effluents where it restores the aerobic conditions of sewage wastes. For pollution control of industrial effluents containing CN⁻ ions. \( \text{H}_2\text{O}_2 \) oxidises \( \text{CN}^- \) ions to harmless products.
POTASSIUM PERMANGANTE, KMnO₄

Potassium permanganate is an inorganic chemical compound with the formula KMnO₄. It is a salt consisting of K⁺ and MnO₄⁻ ions. Formerly known as permanganate of potash or Condy's crystals, it is a strong oxidizing agent.

Test for Purity:

1. Chloride and sulphate
2. Water-insoluble matter
3. Colour of the solution

Storage:

Solid KMnO₄ is a strong oxidizer and thus should be kept separated from oxidizable substances. Store in well-closed containers.

Uses:

As an oxidant, potassium permanganate can act as an antiseptic

Permanganate washes were once used to treat gonorrhea[^25] and are still used to treat candidiasis.[^26] It can also be used to inactivate the poison strychnine.

Potassium permanganate is one of the principal chemicals used in the film and television industries to "age" props and set dressings. Its oxidising effects create "hundred year old" or "ancient" looks on hessian cloth, ropes, timber and glass.
**CHLORINATED LIME OR BLEACHING POWDER, Ca(OCl)Cl**

Calcium hypochlorite is a chemical compound with formula Ca(ClO)\(_2\). It is widely used for water treatment and as a bleaching agent (bleaching powder). This chemical is considered to be relatively stable and has greater available chlorine than sodium hypochlorite (liquid bleach).

**Preparation:**

It is manufactured by the calcium process:

\[
2\text{Cl}_2 + 2\text{Ca(OH)}_2 \rightarrow \text{Ca(OC}l)\_2 + \text{CaCl}_2 + 2\text{H}_2\text{O}.
\]

Bleaching powder is actually a mixture of calcium hypochlorite (Ca(ClO)\(_2\)) and the basic chloride CaCl\(_2\), H\(_2\)O with some slaked lime, Ca(OH)\(_2\).

**Assay:**

An aqueous suspension of the substance is first treated with excess of potassium iodide and acetic acid. Acetic acid like other acids liberated chlorine from chlorinated lime as below:

\[
\text{Ca(OCl)Cl} + 2\text{CH}_3\text{COOH} = (\text{CH}_3\text{COO})_2\text{Ca} + \text{HOC}l + \text{HCl}
\]

\[
\text{HOC}l + \text{HCl} = \text{Cl}_2 + \text{H}_2\text{O}
\]

The liberated chlorine displaces an equivalent amount of iodine from potassium iodide.

**Storage:**

Stored in tightly closed containers.

**Uses:**

Calcium hypochlorite is used for the disinfection of drinking water or swimming pool water. It is used as a sanitizer in outdoor swimming pools in combination with a cyanuric acid stabilizer, which reduces the loss of chlorine due to ultraviolet radiation. The calcium content hardens the water and tends to clog up some filters; hence, some products containing calcium hypochlorite also contain anti-scaling agents.

Calcium hypochlorite is also an ingredient in bleaching powder, used for bleaching cotton and linen. It is also used in bathroom cleaners, household disinfectant sprays, moss and algae removers, and weedkillers.

In addition, calcium hypochlorite may be used to manufacture chloroform.

Bleaching powder is used also in sugar industry for bleaching sugar cane juice before its crystallization.
**IODINE, I**: 

Iodine, I, is a dark violet (Greek, ioeides, violet) non-metallic halogen element belonging to Group VIIb (i.e. the Halogen Group of elements) of the periodic table.

