Partition coefficient of succinic acid

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3 rd stage: 1st lab.

Lab. 1

Partition coefficient of succinic acid

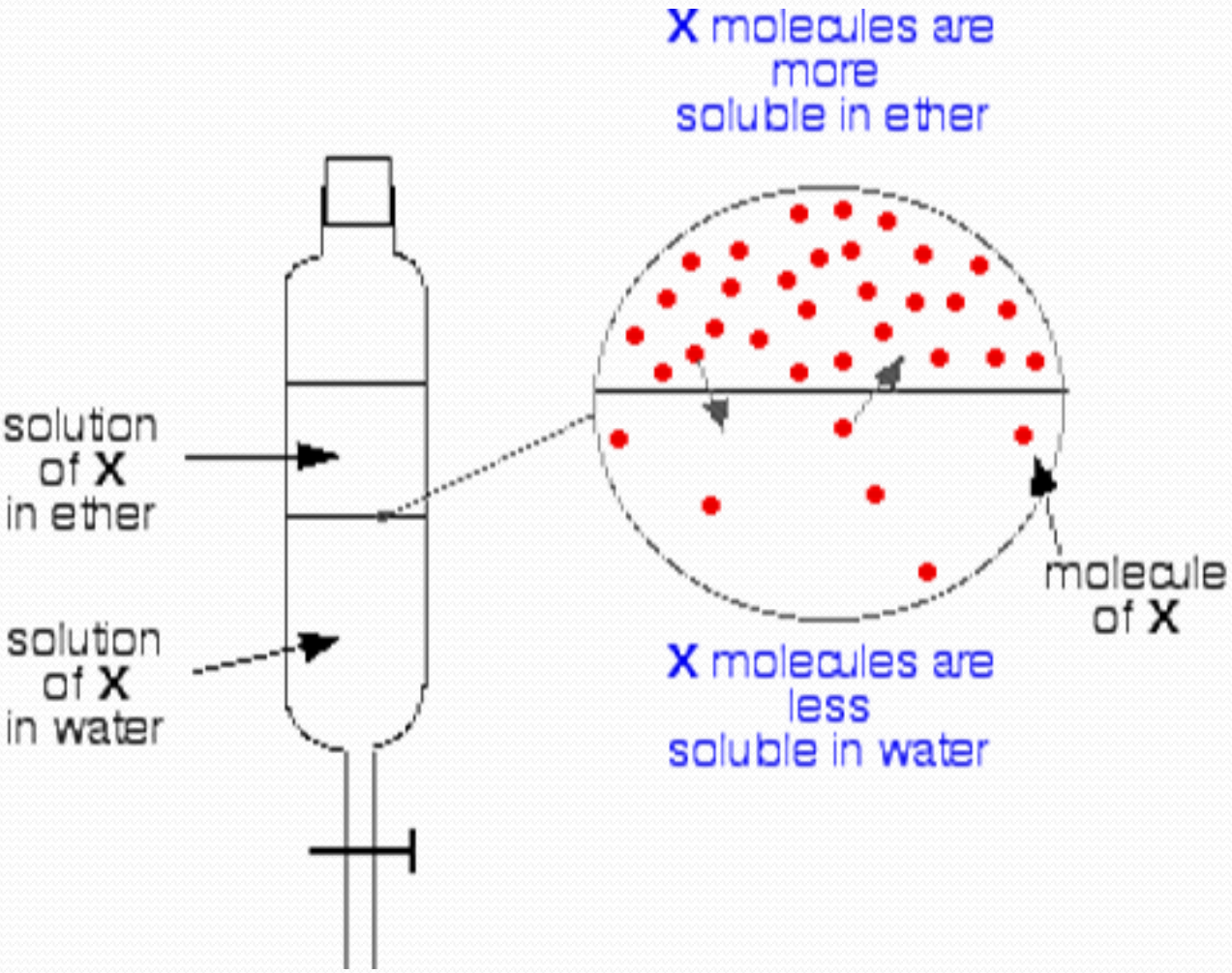
Theory:

Consider a system consisting of two liquid layers (phases) of two immiscible or slightly miscible liquid. If a third substance ,

Which is soluble in both liquids, is added into the system it is found to distribute ,or divide, itself between the two layer in a definite manner .It has been shown experimentally that at equilibrium, at constant temperature ,the ratio of the concentrations in the layers has a definite value. If C1 and C2 are the concentrations of this substance in two layers ,then:

$$K = C_1 / C_2$$

The ratio equal to the constant in equation is referred to the partition constant or partition coefficient (K) or (p).This equation for distribution low can usually be applied only to dilute solution.


X molecules are more soluble in ether
solution of X in ether
solution of X in water
molecule of X
X molecules are less soluble in water

Hence both the partition and distribution coefficient are measures of how hydrophilic ("water-loving") or hydrophobic ("water-fearing") a chemical substance is. Partition coefficients are useful in estimating the distribution of drugs within the body. Hydrophobic drugs with high octanol/water partition coefficients are preferentially distributed to hydrophobic compartments such as the lipid bilayers of cells while hydrophilic drugs (low octanol/water partition coefficients) preferentially are found in aqueous compartments such as blood serum

The most common physicochemical descriptor is the molecules partition coefficient in an octanol/watre system. For example an orally administered drug will go through a series of partitioning steps:

1- Leaving the aqueous extracellular fluids.

