Lab. 4 Pharmaceutical Technology

Suspensions (Part one)

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and

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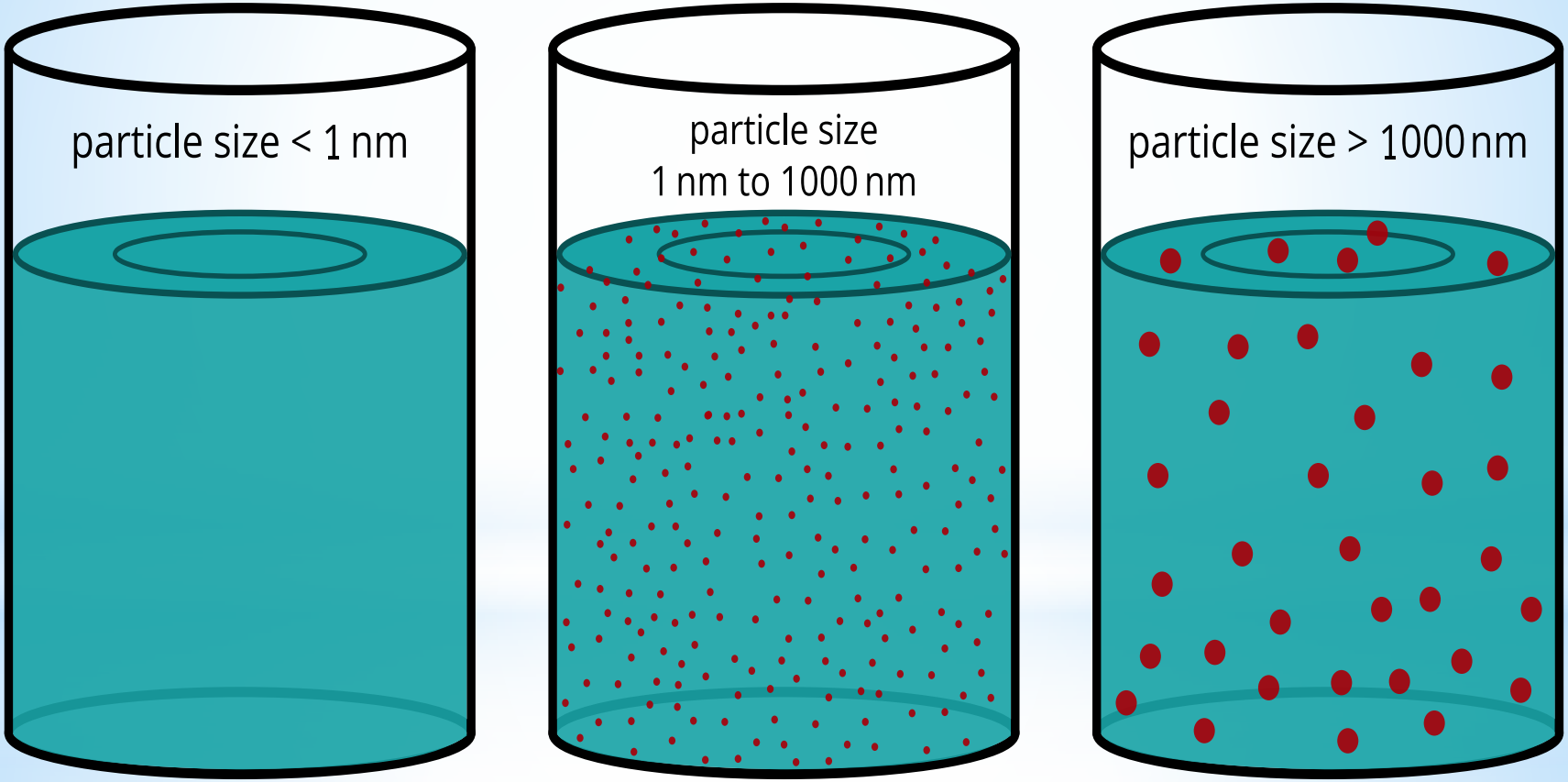
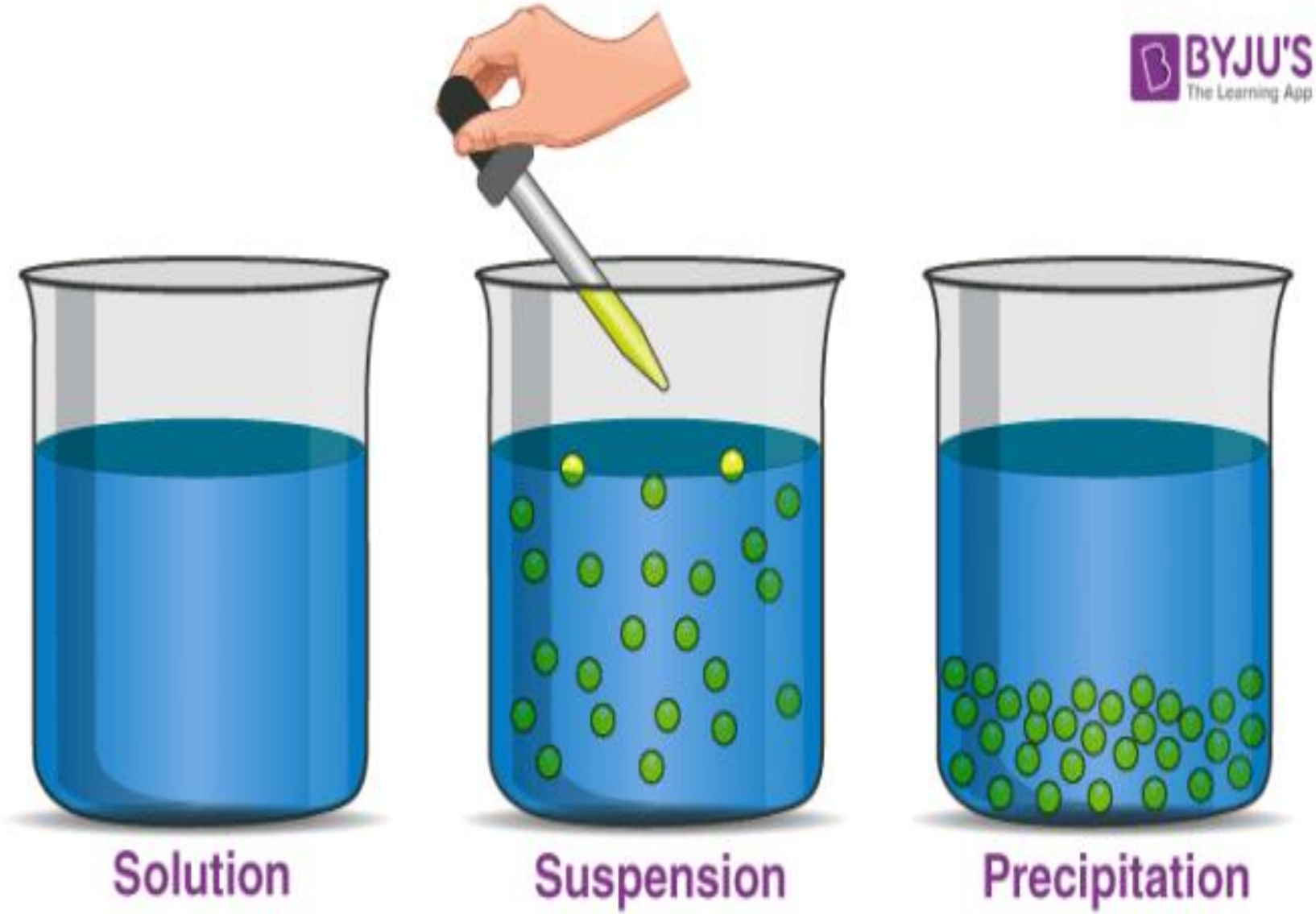


Solution Colloid Suspension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Solution
Suspension
Precipitation

» Suspensions are heterogeneous systems consisting of two phases: Continuous (external) phase and dispersed (internal) phase.

