ALIPHATIC NITROGEN COMPOUNDS

DIAMIDE

UREA (CARBAMIDE)

- $HN2CONH_2$
- DIAMIDE OF CARBONIC ACID
- Decomposition proteins
- Occurs in urine
- First laboratory method is synthesised by Wholer(1828)

preparation

- From urine
- Wholer’s syntheis
- Laboratory method
- manufacture

From urine

- By evaporating it to a small bulk
- Nitrate is added to precipitate sparingly soluble urea nitrate
- $NH_2CONH_2.HNO_3$
- Liberation with barium carbonate.
- $2OC(NH_2)_2.HNO_3 + BaCO_3 \rightarrow 2CO(NH_2)_2 + Ba(NO_3)_2 + CO_2 + H_2O$

Wholer's synthesis

- Evaporating the solution of potassium cyanate and ammonium sulpate
- Ammonium cyanate is formed
- It undergoes molecular rearrangement
- $NH_4CNO \rightarrow NH_2CONH_2$

Laboratory method

- By the action of ammonia on carbonyl chloride or ethyl carbonate.

Manufacture

- By partial hydrolysis of cyanamide
- Cyanamide is obtained from calcium cyanamide.

- By allowing liquid carbon dioxide and liquid ammonia to interact in an autoclave when ammonium carbamate is formed.
- heated to 400-450 K under 35 atmosphere pressure to give urea in abour 40 percent yeils.

- $CaC_2 \rightarrow CaNCN \rightarrow H_2NCN \rightarrow NH_2CONH_2$
- $2NH_3 + CO_2 \rightarrow NH_2COONH_4 \rightarrow NH_2CONH_2 + H_2O$

properties

physical properties

- ❖ colourless, odourless solid in water and alcohel
- ❖insoluble in ether.

chemical properties

- ❖ basic nature
- ✓ neutral but it behves as if it were a very weal momoacid base.
- ✓ concentrated solution of urea reacts with strong nitric acid as well as concentrated solution of ocalic acid to give sparinglu soluble urea nitrate $CO(NH_2)_2.HNO_3$ and urea oxalate $[CO(NH_2)_2]_2.H_2C_2O_4$ respectively.

- ❖ biureat reaction
- ✓ when heated gently, urea loses a molecule of ammonia to give biuret.

$$NH_2CONH_2 + NH_2CONH_2 \rightarrow NH_2CONHCONH_2$$

❖Reaction with nitrous acid

urea reacts with nitrous acid with liberation of nitrogen and carbon dioxide.

$$NH_2CONH_2 + 2HNO_2 \rightarrow H_2CO_3 + 2N_2 + 2H_2O$$

$$H_2CO_3 \rightarrow CO_2 + H_2O$$

- Hydrolysis

  on boiling with aqueous alkalis or acids or water under pressure urea hydrolyses to give carvon dioxide and ammonia.

- action of alkaline hypochlorite or hypobromite

  when urea is treated with excess of alkaline hypochlorite or hypobromite, nitrogen is evolved.

$$Br2 + 2NaOH \rightarrow NaBr + NaBrO + H2O$$

$$CO(NH2)2 + 3NaBrO + 2NaOH \rightarrow N2 + Na2CO3 + 3NaBR + 3H2O$$

- Acetylation

urea reacts with acid chlorides and acid anhydrides to form ureides, i.e., eith acetyl chloride it gives acetylurea