



**PHYTO**  
PHARMACEUTICALS



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# INTRODUCTION

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- Phytopharmaceuticals are herbal medicines whose efficacy is down to one or several plant substances or active ingredients. They have been used for treating diseases since time immemorial. This traditional knowledge is still the basis for many medicinal products made from plants or parts thereof. Herbal medicines have been produced in Baden-Württemberg for many generations.
- Phytopharmaceuticals are medicines with pure active substances that come from plants or parts of plants.

# HISTORY



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Plants produce an incredible variety of natural compounds. it is therefore not surprising that humans make use of this huge diversity. Historical sources show that the use of medicinal plants goes way back to the bronze age. Europe has a culture of using medicinal plants that starts with hildegard von bingen, continues with friedrich sertürner who was the first to isolate morphine in pure form and ends with the modern-day production of herbal medicines.



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# EXAMPLES

The crude drugs are subjected to a suitable method of extraction and purification for the isolation of phytopharmaceuticals, which could be incorporated as active ingredients in the modern system of medicine.

1. The anthracene glycosides such as sennosides are extracted in the form of their stable calcium salts from the leaves and pods of senna.
2. The indole alkaloids such as ergometrine and ergotamine are commercially extracted as their salts from the fungus of ergot, known as *Claviceps purpurea*
3. Caffeine is extracted from tea or teawaste, where as *nuxvomica* seeds serve as the raw material for the extraction of strychnine.

# EXAMPLES

4. The antihypertensive and tranquilising agent reserpine is commercially obtained from the roots and rhizomes of *Rauwolfia serpentina*.
5. Other tropane alkaloids l-hyoscyamine and atropine are obtained form *Atropa belladona* and *Datura metal* .
6. Isoquinoline alkaloids such as morphine, papaverine, codeine and thebaine are extracted from opium, latex obtained from poppy capsules.
7. The alkaloids quinine and quinidine are commercially obtained from the bark of different cinchona species.
8. pilocarpine nitrate, a life saving drug useful in treatment of glaucoma, is extracted from leaves of *Pilocarpus jaborandi*



# EXAMPLES

9. A number of essential oils and their chemicals used as medicinal and flavouring agent are obtained from plants sources. Examples volatile oils of peppermint, spearmint, clove, eucalyptus, ginger, citronella, thyme and vetiver.
10. Citral from lemon grass oil, is itself used in perfumery and soaps .
11. Spices are usually more diversified than the perfume principles containing not only terpenes, from dill, caraway, fennel, celery etc. But also aromatic aldehydes, phenols and sulphur compounds.



# OBJECTIVES

1. To impart knowledge on basic principles of Herbal Drug Science.
2. To teach different levels of Pharmacognosy, from Sources of Drugs and Pharmaceuticals to isolation of phytopharmaceuticals and their evaluation.
3. To create awareness on advanced techniques of Drug development from natural sources and Research by conducting Live Demonstrations and Audio-Visual presentations.
4. To create awareness on Lab safety Precautions, Handling techniques, Hazardous crude drugs usage and their proper disposal for maintaining Clean and Green environment.
5. To involve Experiential Learning by conducting laboratory experiments to the students.



# FUNCTIONS

1. Phytochemicals plays a vital role in preventing oxidative damage.
2. Phenolics play a vital role in plant physiology, providing to resistance to microbes, insects, pigments, odor and flavor.
3. Polyphenolic compounds mainly flavonoids have potential therapeutic value as antioxidant and anti-inflammatory agents for prevention of cardio vascular disease.



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# OBJECTIVES

5. Plants have shown varying degree of hypoglycemic and antihyperglycemic activity
6. Consumption of green tea helps kidneys to process toxins and waste products more efficiently.



