
**A REVIEW ON THE CULTIVATION, COLLECTION AND
PROCESSING OF SEMECARPUS ANACARDIUM LINN**

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DOI: <https://doi-doi.org/101555/ijarp.5825>**ABSTRACT**

Semecarpus anacardium Linn. (Family: Anacardiaceae), popularly known as marking nut or Bhallataka, is a deciduous tree native to the tropical regions of India that holds significant value in traditional medicine. However, the raw fruit pericarp contains highly corrosive phenolic compounds, primarily bhilawanols, which cause severe dermal blistering and systemic toxicity. Consequently, the crude drug cannot be used in its raw form and must undergo a meticulous traditional purification process called Shodhana or advanced laboratory fractionation to isolate its healing properties. Chemically, the plant is rich in toxic alkyl phenols, beneficial biflavonoids (e.g., jeediflavanone, semecarpuf flavanone), anacardic acid, fixed oils, and sterols. Standardizing the extract involves strict quality control, including High-Performance Thin-Layer Chromatography (HPTLC) for active marker tracking and Gas Chromatography-Mass Spectrometry (GC-MS) to confirm the complete elimination of hazardous toxins. Once safely detoxified, *Semecarpus anacardium* exhibits profound therapeutic applications, including anti-inflammatory, analgesic, and potential anticancer properties, alongside various industrial uses such as indelible dyes, varnishes, and natural wood preservatives. This article reviews the botanical source, cultivation, safety requirements, industrial processing, and diverse applications of this highly potent yet dual-natured crude drug.

INTRODUCTION

Semecarpus anacardium Linn., commonly known as marking nut or Bhallataka, is an important medicinal plant belonging to the family Anacardiaceae. It is a medium-sized

deciduous tree found in tropical regions of India. The fruit is drupe-like, consisting of a hard black pericarp and a fleshy receptacle.

The pericarp of the fruit is highly irritant and toxic, containing phenolic compounds such as bhilawanols, which can cause severe skin inflammation and blistering on contact. Due to this toxicity, the crude drug is not used in raw form.

After proper detoxification (Shodhana), it is widely used in traditional medicine, especially in Ayurveda, for treating conditions like arthritis, skin diseases, digestive disorders, and as a rejuvenating agent. The seeds are oily and yield a resinous oil that has medicinal importance after purification.

Thus, *Semecarpus anacardium* is a potent but toxic crude drug that requires proper processing before therapeutic use.



FIG NO 1: Ripe fruit of marking nut.

BIOLOGICAL SOURCE

Marking nut is the dried, ripe fruit of the tree species *Semecarpus anacardium* belongs to the Anacardiaceae family.

CHEMICAL CONSTITUENTS

1. Phenolic Compounds (Bhilawanols)

The most significant active principles are a mixture of phenolic compounds known collectively as Bhilawanols.

- These are catechol derivatives with long-chain alkyl or alkenyl side chains (C15 carbon chains).
- Specifically, Bhilawanol A and Bhilawanol B are the primary components.
- They are chemically related to urushiol, the irritant found in poison ivy.

2. Biflavonoids

The nut shells contain a unique series of biflavonoids, which contribute to the plant's antioxidant and anti-inflammatory activities:

- Jeediflavanone
- Semecarpuf flavanone
- Galluflavanone
- Anacarduf flavanone

3. Other Major Constituents

- Anacardic Acid: A salicylic acid derivative with an alkyl chain.
- Fixed Oils: The kernel contains a non-toxic edible oil (about 25%), which is rich in linoleic, oleic, and palmitic acids.
- Sterols: Presence of β -sitosterol and stigmasterol.
- Vitamins and Minerals: High concentration of Vitamin C (ascorbic acid) in the fruit.

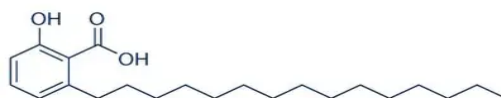


FIG NO 2: Chemical Structure of Anacardic acid.

CULTIVATION AND COLLECTION

The *Semecarpus anacardium* tree, known as the Marking Nut or Bhilawa, is a medium-sized tree that grows wild in the hotter parts of India. It is famous because its fruit contains a powerful black liquid that was traditionally used to mark laundry, which is how it got its name.

