# NATURAL REMEDIES: A COMPREHENSIVE PHARMACOGNOSTIC EVALUATION

**Abstract**

Natural medicinal products, derived from various sources such as plants, animals, minerals, and microorganisms, have been integral to traditional medicine systems globally for centuries. Their perceived safety and efficacy, based on empirical evidence, have made them a preferred choice for many individuals. However, the variability in potency, purity, and potential for adulteration necessitates rigorous evaluation. This paper provides an overview of the importance of drug evaluation, focusing on confirming identity, determining quality and purity, and detecting adulteration. Various techniques, including organoleptic, microscopic, chemical, physical, and biological evaluations, are discussed in detail. These evaluations help ensure the standardization, quality, and safety of natural medicinal products, thus supporting their effective therapeutic applications.

**Keywords:** Natural medicinal products, Drug evaluation, Organoleptic evaluation, Microscopic evaluation, Chemical evaluation, Physical evaluation, Biological evaluation.

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## I. INTRODUCTION

Natural medicinal products are derived from plants, animals, minerals, or microorganisms and have been used for centuries in traditional medicine systems worldwide. They encompass a wide range of substances, including herbs, botanical extracts, essential oils, fungi, and more. These products contain bioactive compounds that can exert therapeutic effects on the body. One of the key advantages of natural medicinal products is their perceived safety and efficacy, often based on centuries of empirical evidence. Many people prefer them due to their perceived gentleness on the body and lower risk of adverse effects compared to synthetic drugs.

However, it's essential to recognize that natural does not always equate to safe. Some natural products can interact with medications or cause allergic reactions. Additionally, their potency and purity can vary widely depending on factors such as cultivation methods, processing, and storage conditions.

Modern scientific research, including pharmacognostic evaluation, aims to understand the bioactive components of natural medicinal products, their mechanisms of action, and potential therapeutic applications. This knowledge helps in standardizing these products, ensuring their quality, safety, and efficacy [1].

## II. DRUG EVALUATION

Evaluation of drugs means confirmation of its identity as well as determination of its quality and purity and detection of nature of adulteration [2]. It is necessary to be carried out because of the following three reasons:

a. Biochemical variation in the drug due to improper collection of the drug and or transportation in the improper conditions.
b. Deterioration due to treatment and storage.
c. Substitution and adulteration: It is a practice of substituting original crude drug partially or wholly with other similar looking substances, but the later is either free from or inferior in chemical and therapeutic properties. Simply, adulteration is the debasement of an article.

**Adulteration can be done by any of the following ways**

- **Substitution with substandard commercial varieties**: It is the most common practice of adulteration. The adulterants used here may resemble original crude drug by morphological, chemical or therapeutic characters, but are substandard in nature. Hence cheaper in cost. E.g. Strychnous nux-blanda or S. potatorum in place of Strychnous nux-vomica.
- **Substitution with superficially similar inferior drugs**: Adulterants used here may not have any chemical or therapeutic value, but give morphological resemblance to the authentic drug. E.g. belladonna leaves are substituted with ailanthus leaves.
- **Substitution with artificially manufactured substances**: This practice is followed for much costlier drugs. E.g. chicony in place coffee.
- **Substitution with exhausted drugs**: The same plant material is mixed which is having no active medicinal components, as they have been already extracted out. It is

most common in case of volatile oils. E.g. clove, fennel, etc.

- **Harmful adulterants:** Sometimes, wastes from market are collected and admixed with authentic drugs. This is noticed for adulteration of unorganized crude drugs. E.g. pieces of amber coloured glass in colophony.
- **Adulteration of powders:** The adulterants are mixed with the authentic powdered drugs, based on its morphological appearance. E.g. dextrin in ipecacuanha.
- Besides these, use of synthetic chemicals to enhance the natural character as in case of addition of benzyl benzoate to balsam of peru, citral to citrus oil, etc.

The different techniques involved in evaluation of natural drugs are as follows:

## III. ORGANOLEPTIC (MORPHOLOGICAL) EVALUATION

It refers the identification of drugs by their general appearance, such as colour, odour, taste, size, shape and special features like touch, texture, sound, etc. E.g. liquorice is of sweet taste, aromatic odour of umbelliferous fruits, etc.

## IV. MICROSCOPIC EVALUATION

It is a qualitative evaluation method used to identify the organized crude drugs and powdered form, by their known histological characters. This involves the observation of type of stomata, trichomes as well as various leaf constants like vein-islet number, vein termination number, stomatal number, stomatal index, etc. It also involves the observation other cell components of the drug, e.g. umbelliferous drugs contain vitta [3, 4].

