PHARMACEUTICAL ORGANIC CHEMISTRY-II- BP301T

UNIT: 2 Aromatic amines

CLASS: 6

TOPIC Basicity of amines:

Amines are basic in nature this is because they possesses an unshared pair of electron on nitrogen this lone pair of electron is available for the formation of a new bond with a proton amines react with acid to form salt.

$$\mathbf{R\text{-}NH_2 + H\text{-}Cl \rightarrow R\text{-}NH_3 + Cl}$$

Amines Ammonia ion

Basicity Constant:

Strong base (NaOH) completely ionize in aqueous solution

Amines are weak bases they are only partially ionized in aqueous solution and an equilibrium exist between the ionized and unionized forms.

$$\mathbf{R\text{-}NH_2 + H_2O \rightarrow R\text{-}NH_3 + OH^-}$$

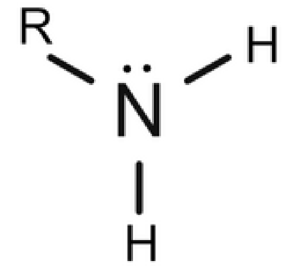
The extent of ionization is described by equilibrium constant (K_b) which is known as basicity constant.

It is defined as the concentration of product of ionization in moles/liter divided by concentration of the unionized base.

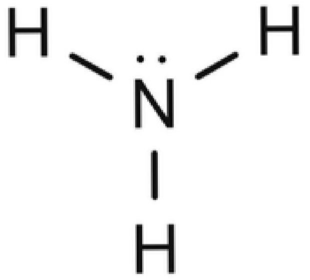
$$K_b = [\ R\ NH_3]\ \ [OH] / [R\ NH_2]$$

The basicity constant describes the relative strength of weak base. Strong base will have higher numerical value of basicity constant.

Ex :



Amine Group



Ammonia

Amines are more basic than ammonia because the electron release by alkyl groups increases the lone pair availability.

Relative Basicity:

Aliphatic amines are stronger base than ammonia this is because the alkyl groups are electron releasing they increase the electron density around the nitrogen atom. There by increase the availability of lone pair of electrons

The greater the number of electrons releasing alkyl groups the greater the availability of nitrogen lone pair and stronger the base.

Ex: Ammonia (NH_3) $K_b = 1.8 \times 10^{-5}$

Methyl amine (CH_3NH_2) $K_b = 3.7 \times 10^{-5}$

Di methyl amine (CH_3- NH_2- CH_3) $Kb = 5.4 \times 10^{-5}$

Tri methyl amine $K_b = 6.7 \times 10^{-5}$

Di methyl amine is strong base than methyl amine

Tri methyl amine is weak base than methyl amine and di methyl amine

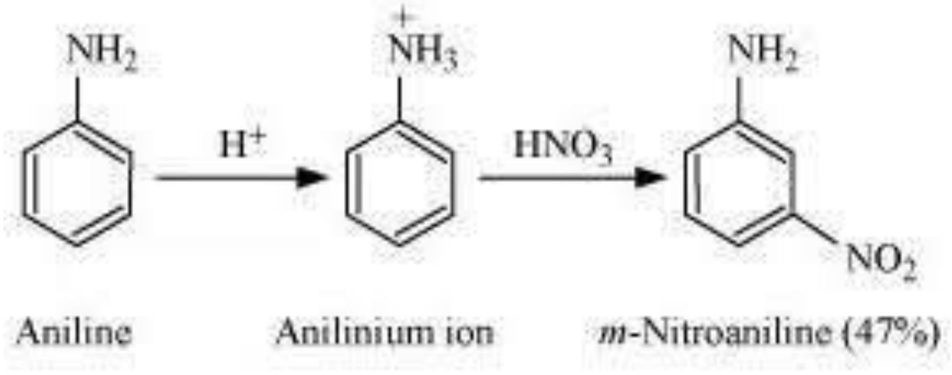
Effect of substituent on basicity of amines:

The basicity of aromatic amines is greatly influences by the position as well as the nature of substituent present on the benzene ring.

The ortho and para positions not meta position of the group determines its net effect on the electron density on nitrogen atom.

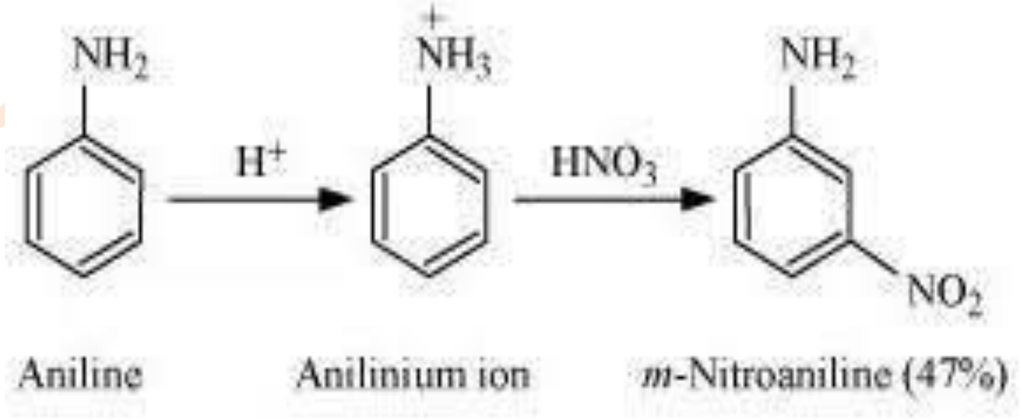
The nature of the group determines its inductive effect which operates at the position on aromatic ring.

