

pH curve

Equivalence point when $[\text{OH}^-] = [\text{H}_3\text{O}^+]$

$$\text{pH} = \log_{10}[\text{H}_3\text{O}^+]$$

Henderson-Hasselbach equation:

$$\text{pH} = \text{p}K_a + \log_{10} \left(\frac{[\text{A}^-]}{[\text{HA}]} \right)$$

$\text{pH} = \text{p}K_a$ at half equivalence point

Procedure:

- Standardize NaOH ($N_1V_1 = N_2V_2$)
- Titrate weak acid with NaOH
- Equivalence point: Peak of $\frac{\Delta \text{pH}}{\Delta V}$

Hardness of water

Secondary standard : EDTA Indicator used : **Erichrome Black T (EBT)**

Initial color : **Red wine** due to cations in the analyte

Intermediate color : **Purple**

Final color : **Bright blue** due to free EBT , Ca^{2+} chelated with EDTA

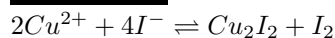
Procedure:

- Standardize EDTA
- Titrate EDTA with CaCO_3

$$\text{Hardness in ppm} = \left(\frac{0.1 \cdot x \cdot y}{m} \right) \cdot 10^6$$

x = Volume of EDTA ; y = Molarity (M) of EDTA

m = Mass of water sample (gm)

Iodometry

Forward shifted rxn. due to continuous removal of Cu_2I_2 (insol. complex)

I_2 liberated titrated against **hypo** with starch as indicator Sources of error:

- Aerial oxidation: $4\text{I}^- + 4\text{H}^+ + \text{O}_2 \rightleftharpoons 2\text{I}_2 + 2\text{H}_2\text{O}$
Minimized by addition of Na_2CO_3 to remove O_2 .
- Volatility of I_2 : $\text{I}^- + \text{I}_2 \rightleftharpoons \text{I}_3^-$
Solved by adding excess I^-

Dibenzalacetone

Final product: β -hydroxy aldehyde/ketone (aldol)

Dehydration is usually exothermic

Benzaldehyde: Best reagent for cross aldol rxn (no α -hydrogens \therefore single product)

Procedure:

- Synthesis of dibenzalacetone
- Recrystallization

Simple stoichiometry/aldol mechanism problems.

Schiff's base ligand

Aldehydes + Amines = Schiff's base (mild conditions)

Schiff's base ligand formed: **Salen's ligand** (Mol. wt = 268.31 gm/mol)

The above ligand is further grinded with

$\text{Cu}(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ to obtain a **Cu(II)** complex

Color of grinded product : **Bright Yellow**

Kinetics

Pseudo 1st order reaction (rate constant = k')

$$-\frac{d[\text{I}_2]}{dt} = k'[\text{I}_2]^x$$

$k' = k[\text{CH}_3\text{COCH}_3]^y[\text{H}^+]^z$ where the concentration terms are approximately constant

$T = \frac{I}{I_0}$ where T is the transmittance and I , I_0 are the intensities of reflected and transmitted lights respectively

$A = -\log_{10} T = \log_{10} \left(\frac{I_0}{T} \right)$, where A is the absorbance of the sample

Beer-Lambert law : $A = \epsilon cl$ where ϵ is the molar absorption coefficient (characteristic of absorbing species) and l is the length of sample through which light passes

Optical density : ϵc

I_3^- : Brownish red species I_2 , I_3^- : Iodinating agents

Equilibrium constant

$$K_c = \frac{[\text{CH}_3\text{COOC}_2\text{H}_5][\text{H}_2\text{O}]}{[\text{CH}_3\text{COOH}][\text{C}_2\text{H}_5\text{OH}]}$$

Acid catalyzed reaction

Procedure:

- Standardize NaOH solution ($N_1V_1 = N_2V_2$); (Phenolphthalein indicator)
- Standardize HCl solution (Phenolphthalein indicator)

Conductometry

Resistance $R = \rho \frac{l}{A}$, where l = distance b/w electrodes and A = area of electrodes

$$\text{Conductance } \Lambda = \frac{1}{R}$$

$$\text{specific conductance } \kappa = \frac{1}{\rho} = \frac{1}{R} \cdot \frac{l}{A}$$

$$\text{Cell constant} = \frac{l}{A}$$

AC current should be used, because a DC current applied to an electrolyte produces a **back EMF**, opposing current flow

$$\text{Equivalent conductance } (\Lambda_c) = \frac{1000\kappa}{C}$$

$$\text{Degree of dissociation } (\alpha) = \frac{\Lambda_c}{\Lambda_0}$$

$$\text{Dissociation constant } (K_a) = \frac{C\alpha^2}{1-\alpha}$$

Where C = concentration of solution, Λ_0 = conductance at infinite dilution

Saponification

Saponification : Triglycerides + $[\text{OH}^-]$ \rightarrow Glycerol + Soap

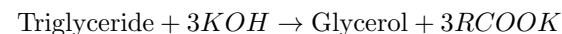
Saponification value : Number of mg of KOH required to neutralize fatty acids resulting from **complete** hydrolysis of 1g of fat

Used for studying **length of fatty acid chain**

$$\text{Saponification value} \propto \frac{1}{\text{Av. molecular weight}}$$

$$\text{Saponification value} \propto \frac{1}{\text{Length of fatty acid chain}}$$

Reaction:



RCOOK = Soap molecule