

**PHB**



**Dr. Arvind Kumar Gupta**  
(M.Pharm, PDCR, PGDMM & Ph.D)  
GATE 2003 Qualified with 97.2 percentile  
Dr. S. N. Dev College of Pharmacy  
Shamli (U.P.)

**OFFICE:** BUILDING No. 3/314, OFFICE-1, GAUSHALA ROAD, SHAMLI DISTRICT SHAMLI (U.P.) – 247776

**Mobile:** +91-9719638415

**Email:** arindrkgit@gmail.com

**Course Name : D. Pharm**  
**Year : First Year**  
**Subject Name : Pharmaceutics**  
**Topic Name : Solutions**

**Solution** is a clear homogeneous mixture, which is prepared by dissolving solid, liquid or gas in another liquid. In a solution, the component which is present in large amount is known as **solvent** and the component present in lesser amount is known as **solute**. Solutions may be used internally, externally or parenterally.

Solutions are sub-classified into four types depending on their use as:

- A.** Solutions meant for internal (oral) use.
- B.** Solutions used only in mouth and throat.
- C.** Solutions applied on the body surfaces.

For the preparation of solutions along with medicament, following additives are used

### 1) Vehicles:

S. No	Type	Examples	Uses
1	Water	<ul style="list-style-type: none"> <li>• Freshly boiled and cooled water</li> <li>• Purified water</li> <li>• Distilled water</li> </ul>	Used for most of the liquid preparations, where flavoring is not required.
2.	Aromatic waters	Chloroform water	Flavoring agent and preservative
		<ul style="list-style-type: none"> <li>• Cinnamon water</li> <li>• Peppermint water</li> <li>• Anise water</li> <li>• Dill water</li> </ul>	Flavoring agent and carminative.
3.	Alcohols	a) Ethanol	Solvent, co solvent for many liquid preparations like elixirs, lotions, liniments.
		b) Glycerin	Solvent, cosolvent for many oral preparations and external preparations.
		c) Sorbitol	Solvent, vehicle for many liquid preparations.
		d) Propylene glycol	Solvent, co solvent and vehicle for many liquid preparations.
4.	Elixirs	<ul style="list-style-type: none"> <li>• Non medicated elixirs</li> <li>• Low alcoholic elixirs</li> <li>• High alcoholic elixirs</li> <li>• Iso-alcoholic elixirs</li> </ul>	Aromatics and vehicles for many oral liquid preparations.
5.	Syrups	<ul style="list-style-type: none"> <li>• Orange syrup</li> <li>• Raspberry syrup</li> <li>• Cherry syrup</li> <li>• Glycyrrhiza syrup</li> <li>• Coca syrup</li> </ul>	Most of the syrups are used as sweetening agent, flavoring agent and vehicles in oral liquid preparations.

## 2. Preservatives:

Sodium benzoate	Salicylic acid
Benzalkonium chloride	Dichlorophenol
Benzoic acid	Methyl paraben
Cetrimide	Phenol
Chloro benzoic acid	Propionic acid
Chloro cresol	Propyl paraben

## 3. Antioxidants (stabilizers):

Ascorbic acid	Sodium bisulphite
Butylated hydroxyl anisole (BHA)	Maleic acid
Butylated hydroxyl toluene (BHT)	Sodium metabisulphite
Citric acid	Sodium sulphite
Cysteine	Sodium thiosulphate
Gallic acid	thioglycerol

## 4. Sweetening agents:

Cyclamates	Maltose
Dextrose(glucose)	Malt extract
D-fructose	Saccharin
Glycyrrhiza glycerin	Sodium saccharin
Glycyrrhiza extract	Sorbitol
Lactose	Sucrose
Tolu balsam	Liquid glucose

## 5. Flavoring agents:

<b>FLAVOURS</b>	<b>OILS</b>	<b>SPIRITS</b>
Banana flavor	Anise oil	Aromatic spirit of ammonia
Cardamom flavor	Caraway oil	Chloroform spirit
Ginger flavor	Clove oil	Compound orange spirit
Orange flavor	Lemon oil	Lemon spirit
Pineapple flavor	Orange oil	Peppermint spirit
Vanilla flavor	Peppermint oil	
Chocolate flavor	Rose oil	

## 2) Coloring agents:

a) Natural colors	Carotene, Chlorophyll, Cochineal, Curcumin, Red and yellow ferric oxide, Titanium dioxide
b) Artificial color	Caramel
c) Coal tar colors <ul style="list-style-type: none"> <li>• blue color</li> <li>• brown color</li> <li>• black color</li> <li>• green color</li> <li>• red color</li> <li>• yellow color</li> <li>• orange color</li> </ul>	Brilliant blue, indigo carmine Resorcin brown Naphthol blue (black) Quinazolinone green, fast green, brilliant green Amaranth, erythrosine Sunset yellow, tartrazine yellow Orange “G”

