

## Addressing the Issue of Adulteration

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Date of Submission: 15-09-2024

Date of Acceptance: 25-09-2024

### ABSTRACT

Ayurveda is an ancient science with a vast body of knowledge. Today, there is a growing global interest in Ayurvedic medicines due to their safety and effectiveness. Approximately 80% of the rural population relies on Ayurvedic treatments, making the proper standardization of Ayurvedic drugs essential. However, adulteration has become a significant concern. Adulteration involves the debasement of a product, where a substance mimics the appearance of a genuine drug but lacks its properties. Various types of adulteration exist, necessitating effective solutions. Physicians should identify and report adulterants to the relevant authorities. Several methods are available for detecting adulterants, and conducting these tests is crucial for ensuring the authenticity of Ayurvedic drugs. Addressing adulteration is key to preventing the distribution of counterfeit drugs and maintaining the availability of genuine products in the market. Adulteration is generally considered an intentional malpractice. By rectifying adulteration practices, we can enhance the effectiveness of Ayurvedic medicines in treating diseases

### I. INTRODUCTION

Ayurveda is a system of medicine aimed at maintaining health in healthy individuals and curing those who are ill. To achieve these goals, four essential components of treatment are necessary: Bhishak (physician), Dravya (medicine), Upasthatha (nurse or attendant), and Rogi (patient). Among these, Dravya (or Bhesaj) is crucial, as it must be both safe and effective, and free from contaminants. Nowadays, the availability of genuine drugs is decreasing due to increased substitution and adulteration of crude drugs. Many people today rely on Ayurvedic medicines.

Adulteration, which is both widely recognized and legally significant, involves the

debasement of a product by substituting the original crude drug partially or wholly with other similar-looking substances. Reasons for adulteration include drug scarcity, the desire to increase profit, and high prices. Adulteration can manifest in various ways, such as admixture, inferiority, sophistication, substitution, spoilage, and deterioration. It may be intentional or unintentional. Intentional adulteration is carried out deliberately by manufacturers or suppliers, often driven by high market prices and profit motives. Unintentional adulteration, on the other hand, occurs without any malicious intent from manufacturers or suppliers.

Addressing the issue of adulteration involves identifying the sources, understanding the consequences and implementing preventive measures.

The keysteps in the process of adulteration are

1. Selection of inferior substances
2. Addition of harmful substances
3. Mislabelling or Mis presentation
4. Dilution of genuine ingredients
5. Failure in quality control
6. Distribution in the market
7. Detection and identification
8. Legal and regulatory consequences

### II. MATERIALS AND METHODS

ASHOKA<sup>1</sup>

Botanical name : Saraca asoca

Family : Fabaceae

- It is one of the most sacred and legendary trees in India.
- All parts of the plant are pharmacologically active.
- Stembark is renowned for its medicinal properties especially in gynaecological & obstetrical problems.

- It is becoming rarer in its natural habitat.
- It has been very widely used in Indian medicine from the time immemorial for the treatment of uterine genital and other reproductive disorders in women.

#### Adulterants of Ashoka

1. Polyalthia longifolia
2. Bauhinia variegata
3. Trema orientalis
4. Shorea robusta

#### MORPHOLOGY

Saraca asoca	Polyalthia longifolia
Tree grows upto 6-9 m height.	Tree or shrub
Bark on old stems is dark green in colour, often marked by bluish & ash white patches of lichen.	Bark is dark greyish brown in colour and is smooth.

- ✓ Morphologically the bark of Ashoka and polyalthia longifolia look like similar.
- ✓ Macroscopic evaluation of the Ashoka bark not fulfilling the API standards.
- ✓ In microscopically genuine Ashoka is fibrous yellow colour and no characteristic odour. But the adulterated one doesn't have these properties.
- ✓ Ashoka contains plenty of stone cells, often containing prismatic crystals of calcium oxalates and simple spherical shaped starch grain. The market sample shows plenty of fibres and shown rosette and acicular crystals that is the peculiar feature of Polyalthia longifolia.

