

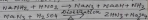
Doc. 2nd Sem. 10th, Paper-III (Course Material)

Hydrazoic acid or Hydrogen Azide (HN_3)

Preparation:-

(1) When hydrazine is oxidized by nitrous acid (HNO_2), HN_3 is formed.
$$\text{N}_2\text{H}_4 + \text{HNO}_2 \rightarrow \text{HN}_3 + 2\text{H}_2\text{O}$$

(2) When sodamide (NaNH_2) is treated with HNO_2 , sodium Azide (NaN_3) is formed. When Sodium Azide is distilled with conc. H_2SO_4 , hydrazoic acid is formed.



When the solution containing HN_3 is distilled and dried over CaH_2 , pure HN_3 is obtained.

Properties:-

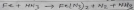
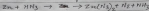
(1) It is very ready to detonate violently when subjected to even slight shock and so it is always used in aqueous solution.

(2) It is colourless mobile liquid,
B.P. = 37°C

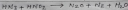
(3) It is explosive.

(A) It is very weak acid.

Zn and Fe dissolve in its aqueous solution liberating H_2 and NH_3



(B) It is oxidised by HNO_2 to N_2O



(C) It is reduced by $SnCl_2$ to NH_4^+



Uses:-

(1) It is used as an explosive.

(2) Lead Azide $[Pb(NH_3)_2]$ is used as initiator in industry.

(3) It is used as detonator for munitions and blasting explosive.

Structure:-



In the Hydrazic acid the symmetry is lost and N-N bond distances are unequal which corresponds to double and triple bond character.

Hydrazic acid (NH_3) has N_3^- (Azide ion)

The structure of Azide ion is $:\ddot{N} \equiv N - \ddot{N}:^-$

Fixation of Nitrogen:-

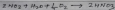
Atmosphere contains 3 volume of N_2 and 1 Volume of O_2 . The conversion of Nitrogen of N_2 Atmosphere to useful compound like NH_3 , HNO_3 and $CaCN_2$ is called nitrogen fixation.

Nitrogen fixation occurs:-

- (1) By natural process
- (2) By Artificial process

(1) By Natural Process:-

(a) N_2 and O_2 combine during lightning in rainy season as:-



The nitric and nitrous acid comes to N_2 soil during rain and form nitrites and nitrates with N_2 soil.



(b) Certain leguminous plants (Peas and Beans) have symbiotic bacteria in their roots.

These bacteria directly convert atmospheric N_2 to plant Protein. This process is called symbiosis.

(2) O_2 and physical fixation

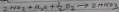
Artificial fixation of N_2 involves formation of (a) HNO_2 (b) NH_3 and (c) cyanamide.

Fixation of N_2 as HNO_2 is carried out as:-

A mixture of N_2 and O_2 is air is subjected to electric discharge. When NO_2 is formed.



When NO_2 is dissolved in water in presence of O_2 (air) HNO_3 is formed.



Nitric acid formed may be converted to nitrates.

Fixation of N_2 as NH_3 (Ammonia)

A mixture of N_2 and H_2 is heated to $500^\circ C$ at 25 atmospheric pressure in presence of FeO_3 catalyst and H_2O promoter.



Fixation of N_2 as Cyanamide

when lime stone is heated lime is formed. $CaCO_3 \rightarrow CaO + CO_2 \uparrow$

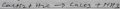
when lime (CaO) is heated with coke (C), calcium carbide (CaC_2) is formed. $CaO + 3C \rightarrow CaC_2 + CO \uparrow$

when CaC_2 is heated in air (N_2), calcium cyanamide is formed.



$CaCN_2$ is sold in the name of Nitrolim "Nitrolim"

The cyanamide is hydrolysed to NH_3



Reaction of NH_3 and CO_2 at high pressure gives urea



Nitrogenous fertilisers :-

- (1) Ammonium Sulphate
- (2) Ammonium nitrate (Mixed with $Ca_3(PO_4)_2$)
- (3) Nitrolim - $CaCN_2$
- (4) Urea