2- Passing through lipid membranes.

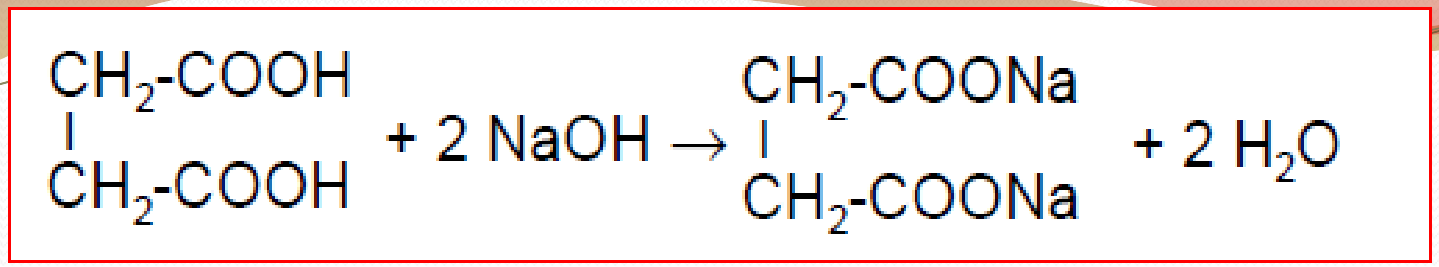
3- Entering other aqueous environments before reaching the receptor.

In this sense, a drug is undergoing the same partitioning phenomenon that happens to any chemical in a separatory funnel containing water and a non- polar solvent as hexane, chloroform, or ether.

Not that there are dynamic changes occurring to the drug ,such as it being metabolized, bound to serum albumin, excreted from the body , and bound to receptor.

The partition coefficient (P) is the ratio of the molar concentration of chemical in the non- aqueous phase (usually 1- octanol) versus that in the aqueous phase, it is one of the main physiochemical properties of drug and is the most important property for determining the distribution and partitioning of a drug through the lipid bilayer.

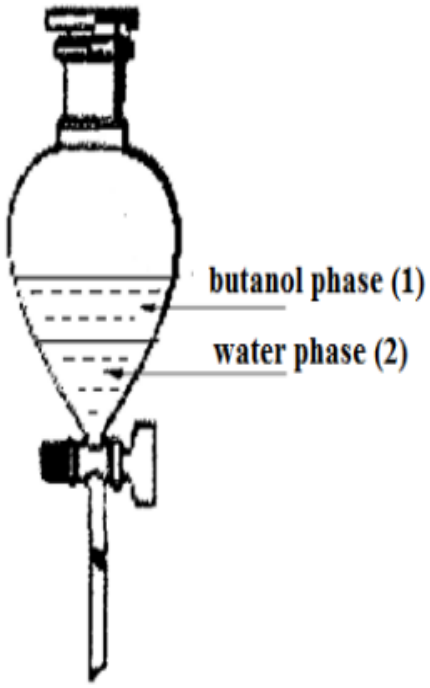
$$k = \frac{c_{Org}}{c_{Wat}}$$



❖Succinic acid is a carboxylic (diprotic acid),process of titration is based on the neutralization reaction.

Procedure:

Funnel no.	Succinic acid solution,ml (Butanedioic acid)	Water, ml	1-Butanol, ml
1	20	0	15
2	15	5	15
3	10	10	15
4	5	15	15



1.Prepare 4 mixtures of butanol, water and succinic acid into separation funnels (Figure above), following Table above.

2. Shake gently the separating funnels with prepared solutions for 20 min.

3. Put them to the holders and wait a few minutes until the mixture is apparently separated into two clear layers: lower layer is water (Wat), and upper layer is butanol (Org).

4. Pour carefully the water phase into a beaker using the funnel's valve.

5 .Transfer the water solution from the beaker into two titrimetric flasks, 5 ml per flask, using a pipete with volume (5 ml)

6. Add 1 drop of phenolphthalein.
7. Fill a burette with a standard solution of NaOH (titrant) and perform titration.
8. When the endpoint of titration has been reached, read the used volume of the titrant (NaOH) from the burette (V_T). Write it down to the Table below .
9. Repeat the procedure for funnels 2 – 4.
10. Proceed in the same way the upper layer (butanol) of the mixtures in the funnels 1 – 4.

No.	Volume of titrant V_T (ml)						c_{Org} (M)	c_{Wat} (M)	k
	1-butanol			water					
	I.	II.	Mean	I.	II.	Mean			

Calculation:

- Calculate the average volume of titrant for the same solution, write it in table.
- Calculate the concentration of Succinic acid in the aqueous layer.
- Calculate the concentration of Succinic acid in the organic layer(1-Butanol)
- Calculate the partition coefficient K of Succinic acid at each composition of partition mixture according to the Equation:

$$k = \frac{c_{Org}}{c_{Wat}}$$

Express the average value of the partition coefficient (k) from four experiments and the appropriate standard deviation (s) using Equation :

$$s = \sqrt{\frac{\sum_{i=1}^{N} (k_i - \bar{k})^2}{N - 1}}$$

where: k_i – partition coefficient in funel number i = 1; 2; 3 and 4

$\bar{k}$ – average value from 4 calculated partition coefficients

N – the number of measurements