

# Lab. 5 Pharmaceutical Technology

## Suspensions (Part 2)

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## 2. Suspensions containing non-diffusible solid(s)

» They will **not remain evenly distributed** in the vehicle long enough to ensure uniformity of the measured dose.

» Examples: **aspirin**, **phenobarbital**, **phenacetin**, **salicylic acid**.

» The simplest way to **solve this problem** is to increase the viscosity of the vehicle by adding a thickening agent (**suspending agent**)

1. Decrease the sedimentation rate of particles.

2. Decrease the collisions of particles by each other which can lead to formation of aggregates that settle down rapidly..

## » Some suspending agents for general use are:

**1. Acacia Gum BP:** Because of the **poor viscosity of acacia**, it is not capable of providing appreciable suspending action, it is therefore usually **mixed with tragacanth, starch and sucrose** to form what is commonly known as **Compound tragacanth powder BP**.

**2. Powdered Tragacanth BP:** Used in a concentration of **0.2% w/v**.

**3. Compound Tragacanth Powder BP:** Used in a concentration of **2% w/v**. Composed of powdered tragacanth 15%, acacia 20%, sucrose 45% and starch 20%.

**4. Bentonite BP:** Used in a concentration of **2-3% w/v**.

**5. Tragacanth mucilage:** Used in a concentration of **25% v/v** ( $\frac{1}{4}$  of the vehicle is displaced).

Composed of tragacanth powder (12.5 g) + alcohol (25 ml) + chloroform water (qs. 1000 ml). It is used when the vehicle is water or chloroform water.

# General method to prepare suspension containing non-diffusible solid(s)

## A) Using Powdered Tragacanth BP or Compound Tragacanth Powder BP:

- Using **mortar and pestle**, reduce the particle size of any ingredient having coarse particles to produce fine powders.
- **Mix insoluble powders and suspending agent by geometrical dilution method.**
- After taking in consideration any liquid ingredients, **measure  $\frac{3}{4}$  of the vehicle** and add part of it ( $\cong \frac{1}{4}$ ) to the mortar and triturate until smooth paste is formed.
- **Dissolve any soluble solid ingredients in the other  $\frac{1}{4}$**  and add it to the mortar for diluting it to a pourable paste.
- Transfer the content **to a measuring cylinder** and rinse the mortar with  $\frac{1}{4}$  of the vehicle.
- Add any liquid ingredients and **complete the volume** with the vehicle.
- **Label:** Shake before use.

## B) Using tragacanth mucilage (25% v/v):

- Using **mortar and pestle**, reduce the particle size of any ingredient having coarse particles to produce fine powders.
- Mix **insoluble powders** by geometrical dilution method.
- **Triturate the powder mixture above with tragacanth mucilage (25 % v/v, i.e. 1/4 of the final volume) to produce a smooth paste.**
- After taking in consideration any liquid ingredients, measure  $\frac{1}{2}$  the vehicle and add part of it ( $\cong \frac{1}{4}$ ) for dilution to produce **pourable paste** (soluble solids are dissolved in this portion).
- Transfer the content to a **measuring cylinder** and rinse the mortar with  $\frac{1}{4}$  of the vehicle.
- Add **any liquid ingredients** and complete the volume with the vehicle.
- **Label:** Shake before use.

# R

Phenacetin 1 g

Caffeine 0.5 g

Syrup of orange 6 ml

P.W. qs. 90 ml

mitte 30 ml

## Method:

$30\text{ml}/90\text{ml} = 0.333$  (factor)

- Vehicle is water → use tragacanth mucilage.
- 25% v/v (i.e.  $\frac{1}{4}$ ) of tragacanth mucilage:  $\frac{1}{4} \times 30 = 7.5$  ml
- $\frac{1}{2} \times$  final volume – (liquid ingredients)
- $\frac{1}{2} \times 30 - (2) = 13$  ml → 2 parts each part 6.5 ml:
- 6.5 ml for dilution.
- 6.5 ml for washing the mortar and pestle.

- Grind 0.333 g of phenacetin and 0.166 g of caffeine by geometrical dilution using mortar and pestle.
- Add 7.5 ml of tragacanth mucilage to the mortar and triturate until smooth paste is formed.
- Add 2 ml of syrup to the smooth paste and triturate.
- Add 6.5 ml of P.W. for dilution.
- Transfer to measuring cylinder and wash with 6.5 ml of P.W.
- Complete the volume to 30 ml with P.W.
- Transfer to suitable bottle and label.

## Pharmaceutical uses

1. **Phenacetin** was used as an **analgesic and fever-reducing drug**.
2. **Caffeine** is a drug of the methylxanthine class used for a variety of purposes, including certain **respiratory conditions of the premature newborn (respiratory stimulant), CNS stimulant, pain relief, and to combat drowsiness**.