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# EVALUATION

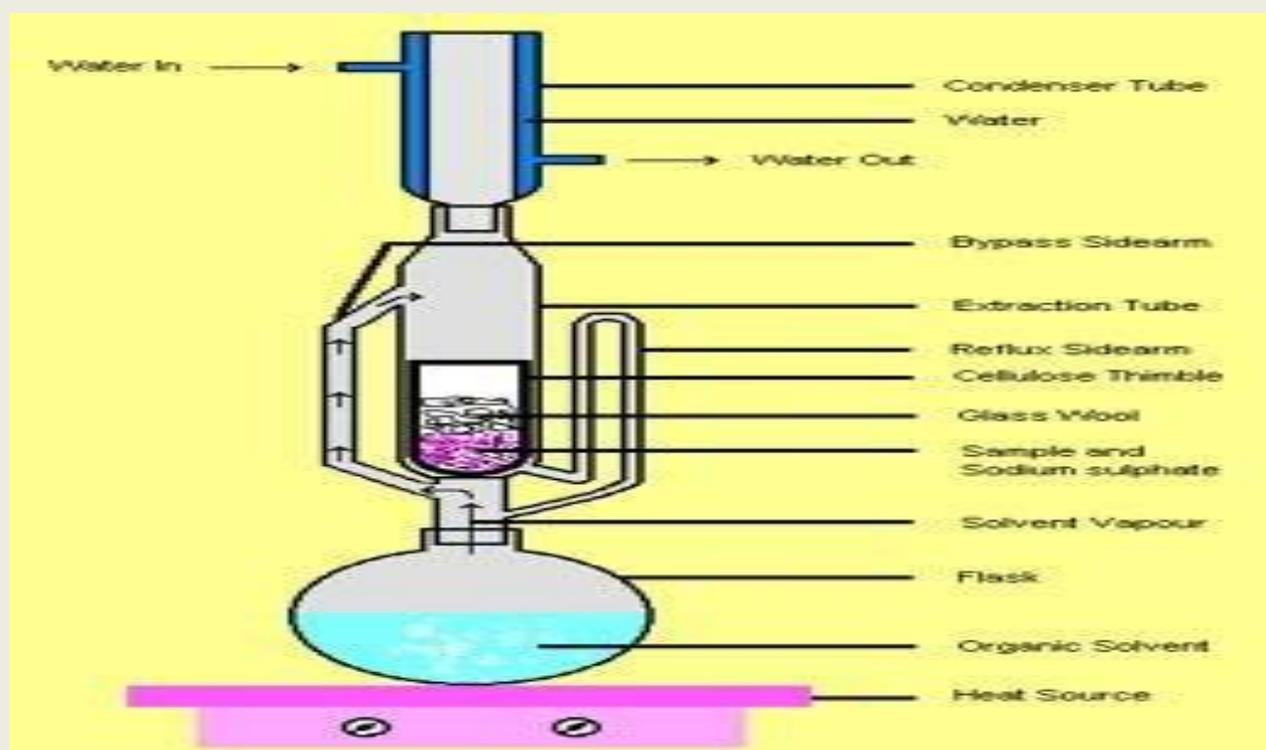
## TESTS FOR ALKALOIDS

- Most alkaloids are precipitated from neutral or slightly acidic solution by
- **D**ragendorff's reagent (solution of potassium bismuth iodide) orange coloured precipitate.
- **M**ayer's reagent (potassium mercuric iodide solution) Cream coloured precipitate.
- **W**agner's reagent (iodine in potassium iodide) red-brown precipitate
- **H**agers reagent (picric acid) yellow precipitate
- Caffeine does not precipitate
- The **murexide test** is an analytical technique to **identify** the presence of **caffeine** and other purine derivatives in a sample. The sample is then evaporated to dryness and the resulting residue is exposed to ammonia vapour. ... Purine alkaloids produce a pink color in this **test**



# ISOLATION OF GLYCOSIDES

- The finely powdered plant part is extracted with water or alcohol in soxhlet apparatus. the concentration of extract gives crude glycoside which is further purified using suitable solvent according to chemical nature and properties of glycoside





# CHEMICAL TESTS FOR CARDIAC GLYCOSIDES

- Baljet Test:** T.S of digitalis leaves + sodium picrate solution= yellow to orange colour due to aglycone or glycoside
- Legal Test :** Alcoholic extract of drug + equal volume water and 0.5 ml strong lead acetate solution. Shake and filtered. Filtrat extracted with equal volume of chloroform. Chloroform extract evaporated to dryness and dried residue was dissolved in 2 ml pyridine+ 2 ml sodium nitroprusside + sodium hydroxide solution ( to make alkaline).pink colour due to glycoside or aglycone moiety.

