Ex. 1: Extraction, Determination of Distribution Coefficient

**Objective:** To calculate the Distribution coefficient \( D_c \) of benzoic acid in dichloromethane.

**Extraction** is a separation technique frequently employed in the laboratory to isolate one or more components from a mixture.

**Distribution coefficient** \((D_c)\) is the ratio of concentrations of a compound in the two phases of a mixture of two immiscible solvents at equilibrium. Hence these coefficients are a measure of differential solubility of the compound between these two solvents.

\[
D_c = \frac{[A]_o}{[A]_w} = \frac{\text{Molar concentration of Solute in Organic layer}}{\text{Molar concentration of Solute in water layer}}
\]

In this experiment benzoic acid distributed between water and other organic solvents like dichloromethane (CHCl\(_2\)).

**Procedure:**

**Part 1**

1. Prepare 0.05 \( M \) solution of benzoic acid in water and prepare 0.02 \( M \) solution of sodium hydroxide (NaOH).
2. Add 20 mL of the aqueous benzoic acid solution in a separatory funnel then add 15 mL dichloromethane (DCM). Shake and drain off the lower DCM layer.
3. Titrate the aqueous layer of benzoic acid (which remaining in separatory funnel) with NaOH. Use phenolphthalein as indicator, then record End point in your lab report.

**Part 2**

1. Repeat same procedure but add 5 ml of dichloromethane CHCl\(_2\) three times in each time you have to drain off the lower part (CHCl\(_2\)). Then titrate the remaining aqueous layer of benzoic acid in separatory funnel with NaOH. Use phenolphthalein as indicator, then record End point in your lab report.
2. Compare the actual amount of benzoic acid remaining in aqueous layer with what you expect from the \( D_c \) calculation.

**Calculations:**

\[
M = \text{mol/L} = \frac{\text{mmol/mL}}{\text{mL}} \quad \text{mmole of unextracted} = \text{mL} \times M
\]

\[
D_c = \frac{(\text{mmoles A})_o \times VW}{(\text{mmoles A})_w \times VO}
\]

\[
D_c = D_m \frac{Vw}{Vo}
\]

\[
D_c = D_m
\]

\[
F = \frac{1}{(Dm + 1)n}
\]

\[
% E = 100 \left[ 1 - \frac{1}{(Dm + 1)n} \right]
\]
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Title of Experiment:

1. Objective:

2. Materials:
   1. Chemicals:
   2. Glassware's:
   3. Devices:

3. Procedure:

4. Calculations:

Student's Name:
Student's No.
5. Observations and Results

6. Conclusion: