

Name: Chandra Shekhar

College: IIT Gandhinagar

Subject: Chemistry

Weightage: Regular

Title: Practical Organic Chemistry

Principles Related to Practical Chemistry

Identification of Acidic Radicals

Group	Reagent Used	Radicals Detected	Observations
1	Dilute H_2SO_4 or HCl	CO_3^{2-}	Effervescence in cold, releasing colorless, odorless gas.
		SO_3^{2-}	Colorless gas with choking smell of burning sulfur.
		S^{2-}	Rotten egg smelling gas evolved.
		NO_2^-	Light brown gas released.
		CH_3COO^-	Vapors with vinegar-like smell.
2	Conc. H_2SO_4	Cl^-	Colorless, pungent gas that fumes in air.
		Br^-	Brown fumes intensified by MnO_2 .
		I^-	Violet fumes intensified with MnO_2 ; black residue forms.
		NO_3^-	Light brown gas with pungent odor; intensified with copper.
		$C_2O_4^{2-}$	Colorless gas turns lime water milky; extinguishes flame.
3	No specific reagent	SO_4^{2-}	No gas formed; gives white ppt. with $BaCl_2$.
		PO_4^{3-}	No gas; yellow ppt. with ammonium molybdate.

Identification of Basic Radicals

Group	Reagent Used	Radicals Detected	Observations
0	NaOH	NH_4^+	Pungent ammonia gas evolves.
1	Dil. HCl	Pb^{2+}, Ag^+, Hg_2^{2+}	White precipitates observed.
2	H_2S in dilute HCl	$Cu^{2+}, Cd^{2+}, Bi^{3+}$, etc.	Yellow, brown, black precipitates form.
3	NH_4Cl + NH_4OH	$Fe^{3+}, Al^{3+}, Cr^{3+}$	Reddish brown, white, green precipitates.
4	H_2S in NH_4Cl + NH_4OH	$Ni^{2+}, Co^{2+}, Mn^{2+}$	Buff, white, black precipitates.
5	$(NH_4)_2CO_3$ with NH_4Cl + NH_4OH	$Ba^{2+}, Sr^{2+}, Ca^{2+}$	White precipitates formed.
6	—	Mg^{2+}, Na^+, K^+	No precipitate with group 5 reagent.

Elemental Analysis in Organic Compounds

Detection of Carbon and Hydrogen

Organic compound is heated with copper(II) oxide. CO_2 turns lime water milky; H_2O turns anhydrous $CuSO_4$ blue.

Lassaigne's Test (N, S, Halogens)

- Organic sample fused with sodium to form ionic compounds.
- Extract dissolved in water = Sodium Fusion Extract (SFE).
- **Nitrogen:** Boil SFE with $FeSO_4$ and $NaOH$, then acidify with HCl and add $FeCl_3$. Prussian blue confirms N.
- **Sulphur:**
 - Violet with sodium nitroprusside.
 - Black ppt. with lead acetate.
- **Halogens:** Acidify SFE with HNO_3 and add $AgNO_3$.
 - White ppt. soluble in NH_4OH = Cl.
 - Pale yellow, slightly soluble = Br.
 - Yellow, insoluble = I.

Phosphorus Detection

Oxidize organic sample with Na_2O_2 , extract with water, add conc. HNO_3 and ammonium molybdate. Yellow ppt. confirms P.

Functional Group Tests

Unsaturation

- **Bromine Water:** Decolorized if double/triple bond present.
- **Baeyer's Test:** Alkaline $KMnO_4$ decolorized by unsaturation.

Alcohols

- **Ester Test:** Fruity smell confirms -OH.
- **Sodium Test:** H_2 gas evolved.
- **Lucas Test:** Turbidity rate distinguishes 1°, 2°, 3° alcohols.

Phenols

- **Ferric Chloride:** Violet, green, or blue complex.
- **Litmus:** Turns blue litmus red.

Aldehydes

- **Tollens' Reagent:** Silver mirror formed.
- **Fehling's Solution:** Brick red precipitate.

Ketones

- **2,4-DNP:** Yellow/orange ppt.
- **Sodium Nitroprusside:** Red coloration.

Carboxylic Acids

- **Litmus:** Blue to red.
- $NaHCO_3$: Effervescence of CO_2 .

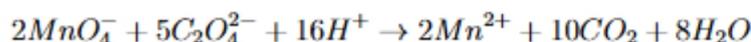
Amines

- **Carbylamine Test:** Primary amines form foul isocyanide.
- **Azo Dye Test:** Aromatic primary amines give orange-red dye.

Volumetric Titrations

Oxalic Acid vs. $KMnO_4$

In acidic medium, oxalic acid reduces $KMnO_4$ at 60-70°C.



Example: 20 mL oxalic acid uses 25 mL of 0.05 M $KMnO_4$. Molarity = $\frac{25 \times 0.05 \times 5}{20 \times 2} = 0.156$
M. Mass = $0.156 \times 126 = 19.656$ g/L.

Mohr Salt vs. $KMnO_4$

Mohr salt ($FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$) titrated with $KMnO_4$.



Molar ratio = 1:5.

