Practical Physical pharmacy/ Lab1

Expression of concentrations in pharmaceutical preparations

Solution, Solvent, and solute

- The simplest solution (sugar + water)
- Which is the solvent and which is solute and why?
- what if adding a water droplet to a bag of sugar?

Solution, Solvent, and solute

- A **solution** is a homogeneous mixture of two or more substances.
- The **solute** is the substance present in a smaller amount
- The **solvent** is the substance present in a larger amount.
- A solution may be gaseous (such as air), solid (such as an alloy), or liquid (seawater, for example)
- What determines the physical state of the solution? The solvent or the solute?(AN)

The concentration of a solution

- What changes the concentration of the solution? And why?
- a/ the solvent
- b/the solute

- Solution concentration law = $\frac{Amount\ of\ solute}{Amount\ of\ solution\ (solute+solvent)}$

- amount here means (mass, volume, moles, equivalents..etc)

Concentration expressions

- Molarity
- Molality
- Normality
- **Ratio :**

1/ Percentage

2/ Strength

The concentration of a solution

- **Molarity** (M): is the number of moles of solute in 1 liter of solution volume

$$M = n\ (mol)/V\ (l)$$

- **Moles**: mass divided by molar mass for the substance

$$n = m\ (g)\ /\ mm\ (g/mol)$$

Q/Calculate number of moles contained in 0.25 g of Benzoic acid?

Q2/Due to temperature effect some favoring percent by mass over Molarity. How?

Molarity (M)

- Calculate the molarity of 0.25 g benzoic acid dissolved in 1.5 l ethanol?

M.wt=122 g/mole

The concentration of a solution

- **Molality** (***m***): is the number of moles of solute in 1 kilogram of solution mass

$$m = \text{n (mol)/m (kg)}$$

Q/Calculate the molality of 0.25 g benzoic acid dissolved in 1.5 kg ethanol?

The normality of a solution

- The **Normality** of a solution expresses the number of equivalents of solute contained in 1 L of solution
- normality of a solution can never be specified without knowledge about how the solution will behave.

- $N = \frac{eq}{V\ (l)}$
- $eq = \frac{n\ (mol)}{\eta}$
- While η is the number of active units in the solute being dissolved.

Example

- Q/Calculate the Normality of (0.024 g) Phosphoric acid in (0.53 l), considering:

$$H_3PO_4 + 2OH^- \rightarrow HPO_4^{2-} + 2H_2O$$

Ratio

- What Is ratio? (A)
- Is a relationship between two quantities
- What is the most common ratio?

Percentage %

- Means how many solute molecules are spreading through 100 molecule of solvent

Percentage by **weight**

- Means how many **grams of** solute are spreading through **100 grams** of solvent

Percentage by **volume**

- Means how many solute **milliliters** are spreading through 100 **milliliters** of solvent

Percentage weight in volume

- Means how many grams of solute spreading through 100 milliliters of solvent

Milligram percent (mg %)

- Means how many solute **milligrams** are spreading through 100 **milliliters** of solvent

The other type of ratio

- The strength of solution: for only one single molecule of solute, how many molecules of solvent are come along with it
- (The number **1** is constant for comparing with others)
- Like 1:50
- Or 1:100
- Or 1:250
- Or 1:500
- Etc…
- Which solution is the most diluted among them?

To compare the two types of ratios together..

- Let us convert one of them to the other
- **Express 0.02% as a strength ratio?**

- **Examples:**

Express 0.02% as strength ratio?

0.02 ⟶ 100
1 part ⟶ x parts

X= 1 * 100 / 0.02 = 5000 parts

So ratio strength = 1: 5000

- **Examples:**

How many grams of dextrose are required to prepare 4000 ml of 5 % solution?

- **Examples:**

How many grams of dextrose are required to prepare 4000 ml of 5 % solution?

5 g ⟶ 100 ml
X ⟶ 4000 ml

X= 4000*5/100 = 200 g

Example:

- **How many grams of potassium permanganate should be used in preparing 500 ml of 1:2500 solution?**

Examples:

How many grams of potassium permanganate should be used in preparing 500 ml of 1:2500 solution?

First convert from ratio to percentage strength

1 part ⟶ 2500 parts
X ⟶ 100 parts

X % = 1* 100/2500= 0.04 parts in 100 parts = 0.04 %

0.04gm ⟶ 100 ml
x ⟶ 500 ml

X = 0.04gm / 100 ml * 500= 0.2 gm

Therefore 0.2 grams of potassium permanganate should be used in preparing 500 ml.

References

- MARTIN'S PHYSICAL PHARMACY AND PHARMACEUTICAL SCIENCES 6th edition
- *Fundamentals of* Analytical Chemistry Douglas Skoog 8th edition