Physical Pharmacy lab
Lab no. 1:
Concentration Expression

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Introduction

The term "physical pharmacy" stems from the application of physical chemistry principles to the area of pharmacy in the design of drug molecules and drug products.

When the physical chemical and biological properties of drug molecules (i.e. preformulation) are understood, it is possible to design dosage forms for selected routes of administration in humans or animals (i.e., formulation). Collectively, the scientific principles applied in the preformulation and formulation processes is termed "physical pharmacy,"

Lab for this course:

Concentration expression,
Two component systems containing liquid phases,
Three component systems,
The tie – line for three component system,
Partition coefficient, and Buffer solutions.

Pharmaceutical mixtures

True solution

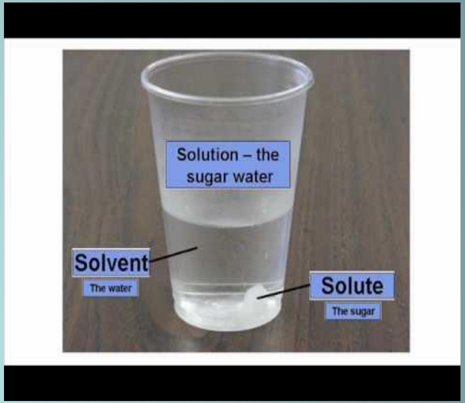
(<1 nm) (one phase system)

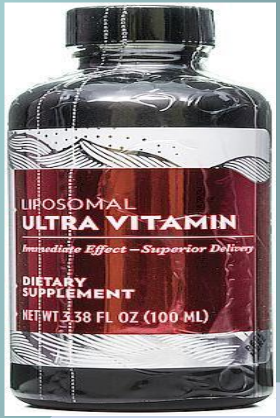
Colloidal dispersion

(1-500 nm) (as liposome, microsphere)

Coarse dispersion

(> 500 nm)(as emulsion and suspension)





- Dispersion :- is pharmaceutical mixture that consist of at least 2phases with one or more dispersed (internal phase)contained in a single continuous (external)phase.

- Phase :-is defined as the homogeneous physically distinct portion of the system separated from other parts of the system by bounding surface .

"True solution will be focused and discussed in this lab. It can be classified according to the states in which the solute and solvent occur,

and because 3 states of matter exist, 9 types

of homogeneous mixtures of solute and

solvent are possible.

Types of Solutions

Solute	**Solvent**	**Example**
Gas	Gas	Air
Liquid	Gas	Water in oxygen
Solid	Gas	Iodine Vapor in air
Gas	Liquid	Carbonated water
Liquid	Liquid	Alcohol in water
Solid	Liquid	Aqueous sodium chloride solution
Gas	Solid	Hydrogen in palladium
Liquid	Solid	Mineral oil in paraffin
Solid	Solid	Gold-silver mixture of alums

Concentration expressions

Expression	Symbol	Definition
Molarity	M,c	Moles(gram molecular weights) of solute in 1 liter of solution.
Normality	N	Gram equivalent weights of solute in 1 liter of solution.
Molality	*m*	Moles of solute in 1000g of solvent.
Mole fraction	*X*,N	Ratio of the moles of one constituent(e.g.; the solute) of a solution to the total moles of all constituents(solute & solvent).
Mole percent		Moles of one constituent in 100 moles of the solution; mole percent is obtained by multiplying mole fraction by 100.
Percent by weight	% w/w	Grams of solute in 100g of solution.
Percent by volume	% v/v	Milliliters of solute in 100mL of solution.
Percent weight-in-volume	% w/v	Grams of solute in 100mL of solution.
Milligram percent	__	Milligrams of solute in 100mL of solution.

examples

Calculate the Molarity of solution containing 4 gm of NaOH in 500 ml solution (M.wt NaOH =40gm)

M = wt./M.wt * 1000/ Vol.(mL)

M=4/40 * (1000/500) ➡ M= 0.2 M

Molality

- Calculate Molality of solution containing 2gm NaOH in 50 gm solvent ?
- Molality = wt /M.wt * 1000/ gms of solvent
- m= 2/40 * 1000/ 50
- m= 1

Q/ How many grams of KI (M.wt=166) are needed to prepare 25ml of 0.75 N solution?

N= wt / eq.wt * 1000/ vol(ml)

0.75= wt / 166 * 1000 / 25

wt = 3.12 gm

Q/ Solution prepared by dissolving 1 mole ethyl alcohol in 3 moles of water. Calculate mole fraction of each one?

Mole fraction = moles of one constituent (solute)/ the total moles of all constituents (solute & solvent)

Mole fraction of ethyl alcohol (X1) =1/1+3 = 1/4 = 0.25

Mole fraction of water (X2) = 3/1+3= 3/4 =0.75 ★(the sum of mole fraction is equal to one)

Mole percent

- 5%w/w NaOH mean 5 gm NaOH in 100 gm solvent
- 10%w/v NaOH = 10 gm NaOH in 100ml solvent
- 15 %v/v NaOH = 15 ml NaOH in 100ml solvent

Q/prepare 25 gm of 4%w/w NaOH?

4gm	100gm
X	25gm

x= 1gm of NaOH with 24 gm of water

Q/prepare 25 ml of 4%w/v NaOH?

4gm	100mL
X	25mL

x= 1gm of NaOH put in volumetric flask then complete the volume to 25 mL

Disadvantages of molarity & normality:

1-changing in value with temperature because of expansion or contraction of liquid so can not be use when studying properties of solution at various temp.

2-because Solvent volume in M&N are not really known it is difficult to study properties such as vapor pressure & osmotic pressure which are related to the conc. of solvent.

↓

(because Molality (m) has not the above disadvantages it is used more likely in theoretical studies more than N & M)

Experimental work:

Materials and equipment:

-NaCl, Na_2CO_3., NaOH, Alcohol, Water.
-Volumetric flasks (50cc), pipettes.

M.Wt of NaCl =58.5
M.Wt of Na_2CO_3 = 106

Density = mass/volume
Density of water =1

Prepare the following solution :

- A. 50 ml of 0.5 M NaCl.
- B . 50 ml of 2N NaCl.
- C. 50 ml of 0.1N Na_2CO_3.
- D. 50 ml of 0.1 M Na_2CO_3.
- E . 50 gm of 2% w/w NaCl solution.
- F. 50 ml of 10% w/v NaOH or NaCl.
- G. 50 ml of 10% v/v alcohol.

Example:

- **A. 50 ml of 0.5 M NaCl.**
- M = wt./M.wt * 1000/ Vol.(mL)
- 0.5M=wt./58.5 * (1000/50mL)
- 20wt=0.5 * 58.5
- wt= 1.46≈ 1.5 gm of NaCl
- And so on for another examples


Thank You