**Preparation:**

Iodine can be prepared in the laboratory by heating potassium Iodide or sodium iodide with dilute sulphuric acid and manganese dioxide.

\[ 2 \text{KI} + \text{MnO}_2 + 3 \text{H}_2\text{SO}_4 \rightarrow \text{I}_2 + 2 \text{KHSO}_4 + \text{MnSO}_4 + 2 \text{H}_2\text{O} \]

**Assay:**

Since it is volatile, it should be weighed in a stoppered container and dissolve the sample in in a solution of potassium iodide and slightly acidify with dilute acetic acid and titrate it against 0.1 M sodium tiosulphate using starch mucilage as indicator.

\[ 2\text{Na}_2\text{S}_2\text{O}_3 + \text{I}_2 = \text{Na}_2\text{S}_4\text{O}_6 + 2\text{NaI} \]

**Test for Purity:**

1. Bromides and chlorides
2. Non-volatile matter

**Storage:**

It is volatile in nature. Iodine topical solution should be stored in light-resistant containers at a temperature not exceeding 35 °C and iodine tincture should be stored in air-tight containers.

**Uses:**

Iodine is used

- in medicine, where its solution in alcohol, called "tincture of iodine", is used as a disinfectant,
- in the manufacture of compounds used in photography (e.g. silver iodide which is a light sensitive material used in film),
- in the manufacture of dyestuffs and drugs, and
- as a reagent in analytical chemistry.
BORIC ACID, \( \text{H}_3\text{BO}_3 \)

Boric acid, also called hydrogen borate, boracic acid, orthoboric acid and acidum boricum, is a weak acid of boron often used as an antiseptic, insecticide, flame retardant, neutron absorber, or precursor to other chemical compounds. It has the chemical formula \( \text{H}_3\text{BO}_3 \) (sometimes written \( \text{B(OH)}_3 \)), and exists in the form of colorless crystals or a white powder that dissolves in water. When occurring as a mineral, it is called sassolite.

Preparation:

Boric acid may be prepared by reacting borax (sodium tetraborate decahydrate) with a mineral acid, such as hydrochloric acid:

\[
\text{Na}_2\text{B}_4\text{O}_7\cdot10\text{H}_2\text{O} + 2 \text{HCl} \rightarrow 4 \text{B(OH)}_3 [\text{or } \text{H}_3\text{BO}_3] + 2 \text{NaCl} + 5 \text{H}_2\text{O}
\]

It is also formed as a by product of hydrolysis of boron trihalides and diborane:

\[
\text{B}_2\text{H}_6 + 6 \text{H}_2\text{O} \rightarrow 2 \text{B(OH)}_3 + 6 \text{H}_2
\]

\[
\text{BX}_3 + 3 \text{H}_2\text{O} \rightarrow \text{B(OH)}_3 + 3 \text{HX} \ (X = \text{Cl}, \text{Br}, \text{I})
\]

Assay:

Assayed by acid-base titration. Sample + water + glycerol titrate against standard sodium hydroxide using phenolphthalein as indicator.

Test for Purity:

1. clarity and colour of the solution
2. sulphate
3. solubility in ethanol
4. arsenic
5. heavy metals
6. loss on drying

Storage:

The substance is quite stable in air. Store in well closed containers.

Uses:

Boric acid can be used as an antiseptic for minor burns or cuts and is sometimes used in dressings or salves. Boric acid is applied in a very dilute solution as an eye wash. Dilute boric acid can be used as a vaginal douche to treat bacterial vaginosis due to excessive alkalinity.\(^{[14]}\) As an anti-bacterial compound, boric acid can also be used as an acne treatment. It is also used as prevention of athlete's foot, by inserting powder in the socks or stockings, and in
solution can be used to treat some kinds of *otitis externa* (ear infection) in both humans and animals. The preservative in urine sample bottles (red cap) in the UK is boric acid.

Boric acid solutions used as an eye wash or on abraded skin are known to be especially toxic to infants, especially after repeated use because of its slow elimination rate.
**SILVER NITRATE, AgNO₃**

Silver nitrate is an inorganic compound with chemical formula AgNO₃.

**Test for Purity:**

1. clarity and colour of the solution
2. acidity and alkalinity
3. foreign salts
4. aluminium, bismuth, copper and lead

**Storage:**

Affected by light, store in tightly closed light resistant containers.

