

# UNIT-1

## ALKALOIDS

### 1.1 INTRODUCTION:

Alkaloids was introduced by W.Meissner in 1819. Alkali like basic-nitrogen containing compounds isolated from plants.

*Alkaloids are defined as natural plant compounds with a basic character –containing one nitrogen atom in a heterocyclic ring structure.*

Modern definition states that –Basic nitrogeneous plant products mostly optically active and possessing nitrogen heterocycle as their structural units with a pronounced physiological action.

### 1.2 OCCURRENCE OF ALKALOIDS

Heterogeneous containing nitrogen containing substances in plant families. Distributed widely in higher plants-dicotyledons- Apocynaceae, Papilionaceae, Rubiaceae- Solanaceae. In plants- basic in nature they occur as salts of organic acids- acetic, oxalic, citric, malic, lactic etc.,

Glycosides of sugars- glucose, Rhamnose, galactose

Esters- Eg:Atropine

### 1.3 FUNCTION OF ALKALOIDS:

(1)Act as reserve substances to supply nitrogen. 2)May be end-products of detoxification mechanisms.3)Poisonous substances protect from animals.4)Plant stimulants or regulators for normal metabolism.5) Reservoirs for protein synthesis.

### 1.4 NOMENCLATURE OF ALKALOIDS

1) According to the plants isolated

Papaverine- Papaver someniferum.

Berberine- Berberis Vulgaris L.

2) According to Physiological Action

Morphine- (Ger- Morphin- God of Dreams)

Narcotine- (Greek Narkoo- to benumb)

Emetine – (Greek- Emetikos- to vomit)

3) Named after the discoverer

Pelletierine- P.J. Pelletier.

Prefixes –epi, iso, neo, pseudo have been used to designate isomeric or slightly modified structures.The Prefix ‘nor’ denotes the structure does not have a methyl group attached to nitrogen atom.

## 1.5 CLASSIFICATION OF ALKALOID:

### 1) Taxonomic- according to the Family.

Solanaceous or Papilionaeous family- Tropane, pyridine, steroidal or pyrrolizidine.

Pharmacological- Analgesic alkaloids, Cardioactive alkaloids.

Biosynthetic- Indole alkaloids- Tryptophan and mevalonic acids

Morphine, papverine –Phenylalanine, tyrosine.

### 2) According to Chemical structure

Phenylethylamine alkaloids-Ephedrine

Pyrrolidine alkaloids-

Pyridine alkaloids- Ricinine, Coniine, Piperine, Pelletierine

Pyridine-Pyrrolidine alkaloids-Nicotine

Tropane alkaloids-atropine, cocaine

Quinoline & Isoquinoline alkaloids- Quinine.