Cultivation

Semecarpus anacardium grows primarily in warm, tropical environments and is most commonly found growing natively in the deciduous forests of India and neighboring South Asian countries. While the tree is highly resilient and adaptable to various soil types, it grows best in well-drained fertile soil that prevents waterlogging. Cultivation begins with fresh

seeds, which are typically sown in nurseries just before the arrival of the monsoon season. After the seedlings have matured to approximately one foot in height, they are carefully transplanted into open fields for permanent growth.

Collection

The tree typically flowers during the summer months, and its fruits mature and become ready for harvest during the winter season, spanning from December to March. Workers gather the fruits only when they are completely ripe and have turned a distinct black color.

Safety Warning: Harvesting this fruit requires extreme caution because the pericarp contains a highly acrid, corrosive juice. Direct skin contact with this liquid causes severe blistering and painful dermatitis; therefore, workers must wear protective gear and handle the nuts with great care.

To ensure the therapeutic value of the harvest, a traditional quality control test is performed by placing the collected nuts in water. Nuts that sink to the bottom are considered high-quality and rich in medicinal oils, whereas those that float are discarded as sub-standard.

Post-Harvest Handling & Storage

Following a successful harvest, the nuts are spread out evenly under the sun to dry completely, a crucial step that prevents mold and extends their shelf life. Once fully dried, they are packed into bags or airtight jars and stored in a cool, dry location. Maintaining a cool storage temperature is vital, as excessive heat can cause the volatile internal oils to liquefy and leak through the shells.

PROCESSING

The processing of *Semecarpus anacardium* (Bhallataka) is one of the most critical steps in its pharmacognosy because the raw fruit is highly toxic and corrosive. In traditional and scientific practice, this process is known as Shodhana (Purification).

1. The Purification Process (*Shodhana*)

Because the raw fruit of *Semecarpus anacardium* contains highly toxic bhilawanols (catechol derivatives) that trigger severe skin blistering and internal gastrointestinal irritation, it must undergo a meticulous detoxification process called *Shodhana* before it can be safely used in medicine.

- Initial Selection: The process begins with a strict quality-control check. Only completely ripe, black fruits are chosen. These fruits are dropped into water, and only the heavy nuts that sink to the bottom are selected for purification, as they contain the highest concentration of active therapeutic properties.
- Method of Detoxification:
 - Thalamus Removal: First, the cup-shaped base of the fruit, known as the thalamus, is carefully cut off and discarded, as it does not contain the desired medicinal properties.
 - Abrasive Bag Treatment: The remaining nuts are placed into a sturdy jute bag filled with brick powder or coarse sand.
 - Vigorous Friction: The bag is tied securely and rubbed or shaken vigorously. The rough, abrasive texture of the brick powder pierces the outermost layers of the fruit, drawing out the toxic, oily resin from the pericarp and safely absorbing it.
- Washing: Once the rubbing is complete, the nuts are removed from the bag and washed thoroughly with warm water. This step is crucial to rinse away the contaminated brick powder, sand, and any residual surface oil.
- Boiling (Chemical Neutralization): In alternative or supplementary traditional protocols, the washed nuts are boiled in either milk or cow's urine (*Gomutra*). The organic compounds present in these liquids chemically react with and neutralize the remaining harsh phenolic compounds, rendering the nut entirely safe for internal medicinal consumption.

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2. Industrial and Technical Processing

In modern pharmaceutical manufacturing, *Semecarpus anacardium* undergoes advanced technical refining to isolate its health benefits while completely eliminating its hazards.

- Extraction: The pre-purified and completely dried fruits are mechanically crushed into a coarse powder to maximize their surface area. This powder is then submerged in a specific chemical solvent most commonly petroleum ether, chloroform, or ethanol which dissolves the plant's active biological compounds. The mixture is heated or agitated over a set period, allowing the solvent to fully absorb the fruit's chemical fractions, including its beneficial biflavonoids and sterols. Finally, the liquid is filtered to remove the solid plant waste, and the remaining solvent is carefully evaporated. This leaves behind a concentrated crude extract, which is ready for further industrial purification and refining.

- **Fractionation:** The fractionation of *Semecarpus anacardium* is an advanced laboratory process that uses column chromatography to separate the raw fruit extract into its individual chemical parts, specifically isolating the therapeutic compounds from the toxic resins based on their molecular polarity.