**Uses:**

Silver salts have antiseptic properties. Until the development and widespread adoption of antibiotics, dilute solutions of AgNO₃ used to be dropped into newborn babies' eyes at birth to prevent contraction of gonorrhea from the mother. Eye infections and blindness of newborns was reduced by this method; incorrect dosage, however, could cause blindness in extreme cases.
**POVIDONE-IODINE**

Povidone-iodine (PVP-I) is a stable chemical complex of polyvinylpyrrolidone (povidone, PVP) and elemental iodine. It contains from 9.0% to 12.0% available iodine, calculated on a dry basis.

**Test for Purity:**

1. heavy metals
2. nitrogen
3. iodide
4. sulphated ash
5. loss on drying

**Storage:**

Since it slightly hygroscopic in nature, store in a well closed, light resistant containers.

**Uses:**

It is used as a disinfectant. Povidone-iodine is a broad spectrum antiseptic for topical application in the treatment and prevention of infection in wounds.
SELENIUM SULPHIDE, SeS$_2$

Selenium disulfide is an inorganic compound with the approximate formula SeS$_2$. Both sulfur and selenium catenate (form chains and rings) readily, and mixtures of selenium and sulfur likewise give rise to numerous "alloys".[1] This compound is not an analogue of sulfur dioxide.

**Test for Purity:**

1. soluble selenium compounds

**Storage:**

Store in well closed containers.

**Uses:**

In the treatment of dandruff. Available as Selsun cream and suspension.
Zinc Undecenoate, (ZINC UNDECYLENATE), \([\text{CH}_2=\text{CH}.(\text{CH}_2)_8\text{COO}]_2\text{Zn}\)

Test for purity:

1. Degree of unsaturationAlkalinity
2. Alkalis and alkaline earth
3. Sulphste
4. Loss on drying

Storage:

Stored in well closed light resistant containers.

Uses:

Antifungal.
CONSUMER DENTAL PRODUCTS

Consumer dental products include dentifrices (tooth powders, tooth pastes and liquid dentifrices), mouth washes and rinses, tooth ache drops, denture adhesives and denture cleaners.

ANTICARIES AGENTS

Role of Fluorides as anticarrier agents:

Indigenous bacterial flora in the mouth is supposed to cause dental caries or tooth decay. They act on the remnants of food materials especially the sugars left on or between the teeth releasing acids during the process. The dissolution of minerals in enamel and also dentin by these acids produces caries lesions in the teeth. The fluoride ion is tough to bond with the enamel and make it tough against dental caries. Fluoridation (adding fluoride to water supply) is the most efficient way for prevention of dental caries in a population. Topical fluorides such as those present in tooth pastes, mouth washes and gels are generally less effective than systemic fluorides such as fluoride in water supply.

SODIUM FLUORIDE, NaF

Test for Purity

1. Acidity or alkalinity
2. Clarity and colour of solution
3. Chloride
4. Fluorosilicate
5. Sulphate
6. Loss on drying

Storage:

Store in well closed containers, preferably in pyrex glass bottles. Aqueous solution should always be stored in pyrex glass bottles only. It should not be stored for more than 6 months.

Medicinal and Pharmaceutical Uses:

Preventive for dental caries and tooth decay. It is considered to bond with tooth enamel and toughen it.
DENTIFRICES

Dentifrices are tooth powders and tooth pastes used to clean the accessible portions of teeth with or without a tooth brush.

STRONTIUM CHLORIDE, $\text{SrCl}_2\cdot6\text{H}_2\text{O}$

Storage:

Since it effloresces in dry air, store in well closed containers.

Medicinal and Pharmaceutical Uses:

Desensitizer.

It is used to reduce sensitivity of teeth to heat and cold. When there is tooth ache or tooth decay, teeth are more sensitive to heat or cold. In this connection, strontium chloride acts like zinc chloride. It is possible that there may act like local anesthetics to prevent the perception of heat and cold by the teeth.
**ZINC CHLORIDE, ZnCl₂**

**Test for Purity**

1. pH
2. ammonium salts
3. aluminium, calcium, heavy metals, iron and magnesium
4. sulphate
5. oxychloride

**Storage:**

Since it is very deliquescent, store in tightly closed non-metallic containers.

**Medicinal and Pharmaceutical Uses:**

It is used in mouth washes for its antiseptic and astringent properties. It is also used for preparing zinc insulins.