

FACTORS AFFECTING STABILITY OF COMPLEXES

- 1) Steric Effect
- 2) Forced Configuration

1) STERIC EFFECT :

When a bulky group is either attached to or is present near a donor atom, it causes mutual repulsions among the ligands, resulting in weakening of the metal-ligand bond. This strain to the molecule because of bulky ligands is known as *steric hindrance*.

E.g. (1) Ni^{2+} complex with 2-methyl-8-hydroxy quinoline ($\log_{10} \beta = 17.8$) is less stable than that with 8-hydroxy quinoline ($\log_{10} \beta = 21.4$) or its 4-methyl derivative ($\log_{10} \beta = 22.3$).

(2) Ethylene diamine, $\text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{NH}_2$, complexes are more stable than those of its tetramethyl derivative, Tetramethyl ethylene diamine, $(\text{H}_3\text{C})_2\text{N}-\text{CH}_2-\text{CH}_2-\text{N}(\text{CH}_3)_2$

The strain in the complexes with large ligands is sometimes due to the geometry of the ligand coupled with stereochemistry of the complexes.

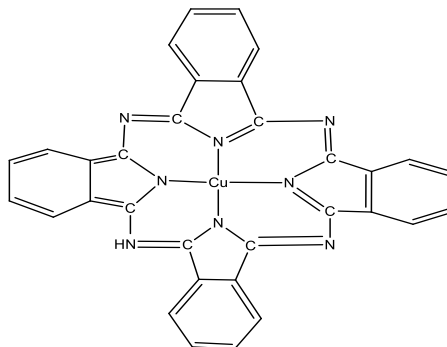
- For example; triethylene tetraamine (***trien***) $\text{H}_2\text{N} \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{NH} \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{NH} \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{NH}_2$ can coordinate through its four nitrogen atoms at the corners of the square but triamino triethylamine (***tren***), $(\text{NH}_2-\text{CH}_2-\text{CH}_2)_3\text{N}$ cannot.

Hence the former forms more stable complexes with Cu^{2+} than the latter because the former is straight chain amine while the latter is a branched chain amine, which is unable to assume the preferred square planar geometry.

2) FORCED CONFIGURATION :

Ligands like porphyrin & phthalocyanine which have completely fused planar ring system, form extraordinarily stable complexes with metal ions that tend to give planar complexes.

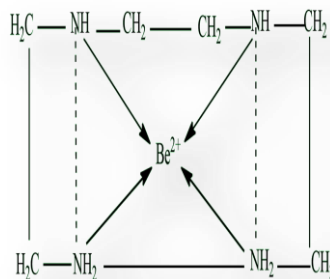
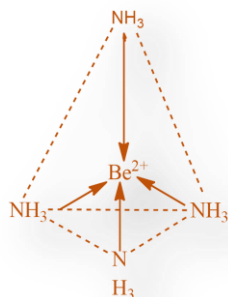
Example: Cu^{2+} complex with phthalocyanine is very stable.



Similarly, *trien* forms very stable complexes with Ni(II) & Cu(II) .

These ligands impose planar configurations even on metal ions that have no tendency to form planar complexes with unidentate ligands.

Example: Be^{2+} & Zn^{2+} ion normally form tetrahedral complexes but when they combine with these polydentate ligands they are forced to assume planar configuration.



TETRAHEDRAL

FORCED SQUARE PLANAR GEOMETRY

Therefore these complexes are less stable.

_____END_____