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Pharmacy

CHM 102

ASSIGNMENT ON CARBOXYLIC ACIDS

1. IUPAC NAMES OF GIVEN ORGANIC COMPOUNDS

HCOOH- Methanoic acid

HOOCCH2CH2CH2COOH- Pentan-1, 5-dioic acid

CH3C H2C H2C OOH- Butanoic acid

HO2C -CO2H - Ethanedioic acid

CH3( CH2) 4C OOH- Hexanoic acid

CH3C H=CHCH2C H2C OOH- Hex-4-enoic acid

2.PHYSICALPROPERTIESOF CARBOXYLICACIDS

i. Physical appearance: 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 ethanoic acid freezes to an ice-like solid below the room temperature.

ii 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 molecular mass.

iiiSolubility: 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 increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvents.

3 INDUSTRIAL PREPARATIONS OF CARBOXYLIC ACIDS

1. Carbonylation of alcohols as illustrated by the cativa process for the production of acetic acid. Formic acid is prepared by a different carbonylation pathway, also starting from methanol.
2. Fermentation of ethanol: this method is used in the production of vinegar

C2H5OH + O2 -——-> CH3COOH + H2O

4 SYNTHETIC PREPARATION OF CARBOXYLIC ACIDS

I. Oxidation of primary alcohols and aldehydes O2 /(CH3 COO)2M n

Oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents (i.e K2C r2O 7 O R KMnO4) in acidic solution. RCH2O H [O], excess acid/ KMnO4 RCHO [O] RCOOH

II. Carbonation of Grignard reagent

Aliphatic carboxylic acids are obtained by bubbling carbon (IV) oxide into the Grignard reagent and then hydrolyzed with dilute acid RMgBr + CO2 (C2H 5) 2O RCOOMgBr H2O /dil. acid RCOOH + MgBrOH R may be 10 , 20 , 30 aliphatic alkyl or aryl radical.

III. Hydrolysis of nitriles (cyanides) or esters

RCN + 2H2O H+ RCOOH + NH4+

(R=alkyl or aryl radical) RCOOR` H2O /H+ reflux RCOOH + R`OH

5.CHEMICAL REACTIONS OFCARBOXYLICACIDS

I Reduction to primary alcohol

4RCOOH + 3LiAlH4

(C2H 5) 2O (RCH2O )4A lLi + 2LiAlO2 + 4H2 | 4H2O

4RCH2O H + Al(OH)3 + LiOH L iAlH4 CH3C H2CH 2C H2OH

CH3C H2C H2C OOH

ii Decarboxylation

This involves removal of the carboxyl group from the acid to give a hydrocarbon or its derivative

Thermal decarboxylation

butanol

Carboxylic acids with a strong electron attracting group e.g –COOH, -CN, NO 2, C=O decarboxylate readily on heating to 100-1500 c while others decarboxylate when their salts are heated with soda lime CH3C H2C H2C OONa + NaOH fuse CH3C H2C H 3 + Na2C O3

Kolbe synthesis

2CH3C H2C OONa + 2H2O electrolysis/aq. CH3O H CH 3( CH2) 2C H3 + CO2(anode) + 2NaOH + H 2(cathode)

iii Esterification

In the presence of strong acid catalyst, carboxylic acids react with alcohols to form esters

CH 3CH 2CH 2COOH +CH 3CH 2CH 2OH H +