Step 1: Preparing the Column

The process begins by setting up the stationary phase, which acts as a fixed, highly polar filter bed inside a vertical glass chromatography column. Technicians utilize silica gel (usually 60–120 or 230–400 mesh size) as the stationary phase, mixing it with a base solvent (hexane or petroleum ether) to form a wet slurry. This slurry is poured into the column and allowed to settle into a tightly packed, uniform solid bed that will systematically slow down different molecules at different rates based on their chemical structure.

Step 2: Loading the Crude Extract

Once the stationary phase is perfectly stabilized, the crude, dark extract obtained from the *Semecarpus anacardium* fruit which contains both healing biflavonoids and toxic alkyl phenols is dissolved in a minimal amount of solvent. This highly concentrated liquid sample is carefully layered directly onto the very top of the silica gel bed without disturbing the surface.

Step 3: Running the Gradient Solvent System

To move the extract down through the column, a liquid mobile phase is continuously poured into the top of the apparatus. Because *Semecarpus anacardium* contains a complex mixture of compounds ranging from highly non-polar to highly polar, a gradient elution system is mandatory for the mobile phase. Rather than using just one liquid, technicians use a succession of different solvents, gradually increasing the polarity of the mobile phase over time:

1. **The Non-Polar Phase:** The process begins using pure hexane or petroleum ether (100%).
2. **The Medium-Polarity Phase:** Technicians then introduce a mixture of hexane and chloroform, steadily increasing the ratio of chloroform (e.g., from 90:10 to 50:50, and finally to 0:100 pure chloroform). Alternatively, a gradient of petroleum ether and ethyl acetate is used.

3. The Polar Phase: Finally, the mobile phase is switched to a combination of chloroform and methanol, gradually increasing the concentration of methanol (e.g., 95:5, 90:10) until pure methanol (100%) is flushed through the column.

Step 4: Molecular Separation and Elution

As this changing mobile phase flows downward through the stationary silica gel, the individual compounds within the *Semecarpus anacardium* extract separate cleanly based on how they interact with the specific solvents:

- Elution of Toxic Phenols: The hazardous, blister-causing alkyl phenols (bhilawanols) are highly non-polar. Because they share no chemical attraction with the polar silica gel, they dissolve instantly in the initial, non-polar mobile phase (100% hexane or petroleum ether). Consequently, they rush down the column first and are washed out in the very first fractions to be safely isolated and discarded.
- Retention of Therapeutic Flavonoids: Conversely, the beneficial biflavonoids (such as jeediflavanone and semecarpufavanone) are highly polar molecules. They form strong chemical bonds with the stationary silica gel bed, completely resisting the non-polar solvents and remaining locked at the top of the column while the toxins pass through.

Step 5: Final Collection of the Purified Fractions

Once laboratory monitoring confirms that the toxic components have completely cleared the column, the technician introduces the highly polar mobile phase solvents, specifically ethyl acetate or a chloroform-methanol (90:10) blend. This strong mobile phase breaks the chemical bond between the medicinal flavonoids and the silica gel, washing the purified, health-promoting fractions out of the bottom of the column. These therapeutic fractions are collected in clean, separate vessels, completely free of the plant's original skin-irritating toxicity.

- Standardization: Before the batch is approved for public use, the final extract undergoes strict laboratory testing. Technicians verify that the product is completely free of irritant phenols, ensuring the standardized extract is 100% safe for human oral consumption or topical skin applications.

1. Physical and Chemical Standards

Every batch of raw material must meet strict pharmacopoeial benchmarks to verify quality and prevent adulteration:

- Appearance: The fruits must be glossy black, heart-shaped, and completely free of dirt, mold, or foreign matter.
- Moisture Content: The total moisture must not exceed 5% to prevent microbial growth during storage.
- Ash Values: Total ash must remain below 5%, with acid-insoluble ash below 0.5%, to ensure the sample is free from soil and sand contamination.

2. Chemical Fingerprinting

Technicians use High-Performance Thin-Layer Chromatography (HPTLC) to verify that the plant is authentic and contains its health-promoting properties:

- The Solvent System: The chemical profile is mapped using a mobile phase typically consisting of Toluene: Ethyl Acetate (9:1) over a polar silica gel stationary phase.
- Active Marker Tracking: The process tracks and measures Tetrahydroamentoflavone (THA), which serves as the primary beneficial bioflavonoid marker used to verify the medicinal potency of the batch.

