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Matric Number - 19/MHS06/014
Course Code - CHM 102

i) $HCOOH$ - Methanoic acid
ii) $HOOCCH_2CH_2CH_2COOH$ - Pentan-1,5-dioic acid
iii) $CH_3CH_2CH_2COOH$ - Butanoic acid
iv) HO_2C-CO_2H - Ethanedioic acid
v) $CH_3[CH_2]_4COOH$ - Hexanoic acid
vi) $CH_3CH=CHCH_2CH_2COOH$ - Hex-4-eneoic acid

2) Physical appearance

All simple aliphatic carboxylic acids up to C_{10} are liquids at room temperature while other carboxylic acids are solid at room temperature but anhydrous carboxylic acid [acetic acid] also known as glacial ethanoic acid freezes to an ice-like solid below the room temperature.

ii) Boiling point

Boiling point increases with increase in relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than the aliphatics of comparable relative molecular mass.

iii) Solubility

Low molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water and it is due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids decreases with increasing relative molecular mass because the structure becomes relatively more hydrocarbon in nature and hence covalent but all carboxylic acids are soluble in organic solvents.

3c] From ethanal

Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanal to ethanoic acid using manganite(II) ethanoate catalyst and ethanal itself is obtained from ethylene.

$$HC\equiv CH \xrightarrow{dil.\ H_2SO_4/HgSO_4} CH_3CHO \xrightarrow[\text{Manganite(II) ethanoate catalyst}]{O_2/(CH_3COO)_2Mn} CH_3COOH$$

Ethyne → Ethanal → Ethanoic acid

ii] From Petroleum

Liquid Phase air oxidation of C_5-C_7 alkanes, obtainable from petroleum at high temperature and pressure will give C_5-C_7 carboxylic acids with methanoic, propanoic and butenedioic acids as by-products.

$$C_5-C_7 \xrightarrow{O_2/\text{High Temp. \& Pressure}} C_5-C_7 \text{ carboxylic acids}$$

4i] Oxidation of Primary alcohols and aldehydes

These can be used to prepare carboxylic acids using the usual oxidizing agents [i.e $K_2Cr_2O_7$ or $KMnO_4$] in acidic solution.

$$RCH_2OH \xrightarrow{[O],\ \text{excess acid}/KMnO_4} RCHO \xrightarrow{[O]} RCOOH$$

(ii) Carbonation of Grignard reagent

Aliphatic carboxylic acids are obtained by bubbling carbon(iv)oxide into the Grignard reagent and then hydrolyze with dilute acid.

$RMgBr + CO_2 \xrightarrow{(C_2H_5)_2O} RCOOMgBr \xrightarrow{H_2O/dil\ acid} RCOOH + MgBrOH$

R may be 1°, 2°, 3°, aliphatic alkyl or aryl radical

To prepare benzoic acid, the reagent is added to solid carbon(iv)oxide (dry ice) which also serves as coolant to the reaction mixture.

$C_6H_5MgBr + CO_2 \xrightarrow{(C_2H_5)_2O} C_6H_5COOMgBr \xrightarrow{H_2O/H^+} C_6H_5COOH + MgBrOH$

(iii) Hydrolysis of nitriles (cyanides) or esters

$RCN + 2H_2O \xrightarrow{H^+} RCOOH + NH_4^+$

(R = alkyl or aryl radical)

$RCOOR' \xrightarrow{H_2O/H^+\ reflux} RCOOH + R'OH$

$C_6H_5CH_2CN + 2H_2O \xrightarrow{H^+} C_6H_5CH_2COOH + NH_4^+$

$CH_3CH_2COOCH_3 \xrightarrow{H_2O/H^+\ reflux} CH_3CH_2COOH + CH_3OH$

5) Reduction to primary alcohol

$4RCOOH + 3LiAlH_4 \xrightarrow{(CH_3)_2O} [RCH_2O]_4AlLi + 2LiAlO_2 + 4H_2$

$\downarrow 4H_2O$

$4RCH_2OH + Al(OH)_3 + LiOH$

$CH_3CH_2CH_2COOH \xrightarrow{LiAlH_4} CH_3CH_2CH_2CH_2OH$

Butanoic acid — Butanol

ii) Decarboxylation - Thermal decarboxylation

$CH_3CH_2CH_2COONa + NaOH \xrightarrow{fuse} CH_3CH_2CH_3 + Na_2CO_3$

Kolbe Synthesis

$2CH_3CH_2COONa + 2H_2O \xrightarrow{electrolysis/aq.\ CH_3OH} CH_3[CH_2]_2CH_3 + CO_2(anode) + 2NaOH + H_2(cathode)$

iii) Esterification

$CH_3CH_2CH_2COOH + CH_3CH_2CH_2OH \xleftrightarrow{H^+} CH_3CH_2CH_2COO\,CH_2CH_2CH_3 + H_2O$