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Vehicle

JV'n Dr. Pushpa Kumawat

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CONTENT

VEHICLES

The term 'vehicle' implies, "Means of conveyance or transmission"

DEFINITON

Vehicles those substances are therapeutically inert as such but develop the therapeutic activity of the medicinal substance. They are the medium for purification, preparation, preservation, internal administration and external application of drug substances or medicines.

In homoeopathy, vehicle is a substance, in which medicines are prepared or mixed and given for their internal administration either by oral route or by the olfaction method and for external application of medication

AN IDEAL VEHICLE

1. It must not have any medicinal property of its own.

2. It should be chemically neutral; neither acidic nor alkaline in medicinal effects. They must not undergo any change or decomposition.

4. It must be harmless regarding its action on human organisms. The pharmacological medicinal action of the original drug should not be disturbed in any way.

5. It should be capable of carrying the dynamic powers of drugs into the interior of the human organism to fight the disease force.

6. It should be edible and palatable.

7. It must preserve the drug substance.

8. It should have a sterilizing property.

USES OF VEHICLES

1. Vehicles are used in the preparation of mother tinctures, mother solutions and mother powders from crude drug materials, and without any vehicles these preparation could not be made.

2. It is used for further triturations and increased potentisation from the mother preparation so that the pharmaceutical message is easily carried on and the therapeutic values are retained of the particular drug substances.

3. Used as bases for preparing external applications of medicines.

4. for dispensing medicines or remedies according to the prescriptions of physicians.

5. Vehicles like olive oil, vaseline, glycerine, etc. are themselves applied externally as a mehanical aid only. 6. As a preservant of certain medicines, vehicles like alcohol are mixed in a certain percentage with the freshly expressed juices of plants (Vide Organon of Medicine, Aphorism 268, footnote).

7. Used as 'Placebo' or 'Phytum' in between the administration of two doses of medicines or remedies, especially in cases of chronic diseases and where long acting remedies are used. Dr. Kent holds, "Second best medicine in our materia medica in Placebo", which is given to the patient to please.

8. Sick babies who could not tolerate fats, sugar of milk is given as a diet.

FORMS OF VEHICLES

There are three forms of vehicles:

1. Solid.

2. Liquid.

3. Semi-solid.

Solid Vehicles	Liquid Vehicles	Semi-solid Vehicles
• Sugar of milk (lactose) • Cane sugar (sucrose) • Grape sugar (glucose, dextrose) • Globules or pillules • Cones • Tablets or tabloids • Pellets	• Purified water • Alcohol i. Absolute alcohol ii. Dilute alcohol iii. Strong alcohol iv. Dispensing alcohol v. Rectified spirit • Solvent ether • Glycerine • Simple syrup • Oils a. Fixed oil i. Olive oil ii. Almond oil iii. Sesame oil iv. Hydrocarpus oil v. Chaulmoogra oil b. Volatile oil i. Sandalwood oil ii. Lavender oil iii. Rosemary oil	• Vaseline (soft paraffin) i. Yellow soft paraffin ii. White soft paraffin • Waxes a. Bee's wax i. Yellow bee's wax ii. White bee's wax b. Spermaceti c. Lanolin (anhydrous) • Soap a. Vegetable origin i. Hard soap ii. Soft soap b. Animal origin curd soap • Prepared lard • Isin glass • Starch

VEHICLES USED FOR MOTHER TINCTURE

Generally the vehicles used for Potentisation are used for preparing the mother tincture or the first trituration. However in a few cases, simple syrup or glycerine may also be used.

VEHICLE USED FOR POTENTISATION

A. Solid Vehicles (dry):

- Sugar of milk.
- Cane sugar.
- Grape sugar.

B. Liquid Vehicles:

1. Alcohol:
   - Strong alcohol.
   - Dilute alcohol.
   - Dispensing alcohol.
   - Absolute alcohol.
   - Rectified spirit.
2. Purified water.

VEHICLES USED FOR EXTERNAL APPLICATIONS

A. Liquid Vehicles:

- Purified water.
- Glycerine.
- Olive oil.
- Almond oil.
- Sesame oil.
- Rosemary oil.

B. Semisolid Vehicles:

1. Vaseline or soft paraffin.
   - Yellow soft paraffin.
   - White soft paraffin.
2. Waxes:

a. Bees wax:
   - Yellow bee's wax.
   - White bee's wax.

b. Spermaceti.

c. Lanolin.

3. Prepared lard.
4. Isin glass.
5. Soap:
   - Soft soap.
   - Hard soap.
   - Curd soap.

6. Starch.

VEHICLES USED FOR DISPENSING MEDICINES

- Aqua distilla or purified water.
- Saccharum lactis or sugar or milk.
- Globules.
- Tablets.
- Pilules.

SUGAR OF MILK

Synonyms: Saccharum lactis or lactose

Sources: It is prepared from goat's milk .

Chemical Nature: It is a disaccharide.

1 unit beta-galactose + 1 unit levo-glucose = Saccharum Lactis

Chemical formula: $C_{12}H_{22}O_{11}\,H_2O$

Source-Prepared preferably from goat's milk. Milk contains proteins, fats, carbohydrates, mineral salts and water.

It is the most important solid vehicle in our pharmacy. Its importance is for two reasons:

1. It has practically no medicinal action.

2. Due its hard crystalline particles, it must undergo a thorough grinding with the original drug (a process which helps to convey the latent curative properties of the drug during trituration) and is available in the powdered form easily.

Physical Characteristics

• Hard, crystalline mass or powder.

• Milky white in colour.

• Odourless.

• Faintly sweet to taste.

• Sandy or gritty on touch.

• Solubility: 1 g. of lactose is soluble in 5 ml. of cold water, and 2.6 ml. of boiling water. It is insoluble in alcohol. Chemical Characteristics

• It's solution is neutral to litmus paper.

• Water of crystallization may be produced at 150ºC or 302ºF.

PREPARATION

1. Fresh goat's milk is skimmed i.e. it is allowed to stand till it's cream rises. This process removes most of the fat portion of milk.

2. This fat-free milk is treated with dilute hydrochloric acid to precipitate the casein (the main protein of milk). Casein so obtained is removed by filtration. The remaining filtrate is called whey.

3. Whey is adjusted to a pH of 6.2 by adding lime and then heated for coagulating the remaining albuminous matter and once again filtered. This filtrate contains the milk sugar and mineral salts.

4. The filtrate is concentrated in vacuum pans, where crude milk sugar crystallises out.

5. These crystals are redissolved in purified water and decolorised with 'animal charcoal'.

6. Finally, this solution is recrystallised, and the crystals thus obtained is 'commercial lactose'. Purification Commercial lactose obtained is again subjected to purification as in homoeopathic pharmacy, we use the purest vehicles. It is done by Staff's process which is as follows:

1. Dissolve 450 gms. of commercial lactose in about 2 litres of boiling, purified water.

2. Filter the solution when warm through a filter paper.

3. Mix the filtrate thoroughly with about 2 litres of 'absolute alcohol' and keep it in a tightly closed container for 4 days in a cold place for the sugar to crystallise.

4. The crystals thus collected are washed with water and then mixed with alcohol.

5. These crystals are dried by pressing between filter papers are be kept in well-closed containers.

6. For further purification of the above lactose, it may be dissolved in a little quantity of boiling, purified water and filtered.

7. By adding an equal quantity of absolute alcohol, sugar of milk is precipitated.

8. The precipitate is collected and washed with alcohol and dried thoroughly before being used

Goat's milk: Composition - (i) Protein (lacto-albumin + lactoglobulin + casinogen)

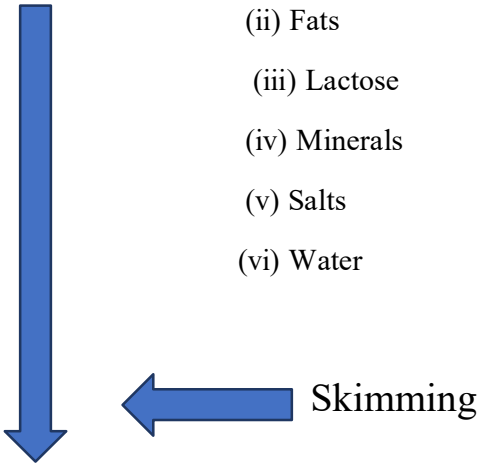
(ii) Fats

(iii) Lactose

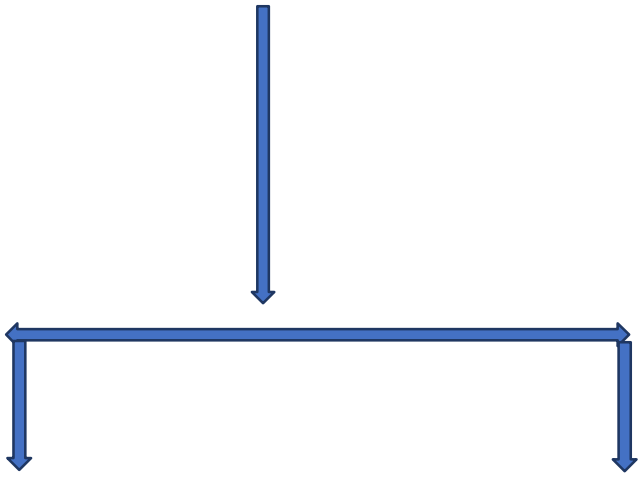
(iv) Minerals

(v) Salts

(vi) Water



Proteins + H2 O + Minerals + Salts + Lactose Fat (removed).



Lactose + H2 O

(liquid portion)

Proteins + Salts + Minerals

(solid portion)

+ HCl (dil.) to remove solid portion.

+ Filtration.

Lactose + H2O(whey)

(Filtrate)

Lactose + H2 O(whey)

(Filtrate)

+ Purified water.

+ Filtration through charcoal bed

Clear solution of whey

+ Boiled on direct heat.

+ Made semi-solid.

+ Process repeated 3 - 4 times by adding purified water.

Semi-solid lactose

+ Strong alcohol.

+ Purified water.

+ Boiled in direct heat and then indirect heat with water-bath.

Crystal lactose

+ Slight alcohol.

+ Dried.

Pure crystals of lactose

USES OF SUGAR OF MILK

• Largely used in biochemic medicines preparations.

• For preparations of mother powders.

• For preparations or potentised medicines in decimal potency.

• For preparation of trituration from mother drugs, which are insoluble in liquid vehicles.

• Sugar of milk is preferred to other solid vehicles for trituration as it is the best crystalline substance, it is odourless, slightly sweet to taste and gritty to touch. It is capable of being ground to a very fine powder. The particles of this are insoluble in both purified water and in alcohol.

• Used as a 'Placebo' (Dr. Kent holds that in our materia medica, a placebo is the 2nd best medicine).

• for Dispensing medicines.

• Has industrial uses in silvering mirrors.

• As a food.