» The external phase is generally a liquid or semisolid and the internal phase is particulate matter (solid).

» The internal phase is insoluble but dispersed throughout the external phase.

• In suspension the vehicle is water and sometimes may be an organic or oily liquid.

• Suspensions can be used orally, parenterally, topically, rectally, ophthalmically, etc

» Some suspensions are available in ready to use form e.g. metronidazole (Flagyl®) and others are available as dry powders intended for suspension in liquid vehicles, most often purified water e.g. amoxicillin (Amoxil®).

- **Types of suspensions**
- **Based on General Class**

– Oral suspension

– Externally applied suspension

– Parenteral suspension

– Ophthalmic suspension

- **Based on Size of Solid Particles**

– Colloidal suspension (< 0.5 micron)

– Coarse suspension (> 0.5 micron)

– Nanosuspension

- **Based on proportion of solids**
- Dilute suspensions – 2 – 10% solids

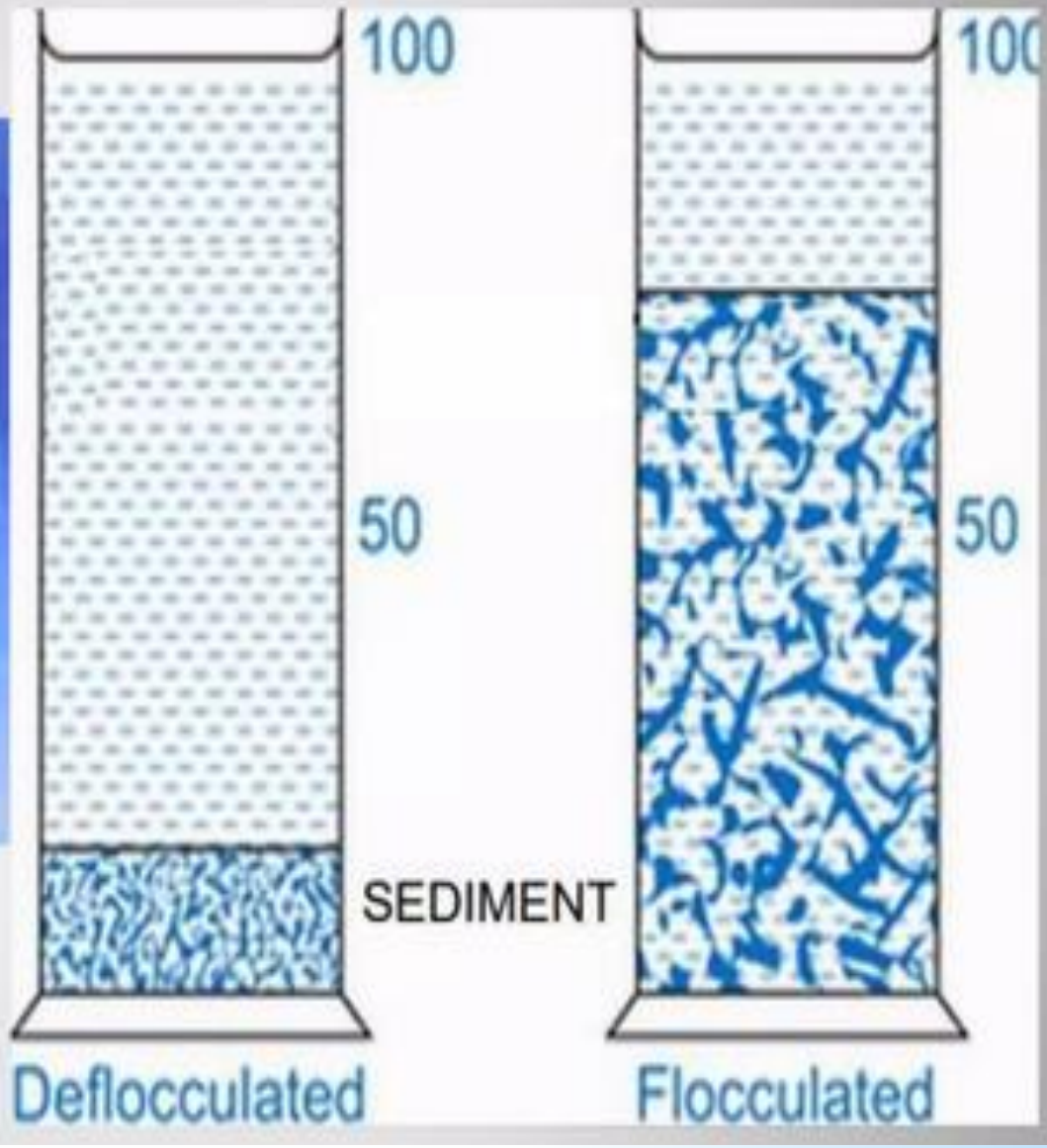
E.g. Cortisone acetate suspension
Prednisolone acetate suspension