Electron releasing groups such as –OH, -CH_3, -OCH_3, -NH_2 increases the basicity of amines.



This is due to the fact that electron releasing groups tend to increase the electron density on the amino group and thus lone pair of electron on nitrogen atom it becomes more available for sharing with an acid and same time substituent's also stabilize the substituted anilium ion by the dispersed of positive charge on nitrogen atom and thus increase its stability relative to the parent amine.

Electron withdrawing groups such as Cl, NO_2, CN, CHO, and COOH on the other hand decrease the basic strength by the decrease the electron density on the amino group and thus the lone pair of electron becomes less available for sharing with an acid.



More over these substituents also do not satisfy the positive charge on substituted anilium ion and decreased the stability relative to parent amine.

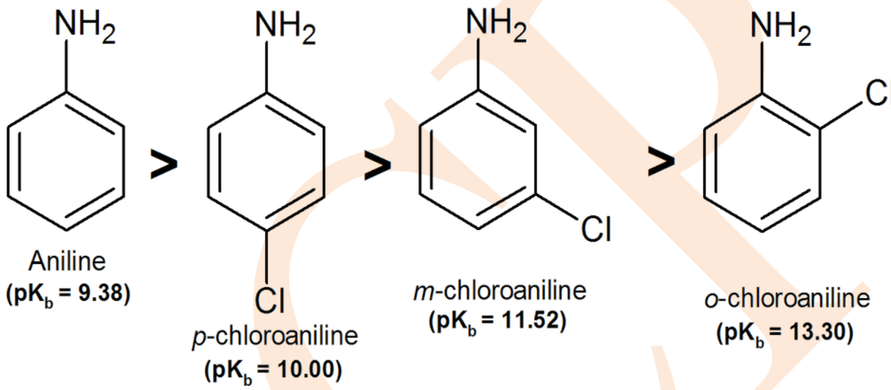
PK_b Value

S.NO	Substituent	O-Isomer	P-Isomer	M-Isomer
1	-CH_3	9.6	9.31	8.93

2	$-OCH_3$	9.58	9.7	8.83
3	$-NH_2$	9.5	9.13	7.83
4	-Cl	11.31	10.53	9.98
5	$-NO_2$	13.46	11.5	13.0

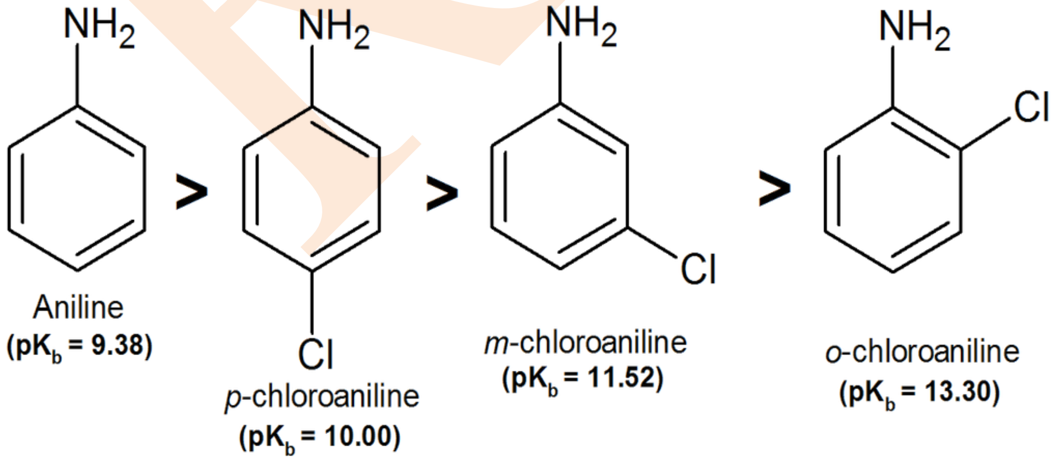
The base strengthening effect of electron releasing group is more exerted at para position than Meta position.

The basic strength of amines can be expressed by their dissociation constant, Kb or pKb. RNH2+H2→RNH+3+OH− Kb=[RHH+3][OH−][RNH2] and pKb=−logKb. Greater the Kb value or smaller the pKb value, more is the basic strength of amine



This is because such groups increase the electron density as nitrogen atom to a greater extent will present at para position than meta position.

The base weakening effect of the electron withdrawing group is more exerted at para position than meta position.



The base weakening effect of halogen such as cl and br is more pronounced at meta position than para position.