**Drug + Pyridine + Sod.nitroprusside (Made alkaline)**



**Pink to Red color**

**due to glycoside or aglycone moiety.**

# Anthraquinone Glycosides



## **1 Borntrager,s test**

To 1 gm of drug add 5-10 ml of dil HCl, boil on water bath for 10 min and filter. Filtrate then extracted with CCl<sub>4</sub>/ benzene and add equal amount of ammonia solution to filtrate and shake. Ammonical layer becomes pink or red due to presence of anthraquinone.

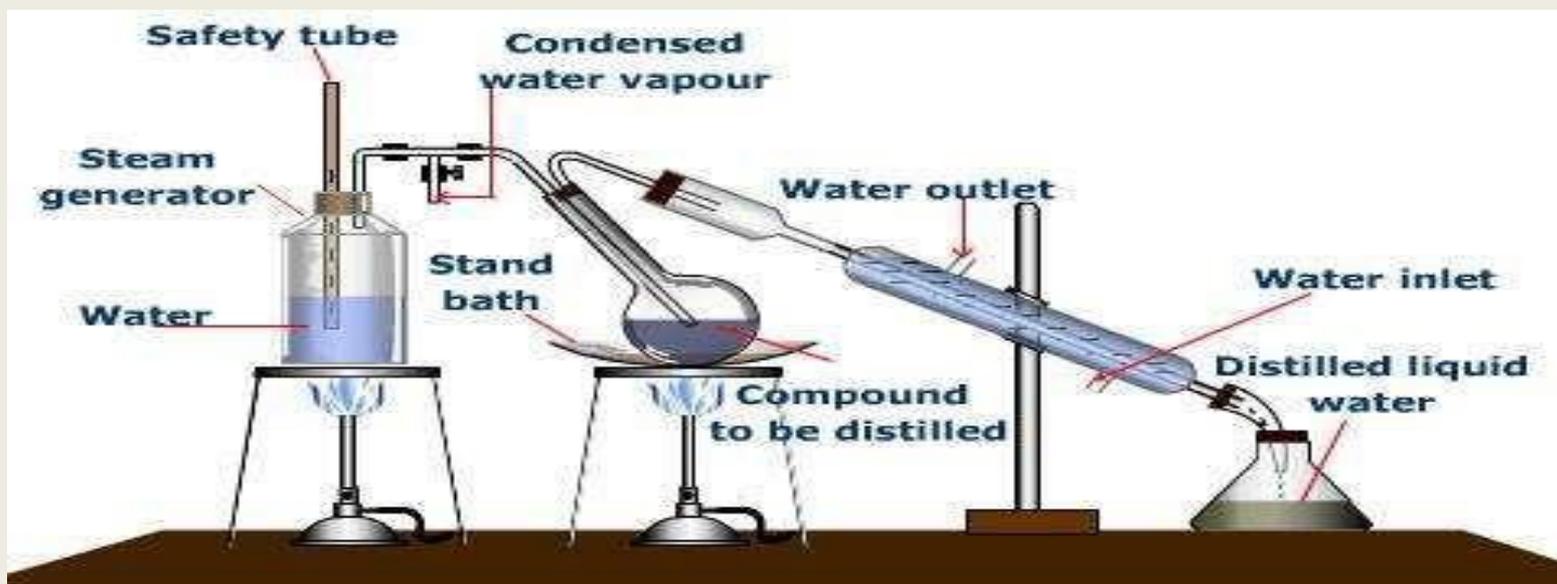
## **2 .Modified Borntrager,s test**

To 1 gm drug add 5 ml dil HCl + 5 ml ferric chloride( 5% w/v). As some plant contains anthracene aglycone in a reduced form, if ferric chloride is used during the extraction, oxidation to anthroquinones takes place, which shows response to the Borntrager's test. Boil on water bath for 10 min, cool , filter. Filtrate then extracted with CCl<sub>4</sub>/benzene and add equal volume of ammonia solution. Pinkor red colour forms due to anthraquinone .