CHARACTERISTICS OF SUGAR OF MILK

1.PHYSICAL PROPERTIES

- Hard, crystalline mass, milky white in color
- It is odorless,
- faintly sweet in taste
- Sandy or gritty feeling on touching in between fingers
- Solubility: one gm lactose is soluble in 5 ml of water ,whereas it is soluble in 2.6 ml of boiling water. Insoluble in alcohol.

2. CHEMICAL PROPERTIES

- Molecular weight : 360.3
- Its solution is neutral to litmus paper
- It may produce 'water of crystalline' at 150**℃**

TESTS FOR IMPURITIES

- The most common impurity is starch, which is easily detected by adding to its aqueous solution a “solution of iodine”. If starch is present, the solution will turn blue.
- If alum is present in its aqueous solution, addition of a little amount of alkaline hydrate to the lactose solution gives a white precipitate.
- If phosphate of sodium is present, addition of silver ammonia nitrate to the lactose solution gives a little yellow precipitate which will get dissolved when cold dilute nitric acid is added.
- A hot saturated aqueous solution of sugar of milk when warmed with an equal volume of sodium hydroxide becomes yellow and then brownish-red, and on adding a few drops of cupric sulphate to the solution, copper is reduced and a red precipitate of cuprous oxide forms.
- If sodium chloride be present, add silver nitrate solution, a precipitate will issue which is insoluble in nitric acid.
- Sulphuric acid will be detected by the solution of barium nitrate or chloride.
- If an aqueous solution of milk sugar reddens the blue litmus paper, then acid is present, which will imply that this milk sugar had been prepared from the milk, that had become sour.
- If copper (from copper vessel used in preparing the milk sugar) be present, addition of a solution of potassium ferrocyanide to its aqueous solution will bring a reddishbrown precipitate.

PRESERVATION OF SUGAR OF MILK

- It should be preserved in air tight plastic container or bottles in dry state & in dry place.
- It should not be preserved for a long time as it may go rancid .

CANE SUGAR

SYNONYMS

- Sucrose.
- Sucrosum.
- Saccharum purification.
- Refined sugar.
- Chini (in hindi).
- Mishri (in hindi)

Chemical Formula- $C_{12}H_{22}O_{11}$

Identification Optical rotation is not less than + 65.9º at 20ºC.

Source

1. Sugar cane: Most common, 15-20%. It grows mainly in tropical countries. In India, mostly this source is used.

2. Beetroot: 12-15%. It mainly grows in cold climates.

3. others: From: Pineapple, Honey, Coffee Almonds.

PHYSICAL CHARACTERISTICS

1. Slightly white or colorless crystals. .
2. Odorless.
3. Sweeter to taste in comparison to other sugars.
4. Solution of cane sugar is neutral to litmus.
5. Easily soluble in water; sparingly soluble in alcohol.

PREPARATION OF CANE SUGAR

1. The first step involves extraction of the juice by crushing sugar cane in iron roller mills. It extracts 75% of the juice and leaves behind the cellulose residue.

2. The sugar cane juice thus extracted in then purified by heating with lime (CaO). This way most of the impurities are collected as scum at the top and removed.

3. Now SO_2 and CO_2 are passed one by one when calcium is precipitated as $CaSO_4$ and $CaCO_3$. Filter the juice to remove the precipitate.

4. The filtrate is now concentrated and crystallized by boiling under reduced pessure and then allowing crystallizing after cooling.

5. After cooling, centrifuge the solution to separate the crystals from the mother liquor.

6. Finally, dry the crystals by dropping them through a hot air chamber.

USES OF CANE SUGAR –

1. Preparation of tablets, globules, and pellets.

2. Preparation of simple syrup.

3. Rarely as a vehicle for trituration.

GLOBULES AND PILULES

Source Globules are made from:

i. Pure Cane Sugar and Sucrose: Most used.
ii. . Milk Sugar: To a very limited extent.

PREPARATION OF GLOBULES -

1. Globules or pilules are made by a ***mechanically rotating stainless steel globule-making pan or pill-tube,*** containing granulated cane sugar, which has been properly moistened with purified water or Syrup simplex and then coated with a thin layer of super-finely crushed cane sugar (of not less than 300 mesh).

2. The pan is rotated till the granules become spherical. The more the quantity of crushed sugar added (with the requisite binding water or syrup), the bigger will be the globules or pilules in size.

3. As they come into proper sizes, they are transferred into drying chambers for drying.

4. On drying properly, they are removed from hot chambers and are made to pass through a sieve-screen, which has various sizes of meshes.

MEASUREMENT OF GLOBULES –

Requirements –

- measuring scale
- Equal size of globules
- A sheet of paper
- Gum
- Pen and paper

PROCEDURE –

- Firstly, the paper sheet is fold and marks the line in the paper**.**
- Then a scale will attach along with the help of gum.
- Then globules are attached and pest on the scale with the help of gum.
- Ten globules are attached along with the scale.
- These globules attaching process repeat three times and average marks noted.

No.	Area covered by globules in mm

according to their sizes and designated by numbers like, 5, 10, 15, 20, 25, 30, 40, 50, 60, 70 and 80.

Pilules: Commonly used sizes of globules are 10, 15, 20, 25, 30 and 40. Globules of size 40, 60, 70 and 80 number are generally called pilules.

CHARACTERISTICS OF GLOBULES PILULES

1. Shape: Globules or pilules are round.

2. Consistency: They are neither too hard nor too soft. They are somewhat soft when freshly prepared but become harder with age.

3. Color: white in color.

4. Odor: odorless.

5. Solubility: easily soluble in water, but insoluble in alcohol.

6. Taste: Usually being made of cane sugar, they are sweeter than milk sugar.

7. Size: The sizes of globules very from 8 to 80.

8. Melting Point: It melts at 160ºC and further melting it decomposes.

TEST OF PURITY OF GLOBULES

- As they are made of cane sugar, they are sweet to taste.
- Concentrated sulphuric acid gradually decomposes and chars then; the charred massfroths up.
- Concentrated nitric acid converts them to oxalic acid.
- They do not react with aldehydes or ketones.
- They are not easily fermented by yeast.
- If copper comes in contact with the globules during preparation in a copper pan, a reddish-brown precipitate will occur on addition of potassium ferro-cyanide solution.

USES

- They are frequently used by the physicians for dispensing and administering remedies.
- As they can retain the medicinal property for a longer period; hence, they are utilised for preserving medicines.
- Hahnemann holds that if carefully kept, they can be preserved for years together.

PRESERVATION

a. Globules should be stored in air-tight vessels or bottles, as they absorb moisture from the air or from humid weather.

b. After medication, globules should be dried before storing, otherwise globules will be

dissolved.

MEDICATION OF GLOBULES

There are two methods medication of globules.

1. **On a large scales**
2. **On small scales**

1. ON A LARGE SCALE

1. Take as many globules as can be put in a clean porcelain bowl, keeping the upper one third or more of it vacant.

2. In order to moisten the globules thoroughly, pour a sufficient quantity of the requisite medicine over them and allow 1-2 minutes for the globules to be soaked.

3. To drain the excess quantity of medicine, the medicated globules are then put on a dry, clean filter paper.

4. On drying, the globules are kept in a phial duly marked with the name and potency of the medicine, and now they are ready for use.

ON SMALL SCALE/ AN EMERGENCY

1. An absolutely clean, dry vial or phial with a new, non-porous velvet cork is taken.

2. Label it with the name and potency of medicine.

3. The vial or phial is filled with globules up to 2/3rd of its space.

4. The requisite quantity of a liquid medicine is poured upon the globules to moisten them

uniformly.

5. The phial is then kept inverted upon the cork for at least an hour, preferably 6 hours.

6. Next, the excess medicine is drained out carefully by loosening the cork a little.

7. The cork is again closed.

8. Within a day or two, the globules will be perfectly dry and then they are ready for use.

Hahnemann's Method of Medication

In Chronic Diseases, Vol. I, page 187, Hahnemann directs: "The globules are poured into a clean porcelain bowl, rather deep than broad, and enough of the required potency dropped upon them to moisten completely every globule in the space of one minute.

The contents of the bowl are then emptied on a piece of clean, dry filtering paper, so that any excess liquid may be absorbed, and the globules are spread out so that they may soon dry.

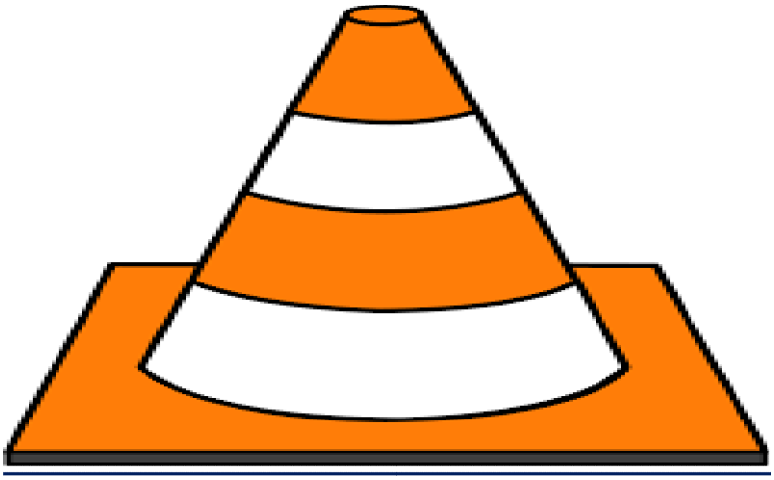
Caution

Do not medicate globules or pilules with the attenuations prepared with 'dilute alcohol', because, such medicated globules or pilules may melt away by the water contained in the dilute alcohol used.

PELLETS

It is a small sphere and made of cane sugar,

CONES



Prepared from Cane sugar and egg albumin

Characteristics:

1. Shape: conical or semi globular.
2. Size: determined by base diameters in mm. commonly size used in homeopathy is no. 6.
3. Harder than globules
4. Absorb less quantity of medicines than globules

USES:

they are used for preserving very highly potentised medicines for long time.

PRESERVATION:

kept in dry palace to prevent fermentation due to dampness.

ADVANTAGES

1. Harder so absorb less quantity of medicines
2. Administration of small doses
3. They do not absorb atmospheric moisture as readily as the globules do and hence they remain intact for a long time.

TABLETS

Tablets are unit forms of solid medicinal substances with or without suitable diluents prepared by composing or moulding.

Source: these are prepared from pure refined Sugar of Milk

Characteristics:

1. Shape: discoid, round but flat,
2. White colored
3. Size: 1 grain or 65 mg
4. Softer than globules since made up of sugar of milk
5. Easily soluble in water, insoluble in alcohol

LIQUID VEHICLES

These are used for substances easily soluble in liquids. Solid trituration are converted into liquid potency using these vehicles, principally alcohol, as alcohol has a preservative virtue for keeping it for a longer period.

In homoeopathy, liquid vehicles are:

• Aqua distillata.

• Alcohol.

• Glycerine.

• Olive oil.

