FAQ

1. **Write a note on the alkaloid which is known to be a teratogen**.

   Two of the Alkaloids in *Conium maculatum*. They are, γ-coniceine and coniine are the major ones which account for most of the plant acute and chronic toxicity. These alkaloids produce a neuromuscular blockage leading to death due to its paralytic effect on the respiratory muscles. The chronic toxicity affects only pregnant animals. Where during the foetus formation period the alkaloid effects the development and the offspring is born with malformations. They are classified as a teratogen.

2. **Write a note on the history of alkaloid discovery**.

   The term alkaloids (or alkali-like) was first proposed by the pharmacist, W. Meissner, in 1819, for plant origin basic nitrogen-containing compounds. The first discovered alkaloid was narcotine, isolated from opium by Derosne in 1803. Ladenburg defined alkaloids, as naturally occurring plant compounds having a basic character and containing at least one nitrogen in a heterocyclic ring. They are found in many plant families. Perhaps 20-30% of all plant species accumulate alkaloids. They are much more common in families such as the Solanaceae and Apocynaceae where as many as 60-70% of species accumulate alkaloids. Alkaloids are derived from a few common amino acids. Most have physiological activity. Mostly they are basic in nature, but have non-basic forms too such as, quaternary compounds and *N*-oxides material.

3. **What is the action of alkali on alkaloids?**

   The action of alkalies like NaOH and KOH on the **a**lkaloids are found to be varying in nature as enumerated below:

   (*a*) Dilute alkaline solutions of KOH or NaOH normally decompose most alkaloidal salts and finally liberate the free alkaloids.

   (*b*) Certain alkaloids containing phenolic hydroxyl groups *e.g.*, mor-

phine, on being treated with alkaline solutions yield, their corresponding soluble sodium or potassium salts.

(*c*) The ester alkaloids usually undergo hydrolysis on being treated with dilute alkalies, such as: atropine, cocaine.

(*d*) Racemic Isomeride: The action of alkali hydroxides on hyoscyamine in alcohol gives rise to the racemic isomeride atropine.

(*e*) Fusion of alkaloids with dry KOH or NaOH by the application of heat ultimately leads to drastic decomposition thereby yielding ultimately the simple heterocyclic bases, for instance: pyridine, quinoline, pyrrolidine etc.

(*f)* Simple fusion of alkaloids with alkali hydroxides may give rise to distinct and visible colour changes.

4. **What is the importance of hairy root culture in alkaloid production**?

Hairy root cultures are used in research for the biosynthesis of alkaloids. They are produced by exposing sterilized plant parts to *Agrobacterium rhizogenes*, which is able to transfer part of its own DNA from a plasmid to the plant's nuclear genome. By inserting desirable genes into their plasmids, Agrobacteria are used to transfer new genes to plants. The T-DNA carries genes encoding the biosynthesis of plant hormones and for the production of unusual nutritional amino acids required by the microorganism. When such cells are grown they continues to produce the alkaloid.

5. **How are the Mammalian nervous systems gets affected by alkaloids?**

Mammalian nervous systems are affected by 2 methods. They are

(a) A transmitter that possesses an ammonium ion and facilitates cholingeric transmission. Eg. Acetylcholine

(b) Those transmitters that possess an aryl-ethyl-amino moiety i.e, 13-phenethyl amino moiety. Eg: dopamine, norepinephrine; serotonin.

6. **Mention the alkaloid which causes heart attack if taken in larg-**

er quantity?

Taxines are the active, poisonous constituents in few plants (*Taxus spp*). Its main action is on cardiac myocytes resulting in heart failure and death immediately in animal and humans.

7. **What are amphoteric alkaloids?**

There are some alkaloids which are amphoteric in nature *i.e.*, they are neither acidic nor basic in character; this is due to the presence of phenolic (–OH) moiety in Morphine or the presence of carboxylic (–COOH) function in Narceine.