# R<sub>x</sub>

Aspirin 500 mg (non-diffusible solid)

Ammonium bromide 65 mg (water soluble solid)

Syrup of orange 1 ml (thick liquid)

Conc. chloroform water 0.25 ml (volatile liquid)

P.W. qs. 20 ml (vehicle)

## Method:

- 25% v/v (i.e.  $\frac{1}{4}$ ) of tragacanth mucilage:  $\frac{1}{4} \times 20 = 5$  ml
- $\frac{1}{2} \times$  final volume – (liquid ingredients)
- $\frac{1}{2} \times 20 - (1\text{ml}+0.25\text{ml}) = 8.75$  ml  $\rightarrow$  divided to 2 parts each part 4.375 ml:
- 4.375 ml for dilution.
- 4.375 ml for washing the mortar and pestle

- Grind **500 mg aspirin** using mortar and pestle.
- Add **5 ml of tragacanth mucilage** and triturate to produce smooth paste.
- Add **1 ml of syrup** to the smooth paste and triturate.
- Dissolve **65 mg of ammonium bromide** in **4.375 ml of P.W.**
- Add **this P.W. for dilution to a pourable paste.**
- Transfer to measuring cylinder and **wash with 4.375 ml of P.W.**
- Add **0.25 ml of concentrated chloroform water** and stir.
- Complete the volume to **20 ml with P.W.**
- Transfer to suitable bottle and label.

### **Pharmaceutical uses:**

1. **Aspirin** is a type of nonsteroidal anti-inflammatory drug (NSAID) that can treat mild to moderate pain, inflammation or arthritis. It also lowers risk of heart attack, stroke or blood clot.

# Home work:

R<sub>x</sub>

Aspirin gr ii

Potassium citrate gr X

Cpd tr. Of camphor  $\boxed{m}$  V

P.W q.s f $\bar{z}$  I

## • Note:

Aspirin in the presence of **sodium or potassium citrate** or **acetate** (except caffeine citrate) it will be react with these salts and form a **soluble complex**.

### 3. Suspensions containing precipitate forming liquid(s)

- ▶ Some liquid preparations may contain resinous material that is precipitated upon addition of water.
  
- ▶ Resins are insoluble in water and form non-diffusible masses particularly when salts are present.
  
- ▶ Examples on precipitate forming liquids:
  - Compound benzoin tincture.
  - Myrrh tincture.
  - Tolu tincture.
  - Podophyllum tincture.

▶ The precipitated resinous materials may adhere to the sides of the bottle or form a clotted precipitate which will not re-suspended upon shaking.

▶ To prevent this, it is necessary to add suspending agent as Compound Tragacanth Powder BP or tragacanth mucilage (in the same percentages used for suspensions containing non-diffusible solids i.e 25 % v/v).

## Method of preparing suspension containing precipitate forming liquid(s)

This method is suitable when diffusible or non-diffusible solids are also present in the mixture.

### ▶ A: compound powder of tragacanth

1. Using mortar and pestle, reduce the particle size of insoluble solids to produce fine powders.

2. Mix insoluble powders and suspending agent by geometrical dilution method (if there is no insoluble solid ingredient in the prescription, put the suspending agent alone in the mortar).

3. After taking in consideration any liquid ingredients, measure  $\frac{3}{4}$  of the vehicle and add part of it ( $\cong \frac{1}{4}$ ) to the mortar and triturate until smooth paste is formed.

4. Measure the precipitate forming liquid in a dry measuring cylinder and add it gradually and slowly in the centre of the smooth paste with rapid stirring.

5. Dissolve any soluble ingredients in the other  $\frac{1}{4}$  of the vehicle and add it to the mortar for dilution to a pourable paste (stirring is continued).

6. Transfer the content to a measuring cylinder and rinse the mortar with  $\frac{1}{4}$  of the vehicle.

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

8. Label: Shake before use.

## **B: using tragacanth mucilage**

1. Mix the **mucilage with equal volume** of aqueous vehicle ( $\frac{1}{4}+\frac{1}{4}$ )
2. Measure the **ppt forming liquid** and pour it slowly into the center of the mixture with constant stirring
3. The electrolyte added after dilution and dissolving in part of the vehicle.

### **Note:**

The **precipitate forming liquids** are **adsorbed** on the **hydrocolloid** (**acacia, tragacanth or starch**) which offers hydrophilic properties and prevents aggregation into clots.