#### ORGANOLEPTIC EVALUATION

Macroscopic and microscopic	Genuine sample	Adulterated sample
Shape	Curved and channelled	Curved and channelled
Size	7mm thickness	12 mm thickness
Colour	External - greyish brown Internal - reddish brown	Greenish
Texture	External with	Smooth,

	warty protuberances and enclosing circular to elongated lenticels	waxy, slightly glabrous
Fracture	Tough	Characteristic
Odour	Odourless	Characteristic
Taste	Astringent	Characteristic

#### Preliminary phytochemical characters

1. Foreign matter > genuine drug
2. Moisture content > genuine drug
3. Ash value > genuine drug

#### Tannin quantification

Tannin most widely occurring group of secondary metabolites present in different families of higher plants.

4. Tannin is seen as hydrolysable tannin and condensable tannin

#### Ashoka contains condensed tannin

During the quantification of marketed Ashoka the tannin content is very less as comparing with the original Ashoka.

#### HISTOLOGICAL EVALUATION

Histological characters	Genuine Ashoka	Adulterated Ashoka
Cork	Multilayered cork with tangentially elongated cells	Multilayered cork with reddish brown contents
Cortex stone cells	Composed of thick walled Parenchyma cells with bands of stone cells	Scattering patches of stone cells thick walled and with a wide lumen seen as group
b) starch grains	Simple	Rosette shaped
c) calcium oxalate crystals	Prismatic	
d) medullary rays	Biseriated and funnel shaped	Multiseriated and funnel shaped

HPTLC used for purity control of chemical pesticides, steroids, water analysis.

HPTLC finger printing analysis analysis show the genuine sample has 8 number of peaks but the adulterates sample has 12 peaks.

Fluorescence analysis is an important standardisation parameters phytochemical present in drug show fluorescence when shown to light. There was huge difference in the light observed in genuine and marketed sample.

### SARIVA<sup>2</sup>

Botanical name – Hemidesmus indica

Family - Apocynaceae

Hemidesmus indica or sariva root is extensively used in Indian traditional used in Indian traditional system due to its biological activities.

It can be adulterated by Decalipus hamiltonii.

Its root extensively used in Indian traditional system due to its biological activities and the Decalipus hamiltonii is another member but from the same family.

### MACROSCOPIC EVALUATION

	Hemidesmus indicus	Decalipus hamiltonii
Shape	Cylindrical	Cylindrical, stout
External colour	Dark brown	Brownish
Internal colour	Pale yellow	Pale yellow
Fracture	Transverse cracks and longitudinal fissures	Smooth when fresh wrinkled and longitudinally ridged on dried
Texture	Hard	Hard
Odour	Characteristic pleasant smell	Strong characteristic pleasant smell
Size	Variable in size	Variable in size
Taste	Sweetish	Sweetish

- It can be adulterated by Decalipushamiltonii
- Microscopically cork, cortex, phloem, xylem, medullary rays and pith & in powder microscopy size and shape of corkcell, fibre, fibre trachieds, vessels, xylem parenchyma cells were different from each other.
- Water soluble extract, alcohol soluble extract, hexane soluble extract all these values are high for Decalipushamiltonii when comparing to Hemidesmusindicus .

- In HPTLC the number of bands present in Hemidesmusindicus are 8 while in the case of Decalipushamiltonii only 5 bands are present.

Studies showed that the plant Decalipushamiltonii is sold in the market in the name of Sariva( Hemidesmusindicus).

### KUSHTA<sup>3</sup>

Botanical name : Saussurea lappa

Family : Asteraceae

Kushta plant grows abundantly on the Himalayas and Kashmir valleys between 2500-3000metre altitude.

