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MATRICULATION NUMBER- 19/ENGO5/035

DEPARTMENT- Mechatronics Engineering

COURSE CODE- CHM102

1.

• HCOOH

Formic acid

• HOOCCH2CH2COOH

Butandioc acid

• CH3CH2CH2COOH

Butanoic acid

• HO2CCO2H

Ethandioc acid

• CH3CH2CH2CH2CH2COOH

Hexanoic acid

• CH3CH=CHCH2CH2COOH

Hex-2-enoic acid

2.Physical appearances: All simple aliphatic carboxylic acids up to C10 are liquids at room

temperature. Most other carboxylic acids are solid at room temperature although anhydrous

carboxylic acid(acetic acid) also known as glacial ethanol acid freezes to an ice-like solid

below the room temperature

• Boiling points: Boiling point increases with increasing relative molecular mass. Aromatic

carboxylic acids are crystalline solids and have higher melting points than their aliphatic

counterparts of comparable relative mass

• Solubility: Lower molecular mass carboxylic acids with up to four carbon atoms in their

molecules are soluble in water; this largely due to their ability to form hydrogen bonds with

water molecules. The water solubility of the acids decreases as the relative molecular mass

1. increase because the structure becomes relatively more hydrocarbon in nature and hence

covalent. All carboxylic acids are soluble in organic solvents.

3. INDUSTRIAL PREPARATIONS OF CARBOXLIC ACID

• From Carbon(II) oxide

Methanoic acid(formic acid) is manufactured by adding carbon(II)oxide under pressure to

hot aqueous solution of sodium of sodium hydroxide. The free carboxylic acid is liberated by

careful reaction with tetraoxosulphate (VI) acid (H2SO4).

CO — HCOONa. — HCOOH + NaHS04

NaOH H2SO4 Methanoic acid

• From ethanol: Ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5%

solution of ethanal to ethanoic acid using manganese (II) ethanoate catalyst. Ethanal itself is

obtained from ethylene.

HC = CH —CH3HO. — CH3COOH

(Dil.H2SO4/HgSO4) (O2) (ethanoic acid)

• From petroleum: Liquid phase air oxidation of C5-C7 alkanes, obtainable from petroleum

at high temperature and pressure will C5-C7 carboxylic acids with methanoic, propanoic

and butanedioc acids as by-products. C5-C7 —

C5-C7carboxylicacids (O2/High temp. & preessure)

4. SYNTHETIC PREPARATIONS PF CARBOXYLIC

ACIDS

• Oxidation Of Primary Alcohols And Aldehydes: Oxidation of primary alcohols and aldehydes

can be used to prepare carboxylic acids using the usual oxidizing agents like K2Cr2O7 or

KMno4 in acidic solution

CH3CH2CH2OH— CH3CH2CHO — CH3CH2COOH

([O], excess acid) ([O])

• Carbonation Of Grignard: Aliphatic carboxylc acids are obtained by bubbling carbon (IV)

oxide into Grignard reagent and then hydrolysis with dilute acid

CH3CH2MgBr + CO2 — CH3CH2COOMgBr

(C2H5)2 |(H2O/dil. acid)

CH3CH2COOH + MgBrOH

In the preparation of benzoic acid, the reagent is added to solid carbon (IV) oxide (dry ice)

which also also serves as coolant to the reaction mixture.

C6H5MgBr + CO2 — C6H5COOMgBr

(C2H5)2O |H20/H+

C6H5COOH + MgBrOH

• Hydrolysis Of Nitriled (cyanides) or esters.

CH3CH2CN + 2H2O — CH3CH2COOH + NH4+

(R=ally or Daryl radical)

CH3CH2COOCH — CH3CH2COOH + CHOH

(H2O/H+ reflux)

5.Reduction of carboxylic acid: Carboxylic acids are very difficult to reduce by catalytic

hydrogebation or dissolving metals but lithium tatrahydidoluminate (III) and diborane form

intermediate compounds with the acids which liberate the alcohol on hydrolysis.

4CH3CH2COOH + 3LiAlH4

|

(CH3CH2CH2O)4AlLi +2LiAlO2 + 4H2

| (H2O)

4CH3CH2OH + Al(OH)3 1 LiOH

CH3CH2CH2COOH — CH3CH2CH2CH2OH

Butanoic acid (LiAlH4) Butanol

• Decarboxlation: This involves removal of the carboxyl group from the acid to give a hydrogen

or its derivative.

Thermal decarboxylation: Carboxylic acid with strong electron attracting group for

example -COOH, -CN, -NO2, -C=O decarboxylate readily on heating to 100-150⁰C while others

decarboxylate when their salts are heated with soda lime.

CH3CH2CH2COOHNa + NaOH

|fuse

CH3CH2CH3 + Na2CO3

Kobe synthesis

2CH3CH2COONa + 2H2O

|electrolysis/aq. CH3OH CH3(CH2)2CH3 + CO2 +2NaOH + H2

(anode) (cathode)

• Esterification: In the presence of strong acid catalyst, carboxylic acids react with alcohols to

form esters. CH3CH2CH2COOH + CH3CH2CH2OH

| H+

CH3CH2CH2COOCH2CH2CH3 + H20