## Home work:

R<sub>x</sub>

Tincture of tolu balsam 5 ml (precipitate forming liquid)

Syrup of orange 2 ml (thick liquid)

Peppermint water qs. 30 ml (vehicle)

## Pharmaceutical uses:

Tincture of tolu balsam used as an **expectorant** and is extensively used as a **pleasant flavoring** in medicinal syrups, suspension and chewing gum.

#### 4. Suspensions containing poorly wettable solid(s)

⊙ Some substances as sulphur, calamine, zinc oxide, and hydrocortisone are insoluble in water and poorly wetted by it. Upon preparing simple aqueous dispersions, it is difficult to disperse clumps and the foam produced upon shaking will not rapidly subside because it is stabilised by a film of a non-wettable solid at the liquid-air interface.

⊙ The interfacial energy between the solid and liquid must be reduced. This could be achieved by adding a suitable wetting agent which is adsorbed at the solid-liquid interface to increase the affinity of solid particles to the surrounding medium and reduce the interparticle forces.

⊙ Examples on wetting agents: **Alcohol**, **glycerine** and **propylene glycol**. **Polysorbate** (Tween) and **sorbitan ester** (Span) are SAA used as wetting agent for internal preparation. While **sodium lauryl sulphate (SLS)** and **quillia tincture** are used in external preparation.

⊙ However, the compound preferred for oral and parenteral suspensions are nontoxic **non-ionic surface active** agents known as **polysorbates** (spans and tweens).

⊙ **Lotions** are liquid or semiliquid preparations containing **one or more pharmaceutically active ingredient** intended for **external application** to the unbroken skin without friction. They usually contain **suspended particles or emulsified liquid droplets** which may be **diffusible or non-diffusible**. A suspending or emulsifying agent is needed if non-diffusible material is present (**suspending agent: solid–liquid, emulsifying agent: liquid–liquid**).

Rx

Calamine 150 g	(poorly wettable solid)
Zinc oxide 50 g	(poorly wettable solid)
Bentonite 30 g	(suspending agent)
Sodium citrate 5 g	(convert bentonite from gel to solution)
Liquefied phenol 5 ml	(preservative, antiseptic)
Glycerol 50 ml	(thick liquid)
P.W. qs. 1000 ml	(vehicle)

### Pharmaceutical uses:

- Used as antipruritic (e.g. for chickenpox).

## Method:

Triturate the calamine, the zinc oxide and the bentonite with a solution of the sodium citrate in about 700 ml of the purified water and add the liquefied phenol, the glycerol and sufficient purified water to produce 1000 ml.

## Compound sulphur lotion

Rx

Precipitated sulphur 40 g	(poorly wettable solid)
Alcohol (95%) 60 ml	(wetting agent)
Glycerol 20 ml	(wetting agent)
Quillaia tincture 0.5 % v/v	(wetting agent –saponin)
Calcium hydroxide solution qs. 1000 ml	(vehicle)
mitte 25 ml	

## Pharmaceutical uses:

Used for scabies.

## Note:

⦿ Calcium hydroxide solution also known as lime water.

## 5. Dispersions of oil in inhalation

⊙ **Inhalations** are liquid products that contain **volatile ingredients** intended to be released and brought into **contact with the respiratory lining**.

⊙ Here, the **volatile ingredient** is adsorbed onto a **carrier powder** (a diffusible solid) and formulated as **suspension**.

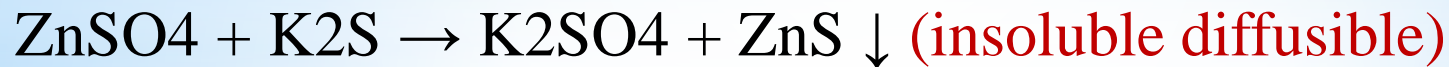
⊙ When used, **an accurate dose of the suspension** is added to hot (about 65 °C) but **not boiling water**, so that the **volatile ingredient** is released and inhaled by the **patient**.

⊙ Example: A **volatile oil** is suspended in water after being adsorbed on **light magnesium carbonate powder**. If the quantity of light magnesium carbonate is not included in the formula, **1 g of it is added to each 2 ml of oil** (e.g. **eucalyptus and pine oil**) or **2 g of volatile solid** (e.g. **menthol and thymol**)

## 6. Suspensions prepared by chemical reaction

⊙ Here, the **insoluble active constituent** of the suspension is formed by chemical reaction.

⊙ Example: **White lotion** is prepared by mixing dilute solutions of **zinc sulphate** and **sulfurated potash**. The mixing must be slowly with continuous stirring so that a finely divided precipitate of **Zinc sulfide** will be formed in the reaction.



### **Pharmaceutical uses:**

White lotion is used in the treatment of number of dermatological diseases.





**THANK YOU**