- Concentrated suspensions - > 50% solids

E.g. Zinc oxide suspension for external use
Procaine Penicillin G suspension as injection

- **Based on nature & behaviour of solids (electrokinetic phenomena)**
- Flocculated suspension
- Deflocculated suspension

Deflocculated &
Flocculated suspension



Stokes law:

$$v = \frac{D^2(d_1 - d_2)g}{18\eta}$$

v = velocity of the sedimentation.

D = particle diameter.

d1 and d2 = density of the particle and the liquid, respectively.

g = gravitational constant.

η = the viscosity of the medium.

Desired properties in the pharmaceutical suspension

1. Settle down slowly (remain suspended long enough to withdraw an accurate dose).

2. Readily redispersed upon gentle shaking of the container.

3. The particle size should remain fairly constant throughout long periods of storage (no caking).

4. Easily pourable from its container (not highly viscous).

5. Suitable odour, colour, and taste. Stable and not decompose or support growth of moulds.

Why Suspensions?

1. Solubility.

2. Stability: Certain drugs are chemically unstable in solution but stable when suspended.

3. Palatability: The disadvantage of a disagreeable taste of certain drugs in solution form is overcome when the drug is administered as undissolved particles of an oral suspension. For example, erythromycin estolate is a less water-soluble ester form of erythromycin and is used to prepare a palatable liquid dosage form of erythromycin.

Some advantages of suspensions

1. Sterile suspensions are injected hypodermically or intramuscularly to produce prolonged release of medication than would a true solution of the same drug.

2. The selection of the flavouring agent to be used in a given suspension may be based on taste preference rather than on a particular flavouring's ability to mask an unpleasant taste.

Some disadvantages of suspensions

1. They must be well shaken prior to measuring a dose.

2. The accuracy of the dose is likely to be less than with the equivalent solution.

3. Conditions of storage may adversely affect the disperse system which might lead to aggregation and caking.

Storage of suspension

The physical stability of suspension is adversely effected by extreme variation in temperature, suspension should be stored in cool place but not refrigeration.

Freezing and very low temperature may cause the suspended particles to reaggregate.

Also should be stored in a wide mouth container that have a space to allow a good agitation before use.

Classification of Suspensions

1. Suspensions containing diffusible solid(s).
2. Suspensions containing non-diffusible solid(s).
3. Suspensions containing precipitate forming liquid.
4. Suspensions containing poorly wettable solid(s).
5. Suspensions prepared by chemical reaction.
6. Dispersions of oil in inhalation.