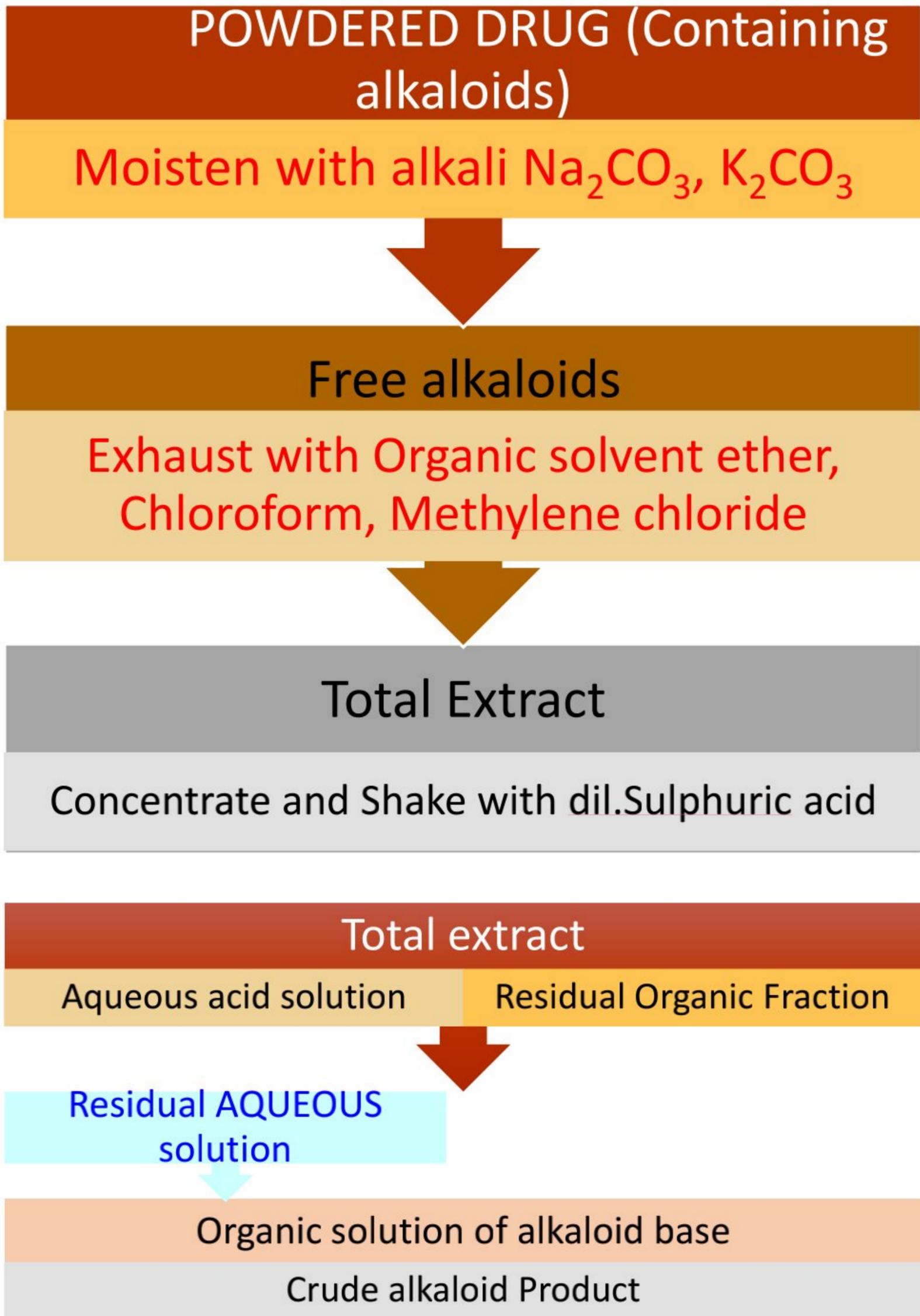
Phenanthrene alkaloids-Reserpine

## 1.6 PHYSICAL PROPERTIES

- 1) Colourless crystalline solids-Insoluble in water, soluble in organic solvents like  $\text{CHCl}_3$ , alcohol ether etc.,
- 2) Bitter in taste- optically active- laevorotatory.
- 3) Basic in character.
- 4) Insoluble precipitates with phosphotungstic acid, picric acid.
- 5) Contains oxygen and nitrogen atoms in their structure. Nitrogen being in their tertiary or secondary state.

## 1.7 ISOLATION OR PRODUCTION OF ALKALOIDS

### 1) *Alkali Extraction*



## 1.8 METHODS FOR DETERMINING STRUCTURE OF ALKALOID

- 1) Molecular formula determination: Elemental composition and its empirical formula is found by combustion method. The molecular formula is obtained by Rast's method.

The number of double bond equivalents and the number of rings in the structure can be calculated by the following expression for the molecule  $C_aH_bN_cO_d = (a - 1/2b + 1/2c + 1)$ . The presence of unsaturation is ascertained by treating the alkaloid with bromine water,  $KMnO_4$ .

### 2) Functional Group Analysis: -Infra-red spectroscopy.

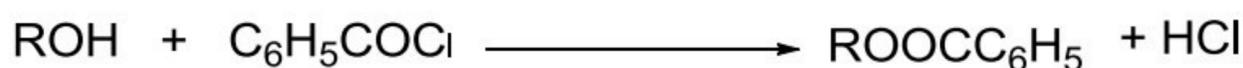
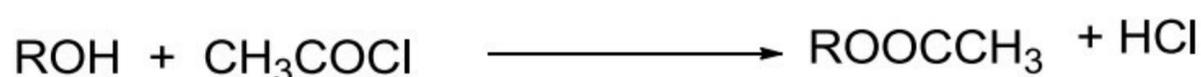
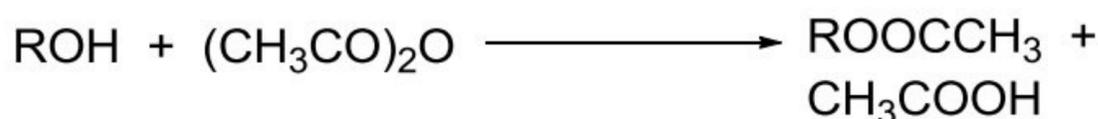
- a) Functional nature of Oxygen:

Oxygen can be present as -OH (alcoholic/phenolic); 2) methoxy ( $OCH_3$ );

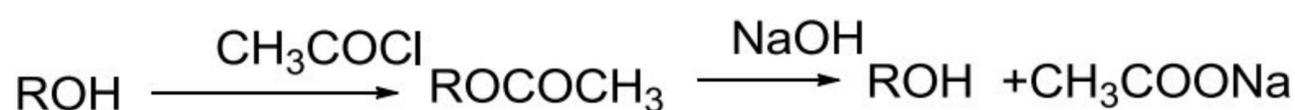
3) Acetoxy ( $-OCOCH_3$ ); 4) Carboxylic ( $-COOH$ ); 5) carbonyl ( $-CO$ ); 6) carboxylate ( $-COOK$ )

#### 1) Hydroxyl group:

On treatment with acetic acid it forms acetate; it forms benzoate with benzoyl chloride.

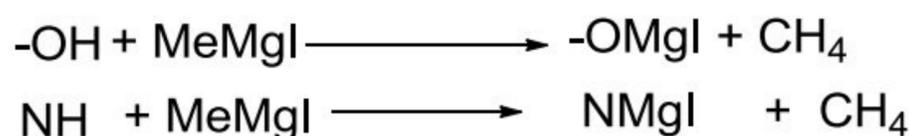


The number of hydroxyl groups is determined by acetylation or zerevitinoff's method, involves acetylating the alkaloid and hydrolysing the acetyl derivative with 1N NaOH



The excess alkali is estimated by titrating with standard HCl. The number of acetyl groups can be calculated from the volume of alkali used for hydrolysis.

Hydroxyl groups can be detected by treatment with methyl magnesium iodide and quantitatively estimating the methane content.



#### 2) Phenolic OH:

Soluble in sodium hydroxide; Reprecipitated by  $CO_2$

Coloration with neutral  $FeCl_3$ .