8. **Classification based on pharmacological characters?**

Many alkaloids have documented multiple effects on different targets, they are

a. neurotransmitter receptors (nicotine, cocaine, morphine)

b. neurotransmitter transport/degradation (cocaine)

c. interfere with cytoskeleton (tubulin - taxol)

d. ion channels (caffeine)

e. enzyme inhibitors (caffeine, theobromine)

9. **Write a note on the Alkaloids Derived from L-Tryptophan**

Alkaloids Derived from L-Tryptophan are neutral heterocyclic amino acid containing essentially an indole ring system. They serve as a precursor for a wide spectrum of indole alkaloids. These are classified as

- Simple Indole Alkaloids; serotonin, psilocin and psilocybin
- Simple b-Carboline Alkaloids; harman, harmaline, harmine and elaeagnine
- Terpenoid Indole Alkaloids; ajmalicine, akuammicine, tabersonine, catharanthine
- Quinoline Alkaloids; *Cinchona,* Cinchonine
- Pyrroloindole Alkaloids; Physostigmine
- Ergot Alkaloids. Ergotamine, ergosine, ergocristine, ergocryptine.

10. **What is meant as N-in the Molecule alkaloid?**

The number of N-atoms vary from one in a molecule *e.g.*, cocaine, to even five in a molecule *e.g.*, ergotamine. These N-atoms are present as a part of the heterocyclic ring in the alkaloid molecule *e.g.*, quinine, whereas there are certain alkaloids that contain the N-atom in the aliphatic side chain. *Eg.* Ephedrine, mescaline.

11. **Which are the Colchicine and their related alkaloids?**

Colchicine is found in the leaves and seeds of at least 19 species of *Colchicum* and 10 other related genera

Amaryllidaceae alkaloids: Amaryllidaceae alkaloids includes compounds such as lycorine, norpluviine, lycorenine, and homllycorine

Mesembryanthemum alkaloids: Alkaloids found in the genera *Mesembryanthemum* and *Scletium*. About 25 alkaloids of this type are known. Some of which are hallucinogenic.

Cephalotaxus and homoerythrina alkaloids: *Cephalotaxus* (Cephalotaxaceae) alkaloids have antitumor activity. Harringtonine, homoharringtonine, isoharringtonine, and deoxyharringtonine have significant antitumor activity. They inhibit DNA synthesis and protein synthesis.

12. **What are the chemical changes caused by the mineral acids to alkalis?**

The chemical changes caused by the mineral acids to alkali are categorized into *three* different types, namely:

(*a*) Dehydration: Dehydration of alkaloids give rise to either *anhydro-* or *apo-* alkaloids. Eg. Apomorphine obtained from Morphine.

(*b*) Demethoxylation**:** The removal or elimination of the methoxyl groups from the alkaloids by treatment with either concentrated HCl or HI to produce methyl chloride (CH3Cl) or methyl iodide (CH_3I) while giving rise to the corresponding hydroxy base. Eg. codeine, quinine, narcotine and papaverine.

(*c*) Hydrolysis: A good number of naturally occurring alkaloids are obtained as esters. They easily undergo hydrolysis on being heated with either alkalis or mineral acids thereby resulting into the formation of the corresponding acids along with respective alcohols or phenols of the alkaloids.

13. **How are the alkaloids classified based on their chemical characteristics?**

The chemical characteristics of the alkaloids vary with individual compounds. They are :

- N-in the Molecule
- O-in the Molecule
- Amphoteric alkaloids
- Unstable alkaloidal salts
- Neutral or slightly acidic alkaloids

14. **Write a note on the medicinal plants at risk of extinction?**

The Botanic Gardens Conservation International (representing botanic gardens in 120 countries) in 2008 stated that "400 medicinal plants are at risk of extinction, from over-collection and deforestation, threatening the discovery of future cures for disease." These included Yew trees (the bark is used for the cancer drug taxol (paclitaxel)); Hoodia (from Namibia, source of weight loss drugs); half of Magnolias (used as Chinese medicine for 5,000 years to fight cancer, dementia and heart disease); and Autumn crocus (for gout). The group also found that 5 billion people benefit from traditional plant-based medicine for health care.

15. **Comment on alkaloids solubility in water and organic solvents?**

Alkaloids and their respective salts exhibit considerable variation, in their solubility both in water and organic solvents. Free alkaloid bases are found to be fairly soluble in organic solvents, such as: ether,

chloroform, hexane, benzene, petroleum, immiscible solvent, lower alcohols (methanol, ethanol); but they are either insoluble or very sparingly soluble in water.

However, the alkaloid salts are almost freely soluble in water, relatively less soluble in alcohol and mostly either insoluble or sparingly soluble in organic solvents. Eg. Atropine sulphate and morphine hydrochloride are much more soluble in water than their corresponding bases *i.e.*, atropine and morphine.