Useful part is root

Adulterants of kushta

- 1) Inula royeleana
- 2) Cardus nutans
- 3) Euphorbia thomsoniana
- 4) Salvia lanata
- 5) Aconitum heterophyllum
- 6) Costus speciosus
- 7) Kyllingia triceps
- 8) Arctium lappa

### MORPHOLOGY

Root Stout, upto 60cm long, brownish with longitudinal streaks and furrows with reticulatesurface , having characteristic odour in genuine sample

In adulterated sample contain stout, fusiform , arched , slightly twisted roots Outer surface is rough , full brown , or light grey in colour

Tranverse section of root show brownish white surface with 3 distinct regions.

### ORGANOLEPTIC EVALUATION

	Genuine sample	Adulterated sample
Appearance	Fusifiform conical and tapering collapsing in the centre having longitudinal wrinkles which anastomoses and ridges running straight	Stout fusiform arched or slightly twisted roots, outer surface is rough,dull brown or light grey in colour with longitudinal wrinkles and small tubercles
Size	7-8cm in	15cm long

	length 2-4 cm thickness	1-5.4cm broad
Colour	Saddle brown	Brownish white surface
Taste	Start with sweetness and then bitter	Very bitter
Odour	Strong and aromatic	Characteristic odour
Fracture	Short and horny	Short

Studies shown that the kushta we brought from the market were identified as root of ashwagandha and roots of pushkaramoola.

The phytochemical tests also show variation in adulterated one when comparing to API standards HPTLC also show variation.

#### MANJISHTA<sup>4</sup>

Botanical name – *Rubia cordifolia*

Family – Rubiaceae

Useful part- stem

They are traditionally used for curing blood disorders, skin disorders, inflammatory, haemostatic, urolithotripic, antipyretic, analgesic, antihelminthic & for improving complexion.

#### Adulterant

*Rubia tinctorum*

It has also contain lucidin which is known for its genotoxicity.

#### MORPHOLOGY

<i>Rubia cordifolia</i>	<i>Rubia tinctora</i> (adulterant)
Stems are cylindrical, slightly flattened	Stems are stout cylindrical
Smooth with no distinct striations	Rough with distinct longitudinal striations
Wiry upto 0.3cm thick	Up to 0.8cm thick
Light reddish brown with distinct nodes possibly having scaly leaves	Dark reddish brown with no distinct nodes or scaly leaves.

#### MICROSCOPY

	Genuine	Adulterated
Cork	Wider with dome shaped structure, consisting of	Not wider

	squarish and tangentially elongated thinwall cells, some contain acicular calcium oxalate (cao) crystals as isolated or bundles present or more	
Cortex	Tangentially elongated thin walled, some contain acicular cao crystals as isolated or bundles present or more	Less present
Secondary phloem	Not wider	Wider
Secondary xylem	Wider	Not wider
Pith	Not wider	Wider

- ✓ GC-MS analysis of *Rubia cordifolia* revealed the presence of 9 phytoconstituents while *Rubia tinctorum* revealed the presence of 6 phytoconstituents, which results they are different from each other.

### III. RESULT AND DISCUSSION

- Majority of the ayurvedic drugs we got from the market are adulterated.
- If we use these adulterated drugs we can't get the maximum efficacy.
- It is crucial to enforce strict regulations, implement quality control measures, raise public awareness and invest in research and development.
- By collectively working towards these goals we can safeguard the efficacy and safety of ayurvedic drugs.
- In Ayurveda, there are various methods to assist the quality of raw materials basically most of them are subjective and required definite objective criteria to enhance knowledge about them.
- Now a days significant number of methods to authenticate crude drugs.
- Simple methods like organoleptic characters may hold good to assess the genuine of certain drugs but some may require highly sophisticated techniques too.
- It is in the hand of researcher to choose the right method for the drug of interest.

- DNA fingerprinting, gas chromatography, high performance liquid chromatography are the most sophisticated methods which can assess the genuinity very keenly.

#### IV. CONCLUSION

We understand from these findings that majority of the drugs we got from the market are adulterated so it is necessary to do more research and information required to rectify and minimize the process of adulteration for improving the safety of patient. Hence it is essential to cultivate more drugs in our surroundings. If we use adulterated drugs for preparing formulations it can cause the adverse effects and we don't get the expected efficacy.

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