• Almond oil

PURIFIED WATER/ AQUA DISTILLATA.

It is a very good solvent, having a physiological inertness, and it is one of the most important vehicles in homoeopathic pharmacy.

SYNONYMS

• Distilled water.

• Purified water.

• Aqua purificata.

Chemical Formula-H2 O

Molecular Weight-18

Boiling Point-100o C

Freezing Point-0o

Critical Temperature-374.2o C.

pH- Neutral

PREPARATION OF PURIFIED WATER

The method of preparation depends upon the amount of purified water required.

1. For small quantities:

a. Distillation process.

b. Deionisation process.

2. For large quantities: By an automatic water distillator.

DISTILLATION PROCESS –

Aim: To study distillation process for purified water in laboratory of homeopathic pharmacy.

Requirement:

- Liebig' condenser
- Bunsen burner
- tripod stand
- wire gauge
- distilling flask
- receiving flask
- beaker
- thermometer.

Definition:

distillation is a process of purification of liquid substance firstly by converting it at its boiling point into its vapour state by application of heat or by reduction of pressure – this is known as vaporisation and then converting the solid vapour into the former liquid state by cooling, which is known as condensation and the liquid collected in receiver- called distillate.

PROCESS OF DISTILLATION:

(a) **Apparatus**:

1) Liebig' condenser – this condenser is the two chambered vessel having a central tube jacketed by a water tube has two side tubes near the ends. The lower side tube is attached with a water tap by means of a rubber tube. When the tap is opened, water enters into the jacket tube, cools the central tube and comes out through the second side tube at the upper side.
2) Flask- 2 in numbers; one distilling flask and one receiving flask.
3) Bunsen burner.
4) Tripod stand

PROCEDURE

I. The water to distillated is taken in a round- bottomed distilling flask. This distilling flask has side tube at the top. This side tube is connected by means of a board cork to one end of the liebig' condenser and the other end of the condenser is inserted into vessel, called the receiver, to collect the distillate.

II. The mouth of the distilling flask is closed with a rubber cork and a thermometer is inserted into the cork for noting the temperature of issuing vapors.

III. The distilling flask is placed on a tripod stand over a wire gauge and kept in position with the help of a clamp and a stand.

IV. Water in the distilling flask is heated. When the boiling point of water is reached, its vapors are produced which come out of the side tube of the flask and pass through the condenser, where they cool down and condense to water and collect in receiver.

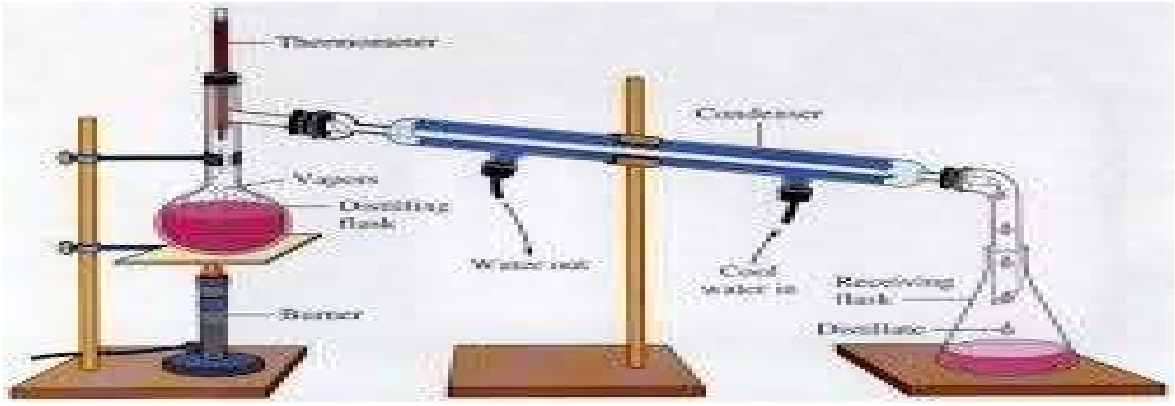


FIG – DISTILLATION PROCESS

DEIONIZATION PROCESS-

- *known as dematerialized water*
- water has almost all minerals and ions such as sodium, calcium, iron,(cations) and copper, chloride and sulfate(anions)

ION EXCHANGE RESINS

There are two basic types of resin - cation-exchange and anion-exchange resins. Cation exchange resins will release Hydrogen (H+) ions or other positively charged ions in exchange for impurity cations present in the Water. Anion exchange resins will release hydroxyl (OH-) ions or other negatively charged ions in exchange for impurity anions present in the Water.

first, cation-exchange resins alone can be employed to soften Water by base exchange; secondly, anion-exchange resins alone can be used for organic scavenging or nitrate removal; and thirdly, combinations of cations-exchange and anion-exchange resins can be used to remove virtually all the ionic impurities present in the feed Water, a process known as deionization. Water deionizers purification process results in Water of exceptionally high quality.

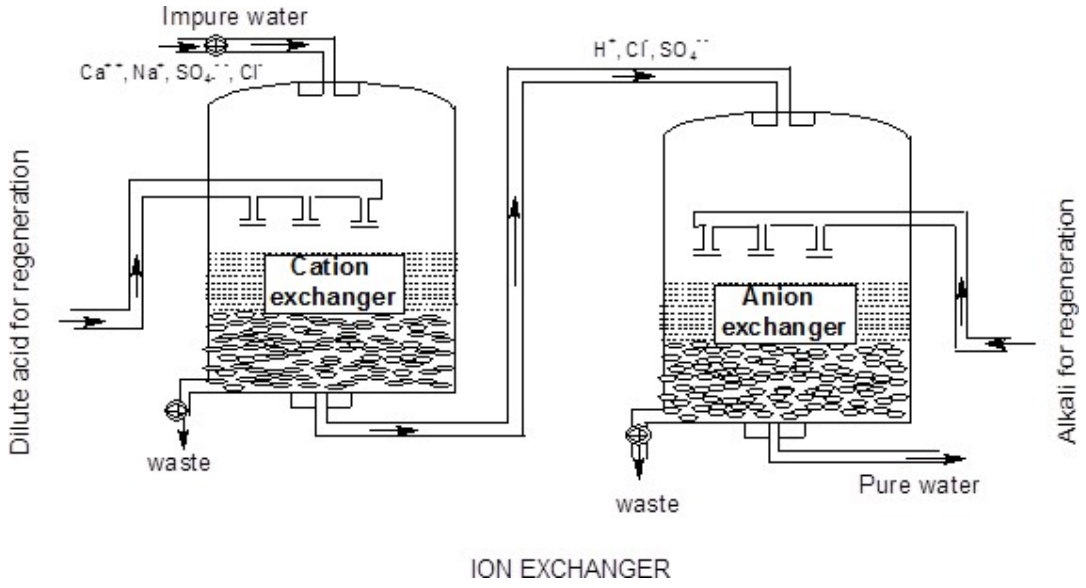


FIG- 2 ION EXCHANGER

PROCEDURE:

1. Impure water containing salts like calcium, magnesium, etc. is passed through columns containing a cation exchanger.

2. As the impure water passes through, all the metallic ions including alkali metal ions are replaced by hydrogen ions. Hence, an equivalent amount of acid is formed to the corresponding anions of the metal salts.

Reaction of chlorides and sulphates of metals is as follows:

CaCl2 + 2HR R2 Ca + 2HCl MgSO4 + 2HR R2 Mg + H2 SO4

where **HR** is the cation exchanger.

3. The water so obtained is entirely free from metal ions but is acidic and is hence not suitable for most purposes.

4. This acidic water is now passed through a column containing an anion exchanger to replace the anions of the acids with hydroxyl groups, forming water.

The reaction taking place is:

HCl + RNOH RNCl + H2 O H2 SO4 + 2RNOH (RN)2 SO4 + 2H2 O

Where **RNOH** is the anion exchanger.

This passage of impure water through the cation and anion exchangers one after the other produces pure water free from ions. This pure water is called deionised or de-mineralised water. It is as good as purified water for all purposes.

AUTOMATIC WATER DISTILLATOR

Water is purified by this process for large scale commercial purposes. A stainless steel vessel known as 'still' is used .

Here, the distillation and cooling are done by the same water.

- Uses for commercial purpose
- Automatic water distillator and stainless-steel vessel known as still is used.
- In this process distillation and cooling done by same water.
- A portion of cooling water will go through some holes into heating chamber.
- Steam will be produced here which will pass into the inner chamber through the special passage at the top and come down for cooling purpose.
- Cooling water exit through an overflow.

FIG- 3 AUTOMATIC WATER DISTLLATOR

PROPERTIES OF DISTILL WATER-

- it is neutral
- pH does not vary more than 6 to 7.
- Specific gravity at 25 degree C: 1:000.
- Freezing point: 0 degree C
- Boling point- 100 degree C
- It is clear, colorless liquid, tasteless and odorless.
- It is nonconductor of electricity due to its negligible ionization into hydrogen and hydroxyl ions.
- Water easily forms crystalline hydrate with many compounds like CuS04.5H2O
- It is good ionizing solvent for acid, base, and salts
- It is amphiprotic solvent.

IMPURITIES-

1. Insoluble substance:
    - clay,
    - sand
    - vegetable matters
2. Soluble substance

    a) nonvolatile substance: chlorides, carbonates sulphate of Na, K, Ca , Mg, Fe.

    b) volatile substance: air CO2, H2S etc.

TEST FOR PURITY-

Physical properties:

- Clear colorless, odorless, and tasteless
- No changes with litmus paper
- Purified water leaves no residue on evaporation.
- Copper sulphate powder reacts with water to form blue color
- Potassium reacts with water to form hydrogen.
- Purified water must be free from chlorides, sulphate, and ammonia etc. which can be tested by various experiments.

TEST –

S.N.	TEST	REAGENT ADDED	ORDINARY OR TAP WATER	PURIFIED WATER
1	Chloride	Silver nitrate soln. + dilute nitric acid	White turbidity	Nil
2	Calcium	Ammonium oxalate soln.+ dilute Acetic acid	White turbidity	Nil
3	Sulphate	Barium chloride soln. dilute HCL	White turbidity	Nil
4	Ammonia	Nesslers reagent	brown color or ppt	Nil

TABLE – 1 TEST OF PURITY OF WATER

USES-

- Uses for final cleansing of utensils or apparatus
- Used for preparation of mother solution of drug substance which are insoluble in alcohol. e.g. carbonates nat. mur.
- Used for preparing reagents and in analytical purpose
- For external application
- For preparing potencies
- For dispensing medicines
- Uses in rectal vaginal douches
- Used for injection
- For preparing different qualities of weaker alcohol like strong alcohol , dispensing alcohol.

STORAGE/ PRESERVATION-

- Purified water should be stored in Pyrex glass bottles

DEMERITS-

- The medicine dispensing with purified water cannot be preserved for long period as aqueous solution are unstable.

ALCOHOL

The term 'alcohol' originates from Arab. It applies to the Arab word 'al-kohl', a black antimony sulphide preparation used for decorating eyebrows and eyelashes in ancient days.