# TERPENOIDS

- **Chemical methods:** Treating the essential oil with some chemical agents like(sodium bi sulphite, phthalic anhydride etc.)
- **Physical methods:**
- Fractional distillation method Gas chromatography method



# RESINS



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## Method –A

- Powdered drug
    1. Extract the resin with alcohol
    2. Filter
    3. Concentrate
  - Concentrate extract an excess of water, shake
- ↓
- Resins get precipitate

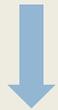
# extraction or isolation methods



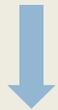
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## **Method – B**

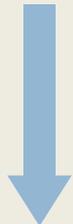
Powdered drug containing oleo-resin, percolate the powdered drug with non-polar solvent (e.g. acetone, chloroform)



Non-polar solvent



Steam distillation



Oleo-resin

Volatile oils (e.g. Rosin)



# CLASSES OF PHYTOCHEMICALS

No.	Phytopharmaceuticals	Natural Source	Activity
<b>ANTI-ULCER</b>			
1.	Catechin	Leaves of <i>Artocarpus integra</i>	anti-ulcer
2.	Cyanidanol	Stereoisomer of catechin from seedcoat of <i>Anacardium occidentale</i>	anti-ulcer (inhibiting action on histidine decarboxylase)
3.	Isoliquiritin	Rhizomes of <i>Glycyrrhiza glabra</i>	anti-ulcer
4.	Sophoradin	<i>Sophora subprotostata</i>	anti-ulcer
<b>ANTI-PROTOZOAL</b>			
5.	Quinine microcapsules in oral formulation	Bark of <i>Cinchona</i> species	anti-malarial
6.	Pycnamine	<i>Triclisia</i> species	anti-malarial
7.	Immuno toxins like pokeweed antiviral proteins	Seeds of <i>Phytolacca maricana</i>	anti-trypanosomal, anti-leishmanial
<b>CARDIOVASCULAR TREATMENTS</b>			
8.	Colenol (forskolin)	<i>Coleus forskohlii</i>	Hypotensive
9.	Digoxin	Enzymatic conversion and further selective 12 $\beta$ -hydroxylation of thevenerrin and nerrifolin from yellow oleander <i>Thevetia nerrifolia</i>	Cardiotonic
10.	Aescin	Seeds of <i>Aesculus hippocastanum</i>	anti-inflammatory
11.	Nimbidin	Seeds oil of <i>Azadirachta indica</i>	anti-inflammatory
12.	Curcumin	Rhizomes of <i>Curcuma longa</i>	anti-inflammatory



# CLASSES OF PHYTOCHEMICALS



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## ANTI-VIRAL AGENTS

13.	Castarospermine	<i>Castarospermum australe</i>	anti-HIV
14.	Lyophilised infusion of hypericum	<i>Hypericum perforatum</i>	Influenza A and B
15.	Calanolide A	<i>Calophyllum lanigeum</i>	anti-HIV (reverse transcriptase inhibitor)

## IMMUNOMODULATORS AND ADAPTOGENS

16.	Sitoindoside VII and VIII	Roots of <i>Withania somnifera</i>	antistress
17.	Polysaccharide fraction	<i>Echinacea angustifolia</i> and <i>E. purpurea</i>	immunomodulator
18.	Syringin and cordiol	<i>Tinospora cordifolia</i>	immunomodulator

## ANTI-CANCER

19.	Bryostatin	Macrolide from bryozoans	anti-cancer (Partial agonist of protein kinase C)
20.	Rhizoxin	fungal metabolite	anti-cancer (antimetabolite)

## ANTI-DIABETIC

21.	Polypeptide P (P-Insulin) and charantin	<i>Momordica charantia</i>	anti-diabetic
22.	Gymnemic acids 1 - 4 and gurmardin	<i>Gymnema sylvestre</i>	anti-diabetic (both in insulin dependent and non-insulin dependent diabetes mellitus)