## 7. Flocculating, suspending and wetting agents:

S. No	Type	Examples	
1.	Flocculating agents	a. Surfactants	Tweens, Spans
		b. Electrolytes	Aluminium Chloride, Potassium Phosphate
		c. hydrophilic polymers	hydrocolloids, bentonite, alginates, carbowaxes, silicates
2.	Suspending and thickening agents	a. natural polysaccharides	Gum acacia, gum tragacanth, guar gum, sodium alginate, starch, xanthan gum
		b. semisynthetic polysaccharides	Methyl cellulose Sodium carboxy methyl cellulose Hydroxyl ethyl cellulose Hydroxyl propyl methyl cellulose Micro crystalline cellulose
		c. inorganic agents	Clays, bentonite, kaolin, aluminium hydroxide
		d. synthetic agents	Colloidal silicon dioxide. Carbomer (carboxy vinyl polymer)
3.	Wetting agents	-----	Alcohol, glycerin, Tragacanth mucilage, sodium alginate, bentonite dispersion, surfactants having HLB value between 7 to 9, sodium lauryl sulphate, sodium dioctyl sulpho succinate

## 8. Emulsifying agents

S.NO	TYPE	EXAMPLES	
1	Natural emulsifying agents	a. From vegetable source	Gum acacia, karaya gum, tragacanth, agar, pectin, starch, alginate, gaur gum, soya bean.
		b. From animal source	Gelatin, egg yolk, casein, lecithin wool fat, serum albumin.
2	Semi-synthetic polysaccharides	-----	Methyl cellulose, carboxy methyl cellulose, sodium carboxy methyl cellulose, hydroxyl propyl methyl cellulose, micro crystalline cellulose
3	Synthetic substances	a. anionic	SLS, polypeptidecondensates, trioyleyl phosphate, sarcosinates, sulfosuccinates, soaps.
		b. Cationic	Alkoxyalkylamines, benzalkonium chloride, cetrimide, benzethonium chloride.
		c. non-ionic	Polyoxyethylene, polyoxyethylene alkyl ethers, polyoxypropylene, sorbitan esters, glyceryl esters, sucrose esters, polyoxyethylene fatty acid esters, macrogol esters and ethers
4	Inorganic substances	----	Magnesium oxide, milk of magnesia, magnesium trisilicate, magnesium aluminium silicate, bentonite.
5	Alcoholic substances	-----	Polyethylene glycols(carbowaxes), cholesterol, lauryl alcohol, lecithin.

**Methods of Preparation:** The following methods are used for the preparation of solutions

- a. Simple dissolution
- b. Solution by chemical reaction
- c. Solution by extraction

**Advantages:**

- The solution is the only form in which a compound can be obtained. Eg: H<sub>2</sub>O<sub>2</sub> solutions
- The Solution is more stable and convenient than the solid component. Eg: Ferric chloride solution
- The solution provides a convenient form for prescribing and dispensing substances

**Disadvantages:**

- Bulk volume of solution to be consumed is high when compound to solids of equivalent dose.
- Cost of solutions per unit dose is relatively high when compared to solids dosage forms. E.g.: Aspirin solution undergoes rapidly hydrolysis compared to aspirin tablets.



**Fig:** Solution Marketed Products

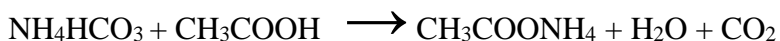
## STRONG AMMONIUM ACETATE SOLUTION

**Aim:** To prepare and submit 100 ml of strong ammonium acetate solution.

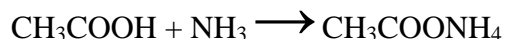
**Requirements:** Glacial Acetic acid, Ammonium bicarbonate, Ammonia solution, Beakers, glass rod, measuring cylinder.

**Category:** Mild expectorant, diaphoretic and diuretic.

**Principle:** Ammonium bicarbonate reacts with glacial acetic acid to give ammonium acetate.



In the above reaction, not all acid is neutralized. Glacial acetic acid which is neutralized with water must be used to produce a solution of derived strength. Ammonia must be used to complete neutralization.



By adding ammonia, the pH of solution is maintained between 7.6 - 8.0. The pH of neutralization is found by mixing one drop of solution with the indicator bromothymol blue and thymol blue separately.

The color which is produced after adding indicator

Bromothymol blue	pH 6	pH 7.6
	Yellow	Blue
Thymol blue	pH 8	pH 9.6
	Yellow	Blue

### Strong Ammonia Acetate Solution Formulation Table:

S. No	Ingredients	Official Formula	Use of Ingredients
1.	Glacial Acetic Acid	45ml	In situ ammonium acetate formation.
2.	Ammonium Bicarbonate	47gm	.....
3.	Ammonia Solution	10 ml	Neutralization
4.	Purified water	q.s. to 100ml	Vehicle

### Procedure:

1. Mix glacial acetic acid with required quantity of purified water and ammonium bicarbonate till it dissolves.
2. Add sufficient quantity of ammonia solution drop by drop until one drop of resulting solution gives full blue color with one drop of thymol blue.
3. After adjusting pH, transfer the solution into measuring cylinder and make up the final volume with purified water.



**Dispensing:** Transfer the solution to a clear or amber colored, narrow mouthed glass bottle, close it thoroughly with metallic screw cap, polish and label.

**Storage:** Store in a closed container at a temperature not exceeding 25°C and protect from sunlight.

**Direction:** 1 to 5 ml daily in divided doses to be taken in two times a day.

**Note:** Diaphoretic a substance that produces or encourages perspiration (sweating).