وزارة التعليم العالي والبحث العلمي

كلية المستقبل الجامعة

قسم الصيدلة

مختبر الصيدلة الفيزياوية / المرحلة الثانية

EXP 4

Determination of Distribution Coefficient

The purpose of the experiment:

To determine the distribution coefficient of iodine between carbon tetrachloride and water.

Principle:

When a dissolved solid is distributed between two immiscible liquids/ solvents, the ratio in which it distributes is called distribution coefficient or partition coefficient. If the solute is in same molecular condition in both the solvents, the distribution coefficient is constant and is depended on temperature. This is also known as partition coefficient.

When a substance is distributed between two immiscible solvent A and B,

$$Distribution\ coefficient = \frac{concentration\ of\ substance\ in\ A}{concentration\ of\ substance\ in\ B}$$

In pharmaceutical sciences, the organic solvent and water system is important.

The distribution or partition coefficient can be expressed as between organic phase and water, or between water and organic phase.

Though concentration of substance in organic and water phase needs to be mentioned in molar concentration, as distribution coefficient is a ratio term, the units get nullified. The concentration can thus be expressed in any unit, if the solute is in the same molecular state in both the phases.

The molecular state of iodine in both the solvents: carbon tetrachloride, and water is same.

Apparatus and Materials Required:

Stoppered bottles, carbon tetrachloride, water, iodine, std. N/10 sodium thiosulphate solution, potassium iodide, starch, pipettes and burettes.

Process:

a- Distribution of Iodine in two phases:

1- A nearly saturated solution of iodine in 150 ml carbon tetrachloride is prepared in beaker by adding few crystals of iodine to carbon tetrachloride and stirring with a glass rod.
2- The following mixture of iodine solution in carbon tetrachloride and water are prepared in three glass- stoppered bottles:

Bottle number	Volume of pure carbon tetrachloride, ml	Volume of iodine solution in carbon tetrachloride, ml	Volume of water , ml
1	20	0	200
2	15	5	200
3	10	10	200

3- After tightening the stopper, the bottles are shaken vigorously for few hours, at frequent intervals of 1 to 2 minutes the stoppers are removed to release pressure.
4- The bottles are then kept undisturbed allowing the liquids to separate into two layer. The lower layer is carbon tetrachloride, and the upper one is that of water.
(Note: the separating funnels can also be used in place of glass stoppered bottles).

b- The determination of Iodine concentration in two phases:

1- 50 ml of aqueous layer is pipetted out from first bottle into conical flask containing about 5 ml 10 % potassium iodide solution and 1 ml starch solution (taking care that the tip of the pipette is above the interface in order to prevent any carbon tetrachloride getting into the pipette). It is then titrated against 100/N sodium thiosulphate solution.
2- 5 ml of carbon tetrachloride layer is pipetted out into a conical flask containing 20 ml of 10 % potassium iodide solution and 1ml

starch solution as indicator. It is then titrated against std. 10/N sodium thiosulphate.

(While titrating the organic layer “carbon tetrachloride”, the titration flask must be shaken continuously; the otherwise the end point may cross without appearance of purple color of non – aqueous layer)

Similarly 5 ml of carbon tetra chloride layer is withdrawn from other bottles and titrated.

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