## V. CHEMICAL EVALUATION

It refers the identification of natural drugs by different chemical tests and assays. The isolation, purification and identification of active constituents are chemical method of evaluation. The preliminary phytochemical screening is a part of chemical evaluation. It includes detection of alkaloids, carbohydrates, glycosides, fixed oils, proteins, tannins, phytosterols, etc. [3, 4]. The various chemical tests are as follows-

**Alkaloids:**

- Mayer's test: Drug with Mayer's reagent (potassium mercuric iodide solution) gives cream or pale yellow precipitate.
- Dragendorff's test: Drug with Dragendorff's reagent (potassium bismuth iodide solution) gives brown or reddish-brown colour or precipitate.
- Wagner's test: Drug with Wagner's reagent (iodine and potassium iodide solution) gives yellow precipitate.
- Hager's (Picric acid) test: Drug with Hager's reagent (saturated solution of picric acid) gives yellow precipitate.

**Carbohydrates**

The minimum amount of the extracts were dissolved in 5ml of distilled water and filtered. The filtrate was subjected to test for carbohydrates.

- Molisch's test: The filtrate was treated with 2-3 drops of 1% alcoholic alpha naphthol

and 2ml of concentrated sulphuric acid was added along the sides of the test tube.

- Fehling's test: The filtrate was treated with 1 ml of Fehling's A and B and heated in a boiling water bath for 5-10min. Appearance of reddish orange precipitate shows the presence of carbohydrates.

**Test for glycosides**

- Cardiac glycoside (Keller-Killani test): To 2 ml of extract, glacial acetic acid, one drop 5% ferric chloride and concentrated sulphuric acid were added. Appearance of reddish brown colour at the junction of the two liquid layers indicates the presence of cardiac glycosides.
- Anthraquinone glycosides (Borntrager's Test): To 3 ml extract dilute sulphuric acid was added, boiled and filtered. To the cold filtrate equal volume benzene or chloroform was added. The organic layer was separated and ammonia was added. Ammonical layer turns pink or red.
- Saponin glycosides (Foam test): The extract and powder were mixed vigorously with water.
- Coumarin glycosides: Alcoholic extract when made alkaline, shows blue or green fluorescence.

## VI. TEST FOR PHYTOSTEROL

1gm of the extract was dissolved in few drops of dry acetic acid, 3ml of acetic anhydride was added followed by few drops of concentrated sulphuric acid. Appearance of bluish green colour shows the presence of phytosterol.

### 1. Test for fixed oils and fats

- Small quantity of the various extracts was separately pressed between two filter papers. Appearance of oil stain on the paper indicates the presence of fixed oil.
- Few drops of 0.5N alcoholic potassium hydroxide was added to a small quantity of various extracts along with a drop of phenolphthalein. The mixture was heated on a water bath for 1-2hrs. Formation of soap or partial neutralization of alkali indicates the presence of fixed oil and fats.

### 2. Test for tannins and phenolic compounds

Small quantity of various extracts were taken separately in water tested for the presence of phenolic compounds and tannins with

- Dilute ferric chloride solution (5%) - violet colour
- 1% solution of gelatin with 10%NaCl - white precipitate
- 10% lead acetate solution - white precipitate

### 3. Test for proteins

Various extracts were dissolved in few ml of water and treated with

- Millon's reagent: Appearance of red colour shows the presence of proteins and free amino acids.

- Biuret test: Equal volume of 5% solution of sodium hydroxide and 1% copper sulphate were added. Appearance of pink or purple colour indicates the presence of proteins and free amino acids.

## VII. TEST FOR GUMS AND MUCILAGES

About 10ml of various extracts were added separately to 25ml of absolute alcohol with constant stirring and filtered. The precipitate was dried in air and examined for its swelling properties and for the presence of carbohydrates.

### 1. Test for flavanoids

- With aqueous solution of sodium hydroxide blue to violet colour (Anthrocyanins), yellow colour (Flavones), yellow to orange (Flavonones).
- With concentrated sulphuric acid yellowish orange colour (Anthrocyanins), orange to crimson colour (Flavonones).
- Shinoda's test – the extracts were dissolved in alcohol, to that a piece of magnesium and followed by concentrated hydrochloric acid was added drop wise and heated. Appearance of magenta colour shows the presence of flavonoids.