The generic term 'alcohol, in chemistry is used to designate an important class of organic compounds which are hydroxy derivatives of aliphatic hydrocarbons. The hydrocarbon replaces one hydrogen atom (but not molecule) by a hydroxyl group OH).

According to the number of 'OH' groups present, the corresponding alcohols are called as mono-hydric, di-hydric, tri-hydric, tetrahydric alcohol, etc.

Monohydric alcohol-

- Formula – $C_nH_{2n+1}OH$ or R-OH
- Further classification is according to –OH groups is attached to primary, secondary and tertiary carbon atoms

a. Primary alcohol-

- Contains CH_2OH group.
- Formula – $R.CH_2OH$.
- Example- methyl alcohol ($H-CH_2OH$)
  Ethyl alcohol (CH_3-CH_2OH)

b. Secondary alcohol

- Contains > CHOH group
- $CH_3CHOHCH_2CH_3$
- (SEC-BUTYL Alcohol)

c. Tertiary alcohol –

- it contain three carbon groups
- T-butyl alcohol — $(CH_3)_3COH$

Di hydric alcohol

- a class of alcohols having 2 hydroxyl groups in each molecule
- e.g. -(ethylene glycol.)

Tri hydric alcohol

- An alcohol containing three hydroxyl groups, such as glycerol.

ETHYL ALCOHOL

- Known as ethanol, sprit of wine, grain alcohol,
- Most commonly used.
- Chemical formula- C_2H_5OH

SOURCES OF ETHYL ALCOHOL-

- Molasses, a waste product from sugar factories.
- Starchy substance like potato, wheat, maize, rice etc.
- Substance rich in sugar. Like beetroot, carrot, grapes , sugarcane.
- From beet sugar, cane sugar
- Synthetically from hydrocarbon ethylene

PREPARATIONOF ETHYL ALCOHOL –

there are two methods of preparation of ethyl alcohol.

- **From molasses**
- **From starch containing substances**

FROM MOLASSES-

- Molasses is mother liquor left after crystallization of cane sugar from cane juice.
- It contains 50%- 60% sugar.
- It is a dark, thick liquid.
- In India is chief source of alcohol.

Steps

- Preparation of wash
- Fractional distillation of wash

PREPARATION OF WASH-

- Molasses is diluted with water to prepare 10% solution of sugar
- a small quantity of nitrogen source (e.g., ammonium phosphate, urea, ammonium sulphate) and sulphuric acid (H_2SO_4) is added in it. pH of this medium is maintained at about 5.0.
- It is work as food for the ferment.
- It warmed/ heated at 25-30 degree C. and yeast ferment added to the molasses.
- It is kept for 2-3 days.
- Fermentation starts and release of CO2 .
- Enzyme invertase and zymase present in yeast.
- Invertase converts molasses into glucose and fructose.

Invertase

Sucrose ⟶ **glucose + fructose**

- Another enzyme like zymase converts glucose into ethyl alcohol.
- Glucose ⟶ zymase ⟶ ethyl alcohol + CO2
- This liquor is known as 'wash'.
- It is contains 6-12% of ethyl alcohol.

FRACTIONAL DISTILLATION OF WASH-

- Wash now goes under fractional distillation in coffee' still, which is a special type of fractionating column.
- Vapors almost pure alcohol. From the head of the fractionating column are lead to the condenser.
- The distillate obtain is known as crude rectified spirit
- It contains about 95% v/v or 92% w/w of ethyl alcohol.

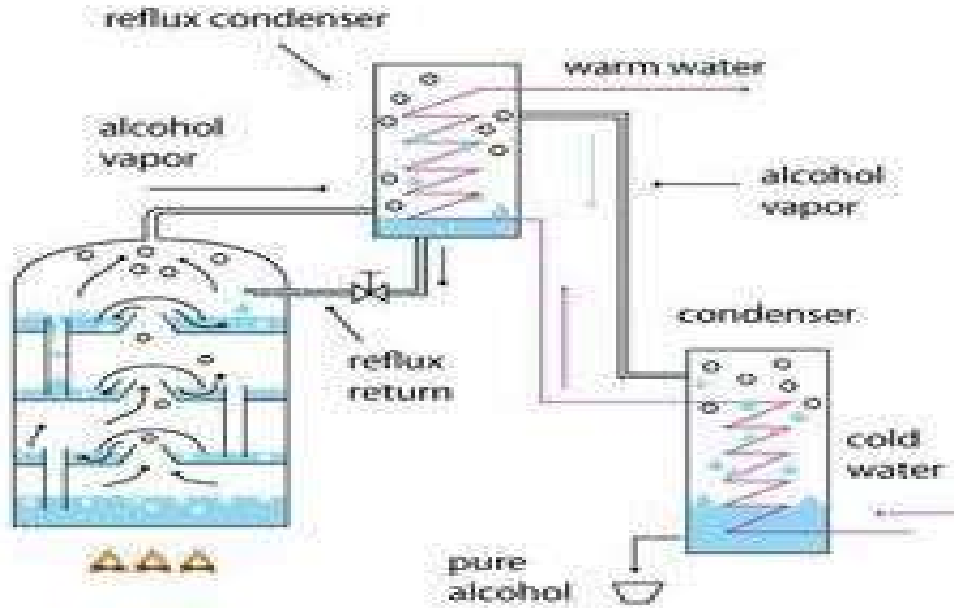


FIG- 2 FRACTIONAL DISTILLATION

FROM STARCH CONTAINING SUBSTANCES-

- This process includes the saccharification of starch to maltose followed by alcoholic fermentation leading to production of ethyl alcohol.
- Starch-(saccharification) - maltose
- Maltose - (alcoholic fermentation)- ethyl alcohol

a. saccharification

- It is conversion of starch into maltose.
- It includes various steps as follows-

I. Preparation
II. Malting
III. Mashing
IV. Hydrolysis

I. Preparation-

- Starchy materials are reduced to a pulp or paste with water.
- Mixed with a little amount of malt.
- Moist barley is allowed to germinate in dark at low temp.
- Then heated and dried.

II. Malting-

- Moist barley is allowed to germinate in dark at low temp. Germinated barley is called Malt and this is heated to (to stop further germination).
- It is then crushed and extracted with water. This Malt extract contains the enzyme diastase.

III. Mashing-

- Starch is reacted with superheated steam (under pressure). This exposes the starch inside that forms a paste like mass called Mash.

IV. Hydrolysis-

The mixture or mash is kept at 50 degree C about 30- 60 minutes.

Fermentation starts and diastase converts into maltase.

ALCOHOLIC FERMENTATION-

solution of maltose is mixed with yeast at 30-35 degree C and kept for 3-4

Yeast secrets two enzymes:

1. Maltase: converts maltose into glucose.

2. Zymase: converts glucose into ethanol

PROCEDURE:

- The maltose solution is cooled to about 25ºC-30ºC and mixed with yeast.
- This mixture is kept for 3-4 days within which time maltose is converted to glucose by the action of enzyme maltase contained in the yeast.
- Glucose now undergoes alcoholic fermentation and is converted into C2 H5 OH and CO2 by enzyme zymase, present in yeast.
- The ethyl alcohol obtained is a 15% solution and is known as ‘wash’.

b. Fractional Distillation

- The 'wash' is subjected to fractional distillation in 'Coffey's Still', a special type of fractionating column. Here, the vapors of almost pure alcohol are obtained from the head of the column and then led into a condenser.
- The alcohol so obtained is 95% v/v or 92% w/v of C2 H5 OH.
- It is commercially known as 'rectified spirit'.
- In homoeopathy, where ever alcohol is mentioned, it is this alcohol of 95% v/v.
- It is also known as:
    - Alcohol fortis.
    - Strong alcohol. Before using in homoeopathic preparations, it should be further rectified.

PROPERTIES OF ALCOHOL-

- A clear, colorless, mobile and volatile liquid.
- Odor characteristic and spirituous
- Taste burning like
- Boils at about 78 degree C, but volatize even at low temp.
- It is highly inflammable, burning with a blue smokeless flame.
- It is freeze at – 114 degree C. So it is used in 'alcohol thermometer' for measuring low temp.
- In small doses, alcohol is stimulant but in excess a poison.
- It mix with water in all proportions, with evolution of heat and contraction in volume
- It is neutral to all indicators when it is pure.

IMPURITIES-

Types

• Fusel oil: The most common impurity.

• Acids: Like succinic acid.

• Water.

• Inferior quality of alcohol.

• Aldehydes and ketones: Like acetaldehyde, etc.

TABLE OF TEST OF PURITY -

S.N.	EXPERIMENTS	OBSERVATION	RESULTS
1	1.sample of alcohol + equal amount of conc. H_2SO_4	Red or brown color appear appears	Fusel oil is present
2	add few drops of AgNO3 solution to a small quantity of alcohol and expose the mixture to bright sunlight.	A reddish color appears	Fusel oil is present
3	. Blue litmus paper is soaked with the alcohol sample	Litmus turns red.	Acid is present
4	Add white anhydrous copper sulphate to given sample	The powder turns blue	Water is present

ADVANTAGE-

- Commercial preparation of alcohol is cheap and simple , because of it is prepared from waste product like molasses
- Alcohols are good solvent and dissolve many organic compounds.
- It is edible in small amounts
- It is neither easily decomposed nor it is spoiled by long storage .
- It has great power of extracting medicinal portions from mother drug and mucilaginous substance.
- It is used as preserver of plant and animal tissue at 70% strength.

- It is soluble in water in all proportions.
- It is neutral neither acidic nor alkaline.

DISADVANTAGE-

- It is highly inflammable and can easily take fire.
- It evaporates too easily, so must be stored in air tight bottles.
- It is poisonous if large doses taken.
- It can not dissolve many inorganic salts, aluminous substance, and starch.

USES-

- It is immediately added to the juice of plant in a fresh state, to prevent fermentation and decomposition.
- For preparing mother tincture from crude drug materials.
- For preparing dilution and higher potencies and also for medicating purpose of globules.
- It is good solvent so is used for preparing medicines from gums, resins, resinoids, alkaloids, and many volatile oils.
- It is used for preparing tincture of chloroform, ether, iodoform which are used in homeopathy.
- It works as an antiseptic, at a strength of above 10%

PRECAUTIONS IN PRESERVING OR USING ALCOHOL-

- As it evaporates easily and absorbs moisture from the atmosphere or air, it must be stored in a dry place in air tight, well closed bottles.
- Bottles for storing alcohol should preferably be made of Pyrex glass.
- Alkaline bottles should not be used for strong alcohol.
- It is highly inflammable; it should be kept in a cool place remote from fire.

THE FOOD VALUE OF ALCOHOL

Within limits, alcohol is a food. It is readily metabolized. It requires no digestive process prior to metabolism and it is rapidly absorbed from the upper portion of the gastrointestinal tract. Alcohol does not serve as a reserve food like glucose. It is not stored in the liver.