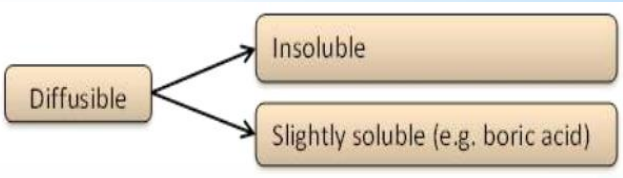
1. Suspensions containing diffusible solid(s)

» Diffusible solids are insoluble powders which are light and easily wettable and therefore readily mixed with water.

» Upon shaking, they diffuse evenly through the liquid for long period enough to ensure dosing consistency.

Examples: Kaolin, pectin, magnesium carbonate, bismuth carbonate.

» Some substances are soluble at low concentrations only and at high concentration, they form suspensions. These are classified as diffusible solids as well.



Example: Boric acid : ≤ 4% w/v: Soluble

> 4% w/v: Not completely dissolved.

General method to prepare suspension containing diffusible solid(s):

1. Using mortar and pestle, reduce the particle size of any ingredient having coarse particles to produce fine powders.
2. Mix insoluble powders in mortar by **geometric dilution method.**
3. After taking in consideration any liquid ingredients, measure ¾ of the vehicle and dissolve any soluble ingredients in it then use it as follows:

- ¼ of the vehicle to prepare smooth paste.
- ¼ of the vehicle for dilution to produce a pourable paste.
- ¼ of the vehicle to wash the mortar.

¾ × final volume – (liquid ingredients)

4. Transfer the mixture from the mortar to a measuring cylinder and rinse the mortar with ¼ of the vehicle.

5. Add any liquid ingredients and complete the volume with the vehicle.

6. Label: Shake before use.

General notes

1. Soluble solids should be dissolved in the second ¼ of the vehicle (dilution part). e.g. sodium bicarbonate

2. Volatile substances should be added to suspension before completing the volume to avoid their loss by volatilisation (e.g. chloroform, some tinctures, flavouring spirits, etc).

3. Liquids with high viscosity such as syrup, glycerine, or propylene glycol are added to the dry powder in the mortar before formation of the smooth paste.

4. Dyes are added to the smooth paste before dilution to allow penetration and distribution of the colour among insoluble particles (e.g. amaranth solution).

℞

Boric acid 10 g

D.W. qs. 30 ml

Mitte (dispense or send) 20 ml

Method:

• mitte/qs. = 20/30 = 0.666 (factor)

• 10 g in 30 ml → 33.33 %w/v → suspension.

• 0.666 × 10 = 6.66 g.

• 0.666 × 30 = 20 ml.

Boric acid 6.66 g (diffusible solid)

D.W. qs. 20 ml (vehicle)

- ¾ × final volume – (liquid ingredients)
- ¾ × 20 – (0) = 15 ml → 3 parts each part 5 ml:
- 5 ml for making smooth paste.
- 5 ml for dissolving soluble solids and dilution.
- 5 ml for washing the mortar and pestle.

- Grind 6.66 g boric acid using mortar and pestle.
- Add 5 ml of D.W. and triturate to produce smooth paste.
- Add 5 ml of D.W. to produce pourable paste.
- Transfer to measuring cylinder and wash with 5 ml of D.W.
- Complete the volume to 20 ml with D.W.
- Transfer to suitable bottle and label.

Rx

Light magnesium carbonate 650 mg

Sodium bicarbonate 975 mg

Chloroform water qs. 30 ml

mitte 120 ml

Method:

120ml/30ml= 4 (factor)

Light magnesium carbonate 2.6 g (diffusible solid)

Sodium bicarbonate 3.9 g (water soluble solid)

Chloroform water qs. 120 ml (vehicle)

- ¾ × final volume – (liquid ingredients)
- ¾ × 120 – (0) = 90 ml → 3 parts each part 30 ml:
- 30 ml for making smooth paste.
- 30 ml to dissolve sodium bicarbonate and dilution.
- 30 ml for washing the mortar and pestle.

 Grind 2.6 g light magnesium carbonate using mortar and pestle.

 Add 30 ml of chloroform water and triturate to produce smooth paste.