**Test for lignin:** With alcoholic solution of phloroglucinol and concentrated hydrochloric acid appearance of red colour shows the presence of lignin.

**Test for terpenoids**

- **Noller's test:** The substance was warmed with tin and thionyl chloride. Pink coloration indicates the presence of triterpenoids.

**Test for steroids**

- **Libermann** – Burchard test: 2 ml extract was mixed with chloroform. To this 1-2 ml acetic anhydride and 2 drops concentrated sulphuric acid were added from the side of test tube. First red, then blue and finally green colour appears.

## VIII. PHYSICAL EVALUATION

This method of evaluation refers the determination of various physical standards of the drugs [5, 6]. It involves the determination of various physical parameters, such as moisture content, viscosity, melting point, optical rotation, ash content, extractive values, volatile oil content, foreign organic matter, etc., to ensure the quality and purity of the drugs as follows-

- **Loss on drying:** 2-4 grams of crude powder of Alternanthera philoxeroides leaves was taken in a glass stoppered shallow weighing bottle and then dried in an oven at 105ºC till constant weight was obtained. The weight after drying was noted and loss on drying was calculated.
- **Alcohol soluble extractive:** 5g of accurately weighed coarsely powdered air dried drug was macerated with 100 ml of methanol in a closed flask for 24 hours, shaking frequently during the first 6 hours and allowing to stand for 18 hours. It was then filtered and 25 ml of the filtrate was evaporated to dryness in a flat-bottomed shallow dish at 105 0C. It was then weighed and calculated the % of methanol soluble

extractive with reference to the air dried drug.

- **Water soluble extractive**: Similarly water soluble extractive also determined using chloroform water as a solvent and calculated the % of water soluble extractive with reference to the air dried drug.
- **Total ash:** Two grams of dried powdered drug was taken in a silica crucible and ignited it by gradually increasing the heat to 450°C until it was white, indicating the absence of carbon. Ash was cooled in a desiccator and weighed without delay. The percentage of total ash was calculated on the basis of sample taken initially.
- **Acid insoluble ash**: To the crucible containing total ash, 25 ml of hydrochloric acid (HCl, ~70g/l) was added; it was covered with a watch-glass and boiled gently for 5 minutes. The watchglass was rinsed with 5 ml of hot water and this liquid was added to the crucible. The insoluble matter was collected on an ashless filter paper and it was washed with hot water until the filtrate was neutral. The filter paper containing the insoluble matter was transferred to the original crucible; it was dried on a hot plate and ignited to constant weight. The residue was allowed to cool and then weighed without delay. The percentage of acid insoluble ash was calculated on the basis of sample taken initially.

- **Water soluble ash**: To the crucible containing the total ash, 25 ml of water was added and boiled for 5 minutes. The insoluble matter was collected on an ashless filter paper. It was washed with hot water and ignited in a crucible for 15 minutes. The residue was allowed to cool and then weighed without delay. Weight of insoluble matter was subtracted from the weight of total ash. The percentage of water soluble ash was calculated on the basis of sample taken initially.
- **Fluorescence Analysis:** The powder was subjected to fluorescence analysis as per the standard procedure as given below and they were observed under day light and UV light.
  - 50% H2SO4 + Powdered drug
  - 1N HCL + Powdered drug
  - 50% HNO3 + Powdered drug
  - 5% KOH + Powdered drug
  - Methanol + Powdered drug
  - 1N NaOH + Powdered drug
  - Distilled Water + Powdered drug
  - Picric acid + Powdered drug
  - 5% I2 slution + Powdered drug
  - 5% + FeCl3 + Powdered drug
  - Ammonia + Powdered drug
  - Acetic acid + Powdered drug

## IX. BIOLOGICAL EVALUATION

It refers the estimation of potency of crude drugs or its preparations by means of its effect on living organisms like bacteria, fungal growth or animal tissue or entire animal. Bioassay of drugs is preferred when the evaluation is not adequately done by chemical or physical means. It includes the evaluation of hepatoprotective activity, hypoglycemic activity, anti-inflammatory activity, etc. by means of a suitable animal model for testing and control [3, 4].

## X. CONCLUSION

The evaluation of natural medicinal products is essential to ensure their quality, safety, and efficacy. Through techniques such as organoleptic, microscopic, chemical, physical, and biological evaluation, we can confirm their identity, purity, and potency. This thorough evaluation process helps mitigate risks associated with adulteration and ensures that these products deliver reliable therapeutic benefits.

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