Metabolism of alcohol within limit serves as a substitute nutrient for carbohydrate, 'protein or fat'. Alcohol supplies 7 calories per gm.; as such a pint of whisky will supply approximately 1400 calories.

THE PHARMACOLOGICAL RESPONSE TO ALCOHOL THE CENTRAL NERVOUS SYSTEM:

When alcohol is injected by the intravenous method, ethanol rapidly penetrates into the brain. The level of ethanol was greater in the grey matter than the white matter. The acute effect of alcohol on the central nervous system is limited to the brain.

Chronic alcoholism may produce myelitis, encephalitis and polyneuritis. 30 to 60 ml. of alcohol exerts an effect upon the ascending reticular formation, and directly or indirectly upon the inhibitory centres in the cerebral cortex. The most usual manifestation of its action appears sequential to the depression of the inhibitory centres. In large doses the depressant action extends to the centres of respiration in the medulla.

ALCOHOL KILLS BY RESPIRATORY PARALYSIS:

The depression of the cerebral inhibitory centres is manifested in a typical behavioral pattern: Speech becomes loud and slurred, mistakes in loquacity for eloquence. Self criticism is diminished and sensitivity to the criticism of others is often lost.

Alcohol has a false reputation of being a stimulant. Affect of Alcohol on the Skin: Alcohol 95% has a cooling but dehydrating action when applied to intact skin. The most suitable concentration of alcohol for external application is 70%. This is not dehydrating.

Alcohol dissolves the sebum from the skin and acts as an excellent solvent for germicides. Rubbing with alcohol is beneficial in reducing the incidence of bed sores during protracted illness. Alcohol has an effect on bacteria also. It is widely employed locally because of its 'germicidal' powers.

Numerous tests have shown that 70% alcohol is more effective for this purpose than undiluted alcohol. This is due to the better penetrating power of 70% alcohol into the bacterial cell; undiluted alcohol coagulates the peripheral cytoplasm which thwarts its further penetration. However, it cannot be relied upon to kill bacterial spores.

As such, alcohol cannot be wholly depended upon as a 'good germicide'. For insulin and other repeated injections 'isoprophyl alcohol' or a mixture of alcohol and isopropyl alcohol is a more reliable germicide than alcohol.

VARIETIES OF ALCOHOL

1. Absolute alcohol.

2. Strong alcohol.

3. Dilute alcohol.

4. Dispensing alcohol.

5. Rectified spirit.

ABSOLUTE ALCOHOL

SYNONYMS –

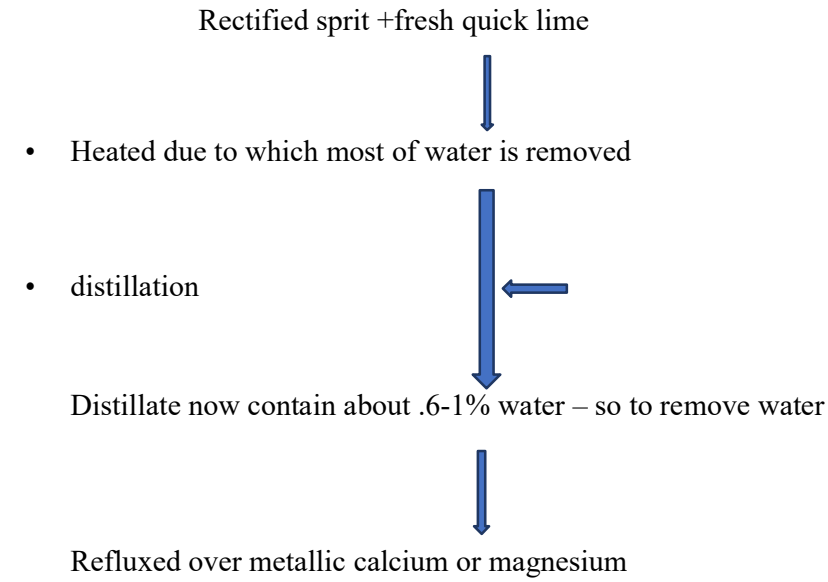
- anhydrous alcohol
- Alcohol dehydrated

This alcohol containing no trace or water, or an anhydrous alcohol is known as absolute alcohol.Theoretically it means 100% of ethyl alcohol by volume (v/v) or by weight (w/w), but it is practically too difficult to get such as alcohol. It is most powerful hygroscopic agent. So practical purpose, alcohol containing at least 99.4% by v/v 99.0% by w/w of pure alcohol may be taken as an absolute alcohol.

PREPARATION OF ABSOLUTE ALCOHOL-

A. small scale production-

- thoroughly mix rectified spirit with fresh quick lime and keep in an air tight , dry vessel
- Heat it to remove most of water.
- distill this mixture. This distillate now contains .6-1% water.
- To remove these few traces of water, the above distillate is refluxed over metallic calcium or magnesium.
- Now redistillation is carried out in a glass apparatus.
- the first and last portions of redistillation are rejected.
- The middle portion is collected which is pure and unmixed.
- If required, this process may have to be repeated till the desired product be obtained.



LARGE SCALE PRODUCTION

- Rectified spirit is mixed with a little benzene.
- Distill the above mixture. The distillate will contain:

a. first portion : mixture of benzene, alcohol and water.

Benzene: 74.1%
Alcohol : 18.5%
Water : 7.4%
boiling point: 64.8 degree C

b. Second portion : mixture of benzene and alcohol.
Benzene: 67.6%

Alcohol: 32.4%
Boiling point: 68.2 degree C

c. Final portion: it is pure anhydrous alcohol known as absolute alcohol.
Boiling point: 78.5 degree C.

TEST FOR PURITY-

- 10 ML of alcohol sample is taken in a test tube and thoroughly shaken with 0.5 gm anhydrous copper sulphate.
- Observation – a blue solution is obtained
- Result water is present.

USES:

it is used in stapf process for the purification of sugar of milk.

DIFFERENCE BETWEEN ABSOLUTE ALCOHOL AND HOMEOPATHIC ALCOHOL

S.N.	ABSOLUTE ALCOHOL	HOMEOPATHIC ALCOHOL
1	Theoretically 100% strength. Practically 95% is the highest.	87% strength
2	Used in making of homoeopathic. attenuations	For purification of milk sugarby Stapf process.

STRONG ALCOHOL

In homoeopathy, whenever the word 'alcohol' is used, it means 'strong alcohol', which contains 95% by volume of pure alcohol and is obtained after second distillation.

SYNONYMS-

- Alcohol Fortis
- Anhydrous Fotier

PREPARATION-

- It is prepared by mixing of 94.9% by volume of pure ethyl alcohol and 5.1% byvolume of purified water.
- It can be diluted to any extent with purified water.
- It contains not less than 94.7% v/v or 92.0% w/w and not more than 95.2%. v/v or 92.7% w/ w of C2 H5 OH.

PROPERTIES OF STRONG ALCOHOL-

- Colorless, transparent. Mobile, volatile
- Pleasing aroma odor
- Burning like taste
- It is miscible with purified water, acetone, chloroform, ether, and many organic solvents.
- It is neutral to all indictors.

IMPURITIES OF STRONG ALCOHOL –

- Iodoform
- Acids
- alkaline
- Aldehydes
- Ketones
- Fusel oils
- Non volatile matter

S.N.	Experiments	Observation	Results

1	20 ml of sample of alcohol + 0.1 ml HCL	A red colored appears with methylene red solution	The solution is acidic
2	20 ml of sample of alcohol + 0.2 ml of N/10 NAOH	A pink color appears with phenolphthalein	The solution is alkaline
3	2-3 ml sample of alcohol is taken in test tube . An equal volume of strong iodine solution in potassium iodide (KI) added. Gently warm this mixture and then NAOH add drop by drop till the color turns pale yellow Cool the test tube.	A yellow precipitate of iodoform separate out.	Iodoform is present.
4	10 ml the alcohol sample and add 5 ml of NAOH . Shake and allow to stand for 5 min.	A yellow is produced	Aldehydes is present
5	1 ml of the sample alcohol and add 3 ml of water and 10 ml solution of mercuric sulphate. Heat on a boiling water bath.	A precipitate is produced in 3 min.	Ketones are present
6	Dilute 5 ml to 100 ml with water in a glass cylinder.	The solution is not clear when examined against a black background	Oilyresinous substance are present in given sample

USES OF STRONG ALCOHOL –

- It is used for preparation of mother tincture from vegetable and animal substance under Hahnemann old method as well as in new method.
- For preparation of mother solution as in class 6 under old method, where the drug substance is soluble in alcohol.
- for preparation of absolute alcohol , dilute alcohol and dispensing alcohol.

STORAGE-

- It should be kept in well stoppered glass bottles, in a cool dark place, away from fire.

DILUTE ALCOHOL

Different authorities differ as regards the specification of dilute alcohol.

- **As per H.P.I. (Vol.1):** Dilute alcohol (66%) contains 62.5% v/v or 60.6% w/w of alcohol. Dilute 695 ml of strong alcohol to 1000ml with purified water
- **As per B.H.P.:** it consists of equal quantity of rectified spirit, 60 o.p and purified water.
- **As per M. Bhattacharya's pharmacopeia:** 7 parts in volume of rectified spirit 60 o.p is added to 3 parts in volume of purified water.
- **As per Drs. Buchner, Gruner, Jahr , J. Hampl** : it prepared by adding equal parts in volume of alcohol and purified water.
- **As per dr. Dewey** : it is prepared by adding 7 parts of 87% alcohol with 3 parts of purified water.

USES : -

- for preparation of potencies. Specially under decimal scale.
- For cleansing of utensils.

DISPENSING ALCOHOL

Synonyms : alcohol officinalis, official alcohol .

- It contains 88% by volume or 83.1% by weight of ethyl alcohol and 12% by volume of purified water.

preparation:

- it is prepared by mixing of strong alcohol and 1 part by weight of purified water.
- 12.25 parts by volume of strong alcohol and 1 part by volume of purified water.

Uses:

it is used for preparing most of dilution as it is more easily absorb by globules or tablets or sugar of milk.

RECTIFIED SPIRIT (60 DEGREE O.P.)-

Definition:

Rectified spirit 60 degree o.p. means that 100 volume of the alcohol, diluted with purified water, will give 160 volumes of proof spirit. In other words, it means pure rectified spirit contain 91.29% by volume of ethyl alcohol having specific gravity at 15.6 degree c

Preparation :

- it is prepared by mixing 375 ml of purified water with 1000 ml of strong alcohol.

Uses:

- It is used for making potencies under the centesimal scale.
- used for cleansing utensils.

RECTIFIED SPIRIT: 40 O.P.-

- It is prepared by mixing 7 parts of strong alcohol with one part of purified water, both by volume.
- It contains 73.37% by weight of strong alcohol.
- Density: 0.8640

RECTIFIED SPIRIT: 20 0.P-

- It is prepared by mixing 6 parts of strong alcohol with two parts of purified water, both by volume.
- It contains 60.85% by weight of strong alcohol.