3. Safety and Detoxification Verification

The final and most crucial step utilizes Gas Chromatography-Mass Spectrometry (GC-MS) to guarantee that the traditional purification process (*Shodhana*) was completely successful:

- Toxin Elimination: The test confirms that the dangerous, blister-causing bhilawanols and anacardic acids found in the raw fruit have dropped below detectable limits.
- Safety Certification: A batch is officially standardized and approved for human consumption only when these raw toxins have safely converted into anacardol, a non-toxic compound that presents no threat of internal irritation or contact dermatitis.

3. Safety Precautions During Processing

Due to the volatile and corrosive nature of the plant's oils, strict safety protocols must be followed during both traditional and industrial handling.

- Protective Gear: It is mandatory for all lab technicians and processing workers to wear heavy-duty gloves, protective eye goggles, and face masks. This gear prevents accidental

contact dermatitis on the skin and protects the respiratory system from inhaling toxic fumes or dust generated during crushing.

- **Oil Application Barrier:** As a time-tested traditional safety measure, workers apply a thick layer of coconut oil or sesame oil to any exposed skin before handling the plant. The oil acts as a protective lipophilic barrier, preventing the plant's corrosive resin from directly touching, binding to, or penetrating the skin cells.

TOXIC PROFILE

1. **Dermal Hazard:** Direct contact with the raw, oily juice causes severe contact dermatitis, intense burning, swelling, and painful, fluid-filled blisters.
2. **Systemic Toxicity:** If ingested raw or unpurified, it acts as a severe gastrointestinal irritant, causing painful blisters in the mouth and throat, nausea, severe abdominal pain, and potential kidney damage (nephropathy).
3. **Fatal Dose & Period:** The fatal dose of the raw juice is estimated to be roughly 5 to 10 grams, with a fatal period spanning 12 to 24 hours if left untreated.

APPLICATIONS

The applications of *Semecarpus anacardium* range from traditional medicine to modern industrial uses. Due to the potency of its chemical constituents, it is utilized across various fields.

1. Therapeutic & Medicinal Applications

In traditional systems like Ayurveda (where it is known as *Bhallataka*), the purified fruit is used to treat several chronic conditions:

- **Anti-Inflammatory & Analgesic:** Used to manage rheumatoid arthritis, sciatica, and joint pain.
- **Anticancer Potential:** Research indicates its effectiveness in inhibiting the growth of certain tumor cells, particularly in leukemia and breast cancer models.
- **Dermatological Use:** Applied topically (in diluted, processed forms) for skin diseases like vitiligo, though it requires extreme caution to avoid irritation.
- **Digestive Health:** Used to treat haemorrhoids (piles), colitis, and helminthiasis (worm infestations).

2. Industrial & Technical Applications

The corrosive resin (marking nut oil) has several non-medicinal uses:

- Dyeing & Marking: The black, resinous juice is naturally indelible. It is used by laundry workers to mark clothes and in the manufacturing of marking inks and hair dyes .
- Surface Coatings: The oil is used in the production of varnishes, lacquers, and enamels because of its water-resistant properties.
- Termite Repellent: Due to its toxic phenolic content, it is used as a natural preservative for wood to prevent termite attacks.

CONCLUSION

Semecarpus anacardium stands out as a unique pharmacological subject that perfectly bridges ancient Ayurvedic wisdom with modern pharmaceutical technology. While the raw fruit presents serious dermal and systemic hazards due to its volatile bhilawanol content, traditional *Shodhana* protocols and modern column chromatography successfully nullify these dangers. By executing a precise gradient solvent elution system, modern processing safely separates the highly non-polar toxic resins from the highly polar therapeutic biflavonoids. Furthermore, stringent pharmacopoeial standardization benchmarks ranging from physical ash and moisture limits to sophisticated GC-MS and HPTLC fingerprinting ensure that final batches are entirely non-toxic and structurally authenticated for public use. When properly handled with mandatory protective gear, the plant transitions from a hazardous botanical entity into a highly valuable asset. Ultimately, the purified extract yields powerful medicinal benefits for chronic inflammatory diseases, digestive disorders, and oncological research, while its raw resin drives robust industrial applications in protective surface coatings, dyes, and pest repellents.

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