 Dissolve 3.9 g of sodium bicarbonate in 30 ml of chloroform water and use this volume to dilute the smooth paste to pourable one.

 Transfer to measuring cylinder and wash with 30 ml of chloroform water.

 Complete the volume to 120 ml with chloroform water.

 Transfer to suitable bottle and label.

Pharmaceutical uses:

1. Boric acid is a weak acid and has antiviral, antifungal, and antiseptic properties.

2. Light Magnesium Carbonate is an inorganic compound with the chemical formula MgCO3. Light Magnesium Carbonate is a common antacid drug that is used pharmaceutical aid.

3. Rhubarb is used primarily for digestive complaints including constipation, diarrhea, heartburn, stomach pain, gastrointestinal (GI) bleeding, and preparation for certain GI diagnostic procedures.

4. Bismuth carbonate used for stomach ulcers and digestive tract infection.

Application and uses:

5. Kaolin is used for mild-to-moderate diarrhea, severe diarrhea (dysentery), and cholera.

6. Magnesium oxide, Heavy powder, USP has many uses, but from a pharmaceutical perspective it is used primarily as a mineral supplement and a tablet and capsule diluent.

7. Belladonna tincture has been used in alternative medicine as an aid in treating arthritis pain, colds or hay fever, bronchospasms caused by asthma or whooping cough, hemorrhoids, nerve problems, Parkinson's disease, colic, irritable bowel syndrome, and motion sickness.

℞

Bismuth carbonate gr IX (583.19 mg)

Compound powder of rhubarb gr V (323.995 mg)

Compound tincture of cardamom ♏ XV (0.924 ml)

Syrup ♏ XXX (1.848ml)

Peppermint water qs. ʒ I (29.5735 ≅ 30 ml)

Method:

- ¾ × final volume – (liquid ingredients)
- ¾ × 30 – (1.8 + 0.9) = 19.8 ml → 3 parts each part 6.6 ml:
- 6.6 ml for making smooth paste.
- 6.6 ml for dilution.
- 6.6 ml for washing the mortar and pestle.

- Grind 585 mg bismuth carbonate and 325 mg compound powder of rhubarb by geometrical dilution method using mortar and pestle.
- Add 6.6 ml of peppermint water and triturate to produce smooth paste.
- Add 1.8 ml of syrup to the smooth paste and triturate.
- Add 6.6 ml of peppermint water for dilution to a pourable paste.
- Transfer to measuring cylinder and wash with 6.6 ml of peppermint water.
- Add 0.9 ml of compound tincture of cardamom and stir.
- Complete the volume to 30 ml with peppermint water.
- Transfer to suitable bottle and label.

℞

Light kaolin 10 g (diffusible solid)

Bismuth carbonate 10 g (diffusible solid)

Heavy magnesium oxide 10 g (diffusible solid)

Tincture of belladonna 4 ml (volatile liquid)

Peppermint water qs. 30 ml (vehicle)

Method:

- ¾ × final volume – (liquid ingredients)
- ¾ × 30 – (4) = 18.5 ml → 3 parts each part 6.16 ml:
- 6.16 ml for making smooth paste.
- 6.16 ml for dilution.
- 6.16 ml for washing the mortar and pestle.

- Grind 10 g of each of light kaolin, bismuth carbonate and heavy magnesium oxide by geometrical dilution using mortar and pestle.
- Add 6.16 ml of peppermint water and triturate to produce smooth paste.
- Add 6.16 ml of peppermint water to the mortar for dilution.
- Transfer to measuring cylinder and wash with 6.16 ml of peppermint water.
- Add 4 ml of tincture of belladonna and stir.
- Complete the volume to 30 ml with peppermint water.
- Transfer to suitable bottle and label.

Note:

In the pharmaceutical industry, geometric dilution involves thoroughly mixing a small amount of drug with the appropriate amount of a solvent, which thins or binds it. By doing so, the resultant compound is evenly distributed with the drug.


THANKYOU