PROOF SPIRIT-

- Proof spirit is a mixture of alcohol and purified (distillated) water, weighing 12/13th of an equal volume of purified water at 10.6º C

- Strength: It contains 57.1% by volume or 49.28% by weight of ethyl alcohol and 42.9% by volume of water.
- Specific Gravity: 0.91976 at 15.6º C or 60º F.

Expression of Proof Spirit:

It is expressed in terms of degrees:

1. Under proof (U.P.).
2. Over proof (O.P.).

1. UNDER PROOF (U.P.):

- Alcohol weaker in strength than proof spirit is known as under proof. For e.g.: 60 U.P.: Means that 100 parts of this alcohol contains 40 parts (by volume) of proof spirit '40' is arrived at by subtracting from 100 the respective U.P. strength i.e. 100-60=40, of the said alcohol.
- 30 U.P.: Means that 100 parts of this alcohol contains 70 parts (by volume) of proof spirit.

OVER PROOF (O.P.)-

- Alcohol stronger in strength than proof spirit
- is called over proof. For e.g.: 60 O.P.: Means that in 100 parts of this alcohol if 60 parts of purified water is added, then 160 parts of proof will be obtained (all by volume).
- 30 O.P.: Means that in 100 parts of this alcohol if 30 parts of purified water is added, then 130 parts of proof will be obtained (all by volume).

IMPORTANCE:

- It helps to decide whether any liquid is stronger or weaker.
- To check the misuse of alcohol and to fetch money for the respective government, alcohol is dutiable item in every country. As such, for the purpose of levying excise duty on alcohol, it is required to ascertain the exact proof strength of the respective alcohols.

DETERMINATION OF PROOF STRENGTH OF ALCOHOL:

- In the past, when there was no appropriate apparatus or method to ascertain the exact strength of an alcohol, some crude method was employed.
- Some amount of the alcohol (to be tested) is poured upon some gunpowder and is ignited. If it does not catch fire, it was inferred that there is much water in the alcohol, and if it would easily take fire, then the alcohol did not contain much water.
- Now, with the aid of specially made 'hydrometers'
- we can easily determine the respective strength or percentage of any alcohol.
- There are other standard methods by which also the respective strength of alcohols can be determined accurately.
- For convenience, the Excise authority uses a special type of hydrometer, constructed in such a way, so that the respective proof strength of any particular alcohol can be determined easily.
- In practice, the hydrometer is immersed in the respective alcohol and the corresponding indication on the scale of the hydrometer is noted, as well as the respective temperature of the alcohol is noted. Out of these two data's, the corresponding proof strength of that alcohol is directly found out for from a special chart, provided for this purpose.

CONVERT RECTIFIED SPIRIT TO ABSOLUTE ALCOHOL:

- For this, initially two procedures are followed simultaneously.

1. In one instance, • 1½ ounces of K_2CO_3 or potassium carbonate is taken in a glass stoppered bottle. 1 pint of rectified spirit 60 O.P. is added to it.

- Keep this mixture in a well stoppered bottle for two days, shake it every now and then. Let us call this spirit I.

2. In the other instance: • 10 ounces of slaked lime, $Ca(OH)_2$ is taken in a crucible which is then covered.

- Heat it for 30 minutes, minimum.
- Let it cool.
- When absolutely cool, transfer the contents to a big flask.

3. 'Spirit I' is now very carefully decanted to the same flask containing slaked lime.

- Don't let the precipitate come into the flask.

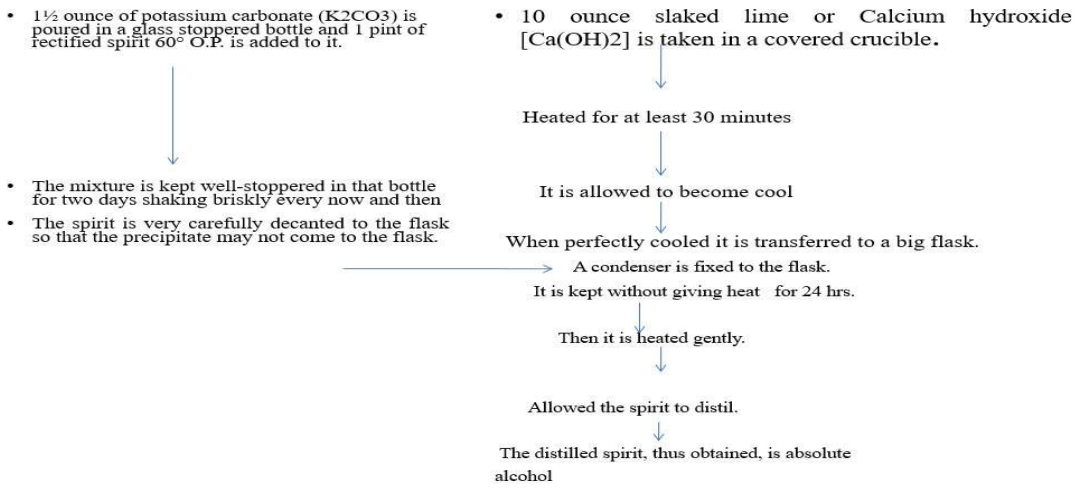
4. A condenser is fixed to the flask.

5. The mixture is kept in the flask for 24 hours without heating.

6. After 24 hours, heat it gently.

7. Now allow the spirit to distil.

    - This spirit obtained after distillation is absolute alcohol.



GLYCERINE

It is a trihydric alcohol, containing not less than 98% of C3 H8 O3 (H.P.I.). It is the common constituent of all animal and vegetable oils and fats, e.g., coconut oil, olive oil, tallow, cod-liver oil, etc.

In small quantities it is formed during alcoholic fermentation of sugars and is present in minute amounts in normal blood.

Synonym-

- Glycerol

Chemical Formula

- CH2OH. CHOH or CH2OH or C3H5 (OH)3

Molecular Weight- 92.1

Specific Gravity- 1.255 to 1.266 at 20°C

Boiling point- 290 °C

PREPARATION OF GLYCERINE –

- It can be prepared from molasses by the fermentation process.
- Can be prepared synthetically.
- From spent soap lyes—the lye contains some glycerine, much water, free alkali, sodium chloride, fatty acids, and protein matters

FROM MOLASSES BY FERMENTATION

When yeast ferments the sugar, approximately 3% glycerol is formed with alcohol.

SYNTHETIC PREPARATION FROM PROPYLENE

Glycerol, obtained from propylene which is a byproduct of cracking petroleum, is now manufactured in large quantities, especially in USA and Russia.

Propylene is chlorinated to form allyl chloride which is converted to allyl alcohol. Now treat it with hydrochlorous acid (HOCl). 'Chlorhydrin derivative' is produced. Extraction of HCl is done with soda lime. This is followed by hydrolysis which yields glycerine.

FROM SPENT SOAP LYES

NaOH solution (lye) hydrolyses fats and oils to form glycerol and sodium salts of fatty acids (soaps).Soap is salted out but glycerol remains in solution. This is known as 'spent lye'.

Spent lye contains 3-5% glycerol, a small amount of free alkali, NaCl, dissolved soap, proteinous matter, inorganic salts and coloring matter.

Glycerol is recovered by the following procedure:

Spent lye is kept in iron tanks to allow the heavy impurities to settle down.The clear liquid now obtained, is pumped into or 'treating tank' filled which is steam coils.Here it is treated with HCl which neutralizes about three-fourth of the free alkali present in the lye.

To neutralize the remaining alkali it is now treated with alum or basic ferric sulphate. It also converts the traces of sodium soaps and the free acids still present into insoluble iron soaps. A gelatinous precipitate of Fe(OH)3 and insoluble iron soaps result.

The liquid and the precipitate is filtered under pressure through filter presses. A clear liquid is now obtained which is concentrated in vacuum pans to about 80% of glycerol.During the evaporation process, common salts separate out. These are removed from time to time from the bottom.

By the above process, the crude glycerol is obtained. It is now de-colorized with animal charcoal and purified by distillation under reduced pressure with superheated steam.

The distillate so obtained contains waterwhich is concentrated in vacuum pans untilglycerol with specific gravity 1.26. This glycerol is 99.9% pure.

PROPERTIES

Physical Properties:

- Odor: Odorless.
- Consistency: A syrupy liquid; oily liquid.
- Color: A clear, colorless, liquid.
- Taste: Sweet, followed by a sensation of warmth.
- MoistureContent: Hygroscopic i.e., absorb moisture from atmosphere or air.
- Solubility: Miscible with water, alcohol (90 %) and methanol; insoluble in chloroform (CHCl3), in solvent ether and in fixed oils.

- Boiling Point: Pure glycerine boils at 290°C unchanged, but impure decompose at its boiling point.
- If kept for a while at a low temperature, it may solidify, forming a mass of colorless crystals. These crystals do not melt until the temperature reaches about 17° C.
- Specific Gravity: 1.255 to 1.266 at 20°.

Chemical Properties:

- When decomposed by heat or when heated with dehydrating agents like KHSO4, i.e. potassium bi-sulphate, it evolves an intensely irritating and pungent smelling unsaturated aldehyde.
- It dissolves fixed alkalies, acids, a large number of salts, pepsin, tanin, gums, starch, soluble carbohydrates, some active principles of plants, etc.

TEST FOR PURITY

- **Acrolein Test: Two drops of glycerine are** taken in a test tube to which a little powdered potassium hydrogen sulphate (KHSO4) is added.
- Heat the test tube cautiously at first and then more strongly.
- An irritating vapor with a pungent smell of scrolein is produced which blackens a filter paper moistened with a solution of ammoniacal silver nitrate (AgNO3).

Dunstan'sTest

(Borax-PhenolphthaleinTest):

- Take 6 ml. of 0.5% solution of borax.
- Phenolphthalein is added drop by drop to it.
- A distinct red color appears.
- To this 20% glycerine is added drop by drop. The red color disappears, but it reappears on heating.
- ***Explanation:***
- Borax or sodium borate in aqueous solution, is partially hydrolysed to boric acid and sodium hydroxide.
- As boric acid is a weak acid, the solution is alkaline. When glycerine is added, glycero-boric acid is formed which is a strong acid, making the solution acidic.
- On heating or boiling glycero-boric acid it again hydrolyses to glycerol and boric acid, turning the solution alkaline.

Copper Hydroxide Test:

- Make a suspension of cupric hydroxide [Cu(OH)2] by mixing 2.5% CuSO4 solution with 3 ml. of 5% NaOH.
- Add a few drops of glycerine to this suspension.
- A blue color is obtained.
- Glycerine prevents precipitation of cupric hydroxide and no change occurs on boiling the solution.

Preservation

- It should be kept in dry, well-closed vessels.

Uses

- It is used in medicines for its mild antiseptic property.

External Application:

- It is used as an emollient, i.e. for application on the chapped and roughened skin as it softens or relaxes the skin over which it is applied.
- It is used in ear discharges, as it absorbs the pus easily.

Internal Application:

- Used as a suppository in constipation.
- For evacuation of bowels, it may be introduced through a metal syringe per rectum, being mixed with olive oil and tepid purified water.
- It is used for preparing mullein oil.
- It is used in preparations of glycerol for external applications.

OILS

OLIVE OIL

- Synonyms • Oleum olivae.
- Source From the ripe fruits of Olea Europea, family Oleaceae; found in southern Europe and around the Mediterranean sea.
- It is an organic compound, a fixed oil, consisting of the glycerides of fatty acids, chiefly oleic acid and smaller amounts of linolic, myristic, palmetic and stearic acid.
- It may be refined. (Glycerides are the esters of glycerine with organic acids.)

PREPARATION

- Ripe olive fruits are crushed in a mill.
- The remaining portion is mixed with a solvent like carbon disulphide (CS2) and boiled.
- The residual oil is extracted by expression.

IDENTIFICATION

a. Acid Value: Not more than 2.

b. Iodine Value: 79 to 88 (iodine monochloride method).

c. Refractive Index: 1.468 to 1.471 at 20º C. d. Saponification Value: 190 to 195.

PROPERTIES

• Color: Pale yellow in color, but it may vary from colorless to green or greenish-yellow.

• Odor: Generallyodorless, but sometimes a faint agreeable smell comes out, but not rancid.

• Solubility: Mixable with chloroform and solvent ether, almost insoluble in alcohol.

Taste: Bland.

• Specific Gravity: 0.910 to 0.913 at 20º C.

• Boiling Range: 40ºC to 60ºC as it contains about 72% of olein and about 8% of palmitin.

• Consistency: May party solidify at extreme lower temperatures.

TESTS FOR PURITY

Tests for Purity

Experiment	Observation	Result
1. Take 1 ml. olive oil in a flask with a reflux condenser. Add 5 ml. 1.5 (N) alcoholic KOH. Boil it for 10 minutes. Now add 50 ml. of alcohol (70%) and 0.8 ml. of conc. HCl. The solution is gradually cooled.	If above 9°C: a. No turbidity. b. Turbidity present.	 a. Sample of olive oil is pure. b. Olive oil not pure, it is mixed with Arachis oil or peanut oil (i.e. china-badam-tel.)
2. A little olive oil is shaken with an equal volume of a mixture of 9 parts by volume of alcohol (90 %) and 1part by by volume of strong ammonia solution Heat on a water-bath until free from ammonia and alcohol. Now, shake 2 ml of the olive oil with 1 ml HCl which contains 1% w/v sucrose. Set aside for 5 minutes.	If the acid layer: a. Does not color pink or fainly pink. b. Colored pink.	 a. Sample of olive oil. b. Olive oil is not pure, it with seasame oil (or til oil).

STORAGE

Keep in well closed containers.

USES

External Application:

• Used as an excellent external application for burns and skin diseases. • Applied externally for getting a smoothening effect on superficial ulcers.

• On rubbing upon the skin, it renders the skin softer, smoother and more flexible. It is advisable to rub it with Cod liver oil on the skin of patients suffering from rickets and marasmus.

• Used in preparations of liniments for external applications. Internal Application:

• Olive oil has the property to retard the flow of gastric juice. Hence it is an excellent food for cases of gastric ulcer as the acid prevents healing of ulcers.

• In constipation, it is introduced per rectum through a specially made syringe.

• Olive oil of good quality is edible.

• Used as a laxative being taken be at bed time.

ALMOND OIL

Synonyms

• Oleum amygdalae.

• Oleum amydalaeexpressum

• Badam tel.

• Expressed almond oil.

Source- From dried kernals of Prunus amygdalainBatsch,

Family- Rosacae.

Constituents Almond oil is a fixed oil expressed by pressure from the dried kernels of varieties of Prunus amygdalain Batsch, by applying heat.

It contains not less than 80% benzaldehyde, composed mainly of olein with some linolein, but no stearin is present.

PROPERTIES

• Color: A pale yellow oil.

• Odor: Nearly inodorous; slight.

• Taste: Bland, nutty taste.

• Solubility: Miscible with solvent ether, with chloroform, slightly soluble in alcohol (90 p.c.)

• Boiling Range: 40º C to 60º C. • Specific Gravity: 0.910 to 0.915 at 20°C.

• Character: Non-drying oil.

TEST FOR PURITY

- The following additional tests for purity of almond oil should be conducted.
- They should also confirm to the H.P.I. standards for refractive index, acid value, iodine value, saponification value, and for the presence of the following: Apricot-kernel oil, peach-kernel oil, Arachis oil, cottonseed oil and seasame oil.
- It is commonly adulterated with peach - kernal oil. It may be rarely adulterated with Arachis oil, seasame oil and cottonseed oil.

SESAME OIL

Source

It is refined flexed oil, expressed from the seeds of one or more cultivated varieties of Sesamum indicum, Linn., family, Pedalicacaea, native of India, China and most other tropical countries.

Synonyms

• Oleum sesami.

• Til oil.

• Gingelli oil.

• Benne oil

Composition

• Sesamin, a crystalline substance.

• Sesamolin.

• Liquid fats, 70% of which are glycerides of oleic acid and linoleic acids.

• Sesamol, a phenol.

• Solic fats, (12-14%) stearin, palmitin, etc.

PROPERTIES

• Color: Pale yellow color.

• Odor: Faint odor.

• Taste: Bland.

• Consistency: Thick.

• Character: A limpid oil.

• Solubility: Slightly soluble in alcohol (90%), miscible with solvent ether, with chloroform and with light petroleum.

• Specific Gravity: 0.916 to 0.919 at 20°C. Storage Should be preserved in well-filled, wellclosed containers.

USES

1. It is used instead of olive oil, in the preparation of liniments.

2. Used in the preparation of hair oil.

3. An edible oil.

SANDALWOOD OIL

Sources

This oil is steam distilled from the wood of Santalam album Linn., family, Santalaceae

Synonyms

• Oleum santili.

• Oleum santali album.

• Oil of Santal.

• Oil of Sandalwood

Composition

Sandalwood oil is a volatile oil. It's chief constituents are:

• Santol, which is a mixture of two sesqui-terpene alcohols.

• Santalal, an aldehyde.

• Esters.

• Free fatty acids, etc.

Properties-

• *Color:* Pale yellow.

• *Odor:* Strong, aromatic.

• *Taste:* Pungent, aromatic.

• *Consistency:* Thick.

• *Character:* Volatile oil.

• *Solubility:* Freely soluble in strong alcohol.

• *pH:* Slightly acidic.

• *Specific Gravity:* 0.073 to 0.985 at 20º C.

Test for Purity-

Adulterations are common. It is often adulterated with castor oil and other flexed oils.

Storage-

Should be kept in well-stoppered bottles in a cool place, protected from light.

Uses-

• It is mixed with other oils and applied externally.

• Due to its sweet odor, it is largely used in perfumes and cosmetics.

ROSEMARY OIL

Sources
It is a volatile oil, steam distilled from the fresh flowering tops of Rosemarinus officinalis, Linn., family, Labiatae, native of England and southern Europe.

Synonyms

• Oleum Rosemarini.

• Oil of Rosemary.

Composition-

• Borncol, 8 - 16%.

• Bornyl acetate and other esters, about 2 - 5% camphor, cincole pinene and camphene.

Properties-

- *Color:* A colorless or pale yellow oil.
- *Odor:* Characteristic odor of Rosemary.
- *Taste:* Warm, camphoraceous.
- *Character:* Volatile oil.
- *Solubility:* In 1 volume of alcohol (90% v/v, but upon further dilution, it may become turbid).
- *Specific Gravity:* 0.894 to 0.912 at 20 º C.
- *Optical Rotation:* From -5° to +10° in a 100 mm. tube at 20º C.
- *Refractive Index:* At 20°, 1.466 to 1.476.

Test of Purity-

It contains not less than 2% w/w of esters calculated as bornyl acetate, and not less than 9% w/w free alcohols, calculated as borncol C10H8O.

Storage-

The oil should be kept in well-closed containers, in a cool place, protected from light.

Uses-

• It is a component of liniment, saponin, etc.

• It is a stimulant and rubefacient to the skin. It is commonly used in the form of a hair oil.

• Largely used in perfumes and cosmetics.

SEMISOLID VEHICLES

1. Vaseline

    - White.
    - Yellow.

2. Spermaceti or Cetaceum spermaceti.

3. Lanolin.

VASELINE

It is a semi-solid mixture of hydrocarbons obtained from crude petroleum, after kerosene oil, disel oil, fuel oil etc., have been separated. It is then bleached and purified.

Synonyms

• Petroleum jelly.

• Soft paraffin.

• Paraffin soft.

Varieties

It is available in two varieties:

1. White paraffin soft.

2. Yellow paraffin soft.

1. WHITE SOFT PARAFFIN

Source

White soft paraffin is a mixture of semisolid hydrocarbons which are obtained from petroleum and then bleached.

Synonyms

• White petroleum jelly.

• Paraff. moll. alb.

• Paraffinummolle album.

Properties

- Color: A white, translucent, soft mass, not more than slightly fluorescent by daylight, even when melted.
- Odor: Odorless, when rubbed on the skin.
- Taste: Tasteless.
- On Touch: Soft mass; unctuous to touch.
- Solubility: Soluble in chloroform and solvent ether; almost insoluble in alcohol and water. Practically insoluble in CHCl3 and solvent ether and in light petroleum.
- Specific Gravity: 0.815 to 0.880 at 20°C.
- Boiling Point: 30º to 60º C.
- Melting Range: 38º to 56º

TESTS FOR PURITY-

The common impurities are:

1. Foreign organic matter.

2. Fixed oils and fats.

3. Sulpated ash.

S.N.	Experiments	Observation	Results
1	Heat the given sample of Vaseline	It volatize while emitting an acid odor.	Foreign organic mat present . ter
2	Digest 10 gm. with 50 ml. solution of sodium hydroxideat 100ºC for 30 minutes. Allow the aqueous layer to separate. Now acidify the aqueous layer with dilute H2 SO4 (sulphuric acid).	A precipitate or oily matter is produced.	Fixed oil and fat present

For Sulphated Ash:

Not more than 0.1%.

USES

• It is used as a lubricant and applied on ulcers or wounds in dressings.

• It is used for the preparation of several medicinal ointments like; emulsifying ointment, paraffin ointment and simple ointment.

YELLOW SOFT PARAFFIN

SOURCE

It is semi-solid mixture of hydrocarbons obtained from petroleum.

SYNONYMS

• White petroleum jelly.

• Yellow petroleum jelly.

• Paraff moll. flav.

• Paraffinummolle flavum.

PROPERTIES

- ❖ Color: A pale yellow , translucent soft mass. It retains these characters on storage. When melted and allowed to cool without stirring, not more than slightly fluorescent by daylight.
- ❖ Odor: Almost free from odor when rubbed on skin.
- ❖ Taste: Almost tree from taste.
- ❖ To Touch: Soft mass; unctous to touch.
- ❖ Solubility: Practically insoluble in water and alcohol (90%); soluble in CHCl3 and in solvent ether and in light petroleum.
- ❖ Specific Gravity: 0.815 to 0.880 at 20°C.
- ❖ Boiling Point: 40º - 60º C.

Test for Purity Common impurities are:

1. Foreign organic matter.

2. Fixed oils and fats.

3. Sulphated ash.

4. Yellow colouring matter. Test for the former three impurities is the same as those described under soft white paraffin.

For Yellow Coloring Matter:

S.N.	Experiments	Observation	Results
1	Boils 5 gms. sample with 10 ml. of alcohol.	The alcohol is colored Yellow	Yellow coloring matter present.

USES

• It is used as a lubricant and applied on ulcers or wounds in dressings.

• It is used for the preparation of several medicinal ointments like; emulsifying ointment, paraffin ointment and simple ointment.

WAXES

These are solid esters of higher fatty acids and monohydric alcohols, besides glycerol.

CLASSIFICATION

1. Bee's wax:

a. Yellow bee's wax.

b. White bee's wax.

2. Lanolin.

3. Spermaceti.

Bee's Wax It is of two types:

a. Yellow bee's wax.

b. White bee's wax.

YELLOW BEE'S WAX

SOURCE

- It is secreted by Apismellifica, the hive bee, family Apidae.
- This wax is used by the bee to make the cells of the honey comb.

COMPOSITION

• Myricin or Myricyl palmitate, C15H31COOC30H61 : 80%.

SYNONYMS

• Cera flava.

• Ceraflav.

• Mom (Bengali).

PREPARATION

- The comb of a honeycomb is procured after removing the honey in it
- It is then put in hot water to wash any remaining honey.
- Cool the comb.
- Yellow bee's wax separates out like a solid cake on the surface, which is then extracted.

PROPERTIES

• Color: Yellow to greyish-brown.

• Odor: Like that of honey.

• Taste: Faint and characteristic.

• Character: Solid; brittle when cold but plastic when warm.

• Solubility: Insoluble in water; barely soluble in cold alcohol; absolutely soluble in $CHCl_3$, ether, fixed and volatile oils.

• Melting Range: 60º - 65º C.

• Acid Value: 17 to 23.

• Iodine Value: 8 to 11 (Iodine monochloride method).

USES

• As a stiffering agent.

• As an ingredient of yellow ointment

WHITE BEE'S WAX

It is the bleached version of yellow bee's wax.

SYNONYMS

• Cera alba.

USES

• Used in cerates and ointment.

• As an ingredient of yellow ointment.

SPERMACETI

-Source –

It is a waxy substance obtained from the head of the sperm whale Physeter macrocephalus Linn., family, Physeteridae.

Synonyms

• Cetaceum.

• Sp. Esperma de ballena.

• C. spermaceti.

COMPOSITION

Physeteridae or the bottle nosed whale spermaceti is a mixture of various constituents, of which the principal one is cetin or acetil palmitate, C15H31 COOC6 H33. Cetin is obtained when crystallised from alcohol.

While on evaporation, the mother liquor deposits an oil, named cetin plain, which on saponification yields cetin elaic acid which resembles, but is distinct from oleic acid.

PREPARATION

It is obtained from the mixed oils which are recovered by expression from the head, bulbar and carcase of the whales. On standing, a crystalline deposit is formed in the oil.

The deposit is separated by filtration, pressed, melted, purified from traces of oil with dilute sodium hydroxide (NAOH) solution and finally freed from the soap thus produced and from excess of alkali. The separated solid fat is termed as cetin which belongs to the class of waxes.

PROPERTIES

• Color: A white, somewhat translucent, mass with a crystalline fracture and pearly luster.

• Odor: Faint odor.

• Taste: Faint; bland milky taste.

To Touch: Slightly unctous mass with crystalline fracture.

• Solubility: Insoluble in water and cold alcohol nearly insoluble in cold water; soluble in boiling alcohol, ether, $CHCl_3$ and in fixed and volatile oils. • Specific Gravity: 0.95 (approximately) at 20º C.

• Melting Range: 42° - 50° C.

• Acid Value: Not more than 10.

• Iodine Value: Not more than 5 (Iodine monochloride method).

• Saponification Value: 120 to 136. Storage It is preserved in well-closed vessels.

USES

It is a solid fatty substance used to give consistency to cerates and ointments, as in the well known water ointments.

LANOLIN (ANHYDROUS)

Source

It is obtained from the wool of the sheep Ovis aries,

Family- Bovidrae.

SYNONYMS

• Wool fat.

• Adepalanae.

• Adepeslan.

COMPOSITION

Contains not more than 200 parts per million of butylated hydroxyanilose or butylated hydroxytoluene. Preparation It is a purified anhydrous fat-like substance, obtained from the wool of the sheep, Ovis aries.

1. Natural grease is extracted from the wool by treating with dilute alkali, with which the grease readily forms an emulsion.
2. Next the emulsion is acidified.
3. The wool-fat separates as a distinct layer at the surface of the liquid.
4. Purification may be affected by repeated treatment with water in a centrifuge.

PROPERTIES

• Color: A pale yellow substance.

• Odor: Faint and characteristic.

• Character: Tenaceous, unctous substance.

• Solubility: Insoluble in water; sparingly soluble in cold alcohol (90%); freely soluble in solvent ether and in $CHCl_3$ (chloroform).

• Melting Range: 36° - 42°C.

• Acid Value: Not more than 1.

• Iodine Value: 18 to 32 (Iodine monochloride method).

• Saponification Value: 92 to 106. Identification Dissolve 0.5 gm. in 5 ml. of chloroform. Now add 1 ml. of acetic anhydride and 2 drops of sulphuric acid, a deep green color is produced.

STORAGE

Store in a well-closed container at a temperature not exceeding 30°C.

USES

Due to its penetrating power within the skin, it is extensively used in ointments.

SOAP

Classification

It is based on the sources from which the soap is manufactured:

1. From vegetable source:

a. Hard soap.

b. Soft soap.

2. From animal source:

a. Curd soap.

HARD SOAP

SOURCE

It is the result of the interaction of NaOH (sodium hydroxide) with a suitable vegetable oil or oils or with fatty acids derived from vegetables.

SYNONYMS

- Wool fat.
- Sapodurus.
- Sap. dur.
- Castile soap.
- Olive oil soap.
- Sodium oleate.

PROPERTIES

- Color: A greyish-white or yellowish-white substance.
- Odor: Nearly odorless.
- Character: It becomes horny and pulverisable when dry.
- Solubility: Soluble in water; almost completely soluble in alcohol (90%) but more readily soluble when warmed.

STORAGE

It is preserved in well-closed containers.

USES

It is commonly used as a detergent.

SOFT SOAP

SOURCE

It is made by the interation of KOH (possium hydroxide) or NaOH (sodium hydroxide) with a suitable vegetable oil or oils or with vegetable fatty acids. It yields and less than 44% of fatty acids.

SYNONYMS

- Sapomollis.
- Sap. moll.
- Green soap.
- Potassium oleate.

PROPERTIES

- Color: It is a yellowish-white to green, or brown unctous substance.
- Solubility. Readily soluble in water and in alcohol (90%).

STORAGE

It is preserved in well-closed containers

. USES

- As a detergent.
- Used in preparation of soap liniment.

CURD SOAP

Source It is made from NAOH (sodium hydroxide) and purified solid animal fats.

SYNONYMS

- Sapoanimalis.
- Sap. animal.
- Sodium stearate.

PROPERTIES

• Color: White or yellowish-white.

• Taste: Tasteless.

• Odor: Odorless.

• Character: Becomes horny and pulverisable when dry.

• Solubility: It is soluble in water; almost totally soluble in alcohol 90% but it dissolves more readily when warm

. USES

It is used in component of opodeldocs.

PREPARED LARD

Source

Prepared lard is the purified internal fat of the abdomen of a hog, Sus scrofa, Linn., Var, domesticus Gray.

Synonyms

• Adeps lard.

• Adepspraeparatus.

• Sukarcharbi.

COMPOSITION

i. Olein (60%).
ii. Stearin.
iii. Palmitin.

PREPARATION

It is prepared by carefully removing the membranes and adhering flesh over the fat in the abdomen of a hog, and then rendered.

PROPERTIES

• Color: A white mass.

• Odor: Faint odor.

• Taste: Bland taste, free from rancidity.

• To Touch: Soft, unctous mass.

• Solubility: It is insoluble in water; very slightly soluble in alcohol (90%); soluble in solvent ether, in CHCl3 (chloroform) and in light petroleum.

• Melting Range: 36° to 42°C. It forms a clear liquid from which no water layer separates.

STORAGE

Store in containers which must be kept in areas protected from conditions favoring rancidity.

USES

Used as an ingredient in ointments.

ISIN GLASS

Source

Isin glass is a collagen derived from the thin, inner, silver, shiny layer of the air-bladder of some fishes, especially sturgeons, carps and car fishes.

PREPARATION

1. The air-bladder of fishes is collected and washed thoroughly.

2. Now the outer thick and fibrous layer of the wall is separated from the inner layer. This is exclusively isin glass raw material.

3. This is then cut into small pieces which are macerated

. 4. This macerated mass in then pressed into sheets by means of a large roller.

PROPERTIES

• Color: Light whitish or yellowish; semitransparent.

• Odor: Odorless.

• Taste: Tasteless.

• On Touch: Tough, fibrous solid.

USES-

It is used as a component of Calendula and Arnica plasters.

STARCH-

SOURCE

• Maize or India corn (Zea maydis S.L.), 65 to 70%.

• Wheat (Triticum sativum Lam.), 60 to 65%.

• Potato (Solanum tuberosum L.), 15 to 20%.

• Paddy (Oryza sativa L.), 75 to 85%.

SYNONYMS

• Amylum.

• Shetsar.

• Beng.

Chemical Formula- $(C_6H_{10}O_5)_n$

PREPARATION

• **From Maize or Indian Corn:** First the germs are separated from the maize mechanically. The cells are made soft so that starch granules may escape out of the cells. This is done by allowing the cells to become sour and decompose. Stop the fermentation before the starch is affected.

• **From Potato:** Grate the potatoes and then wash the soft mass upon a sieve. It separates the cellular substances and permits the starch granules to pass through by decantation.

• **From Wheat:** First, a stiff ball-like dough is made. Knead it with a small stream of water trickling upon it. As a result, the starch is carried off with the water while the 'gluten' remains as a soft elastic mass. This gluten can be purified which may be used for other purposes.

PROPERTIES

• Color: White.

• Odor: Odorless.

• Taste: Tasteless.

• Solution: A hygroscopic powder, insoluble in cold water and all organic solvents except formamide and dimethyl sulphoxide.

USES- It is a component of 'glycerole of starch.'

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