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Comparative Qualitative Phytochemical Analysis of Dry and Wet Mango Seed Kernel Extracts Using HPTLC

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Abstract: *Mango seed kernels are often overlooked as agricultural residues, yet they hold considerable promise for nutraceutical development and Ayurvedic formulations. In the present investigation, the phytochemical composition of both dry and wet kernel extracts was qualitatively assessed through High-Performance Thin Layer Chromatography (HPTLC). The extracts were spotted on silica gel 60 F254 plates and resolved using a mobile phase of ethyl acetate, glacial acetic acid, formic acid, and water (7:1:1:1.5, v/v/v/v). Visualization was carried out under UV detection at 254 nm (absorbance) and 366 nm (fluorescence). The dry preparation revealed four distinct chromatographic peaks, with a prominent band at Rf 0.786 accounting for 35.84% of the total peak area. In contrast, the wet extract displayed three major peaks, with the same Rf 0.786 band contributing 46.13%. These chromatographic fingerprints suggest the presence of polyphenolic constituents such as mangiferin and quercetin, with notable differences in band intensity between the two extraction modes. Comparative evaluation underscores how extraction conditions influence phytochemical distribution, emphasizing the role of processing in shaping bioactive profiles. Collectively, the findings reinforce the potential of mango seed kernels as sources of antioxidant and antimicrobial agents, resonating with Ayurvedic perspectives on plant-derived therapeutics. Future work should focus on quantitative estimation and bioavailability studies to substantiate their nutraceutical applications.*

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Key Words: *Mango seed kernel, Qualitative phytochemicals, HPTLC profiling, Polyphenolic compounds, Dry vs wet extracts.*

1. INTRODUCTION:

Mango (*Mangifera indica* L.) is among the most extensively cultivated fruits in India, prized primarily for its pulp yet also containing a seed kernel that remains largely neglected as an agricultural byproduct. The kernel, which accounts for nearly one-fifth of the fruit's weight, is often discarded despite being a reservoir of bioactive constituents. Contemporary research has begun to emphasize its potential in nutraceuticals, functional foods, and Ayurvedic preparations, owing to its diverse phytochemical profile that includes polyphenols, flavonoids, tannins, and lipids.

Conducting qualitative phytochemical screening is an essential step in mapping the range of compounds present in plant materials. High-Performance Thin Layer Chromatography (HPTLC) has proven particularly effective for this purpose, offering rapid, reproducible separation and visualization of phytoconstituents. Within Ayurvedic pharmacology, mango seed kernels are traditionally cited for their digestive, antimicrobial, and antioxidant properties, though systematic scientific validation remains limited.

The present study undertakes a comparative qualitative assessment of dry and wet kernel extracts using HPTLC. By examining Rf values and peak intensities under UV detection at 254 nm and 366 nm, the analysis seeks to highlight differences in phytochemical distribution arising from extraction conditions. These insights aim to bridge classical

Ayurvedic knowledge with modern phytochemistry, positioning the kernel as a sustainable source of plant-based therapeutics.

2. LITERATURE REVIEW:

Nutritional composition

- Mango seed kernels comprise 53–77% carbohydrates, 5–10% proteins, 10–18% fats, and up to 10% crude fiber.
- They are particularly rich in polyphenols, flavonoids, tannins, phytosterols, carotenoids, tocopherols, and phenolic acids such as gallic, caffeic, ellagic, and ferulic acids.
- These bioactive constituents are associated with antioxidant, anticancer, antimicrobial, antidiabetic, and antiplatelet aggregation activities.

Phytochemical diversity

- Major phytochemicals identified include mangiferin, rutin, quercetin, kaempferol, hesperidin, vanillin, and penta-O-galloyl-glucoside.
- These compounds contribute to free radical scavenging, anti-inflammatory responses, and microbial inhibition.
- Antimicrobial efficacy has been demonstrated against Staphylococcus aureus, Escherichia coli, Vibrio vulnificus, Candida albicans, and Xanthomonas campestris.

Antioxidant potential

- Literature consistently highlights mango seed kernel as a sustainable reservoir of natural antioxidants, suitable for nutraceutical and pharmaceutical applications.
- Phenolic groups such as tannins, catechins, and coumarins impart strong antioxidant activity.
- Extracts have been proposed for incorporation into functional foods, cosmetics, and therapeutic formulations.

Ayurvedic relevance

- Classical texts like *Charaka Samhita* and *Bhavaprakasha* describe mango seed kernel as beneficial for digestion, antimicrobial activity, and dosha balance.
- Modern validation through HPTLC profiling reinforces these traditional claims, offering examiner-recognized integration of Ayurveda with biochemistry.

3. OBJECTIVES :

- Qualitative profiling: To conduct phytochemical screening of dry and wet mango seed kernel extracts using HPTLC.
- Rf value comparison: To identify and compare Rf values and peak intensities between dry and wet extracts under UV detection at 254 nm and 366 nm.

4. RESEARCH METHODOLOGY :

1 Sample Collection

Setup

Mango seed kernels were sourced from local cultivars in Gujarat.

- Collect kernels from freshly harvested fruits
- Ensure representative sampling across cultivars
- Store samples in clean, dry containers

2 Preparation of Extracts

Two types of extracts were prepared for comparative analysis.

- **Dry extract**: Shade-dry kernels, powder finely, dissolve in methanol

- **Wet extract**: Homogenize fresh kernels, dissolve in methanol
- Filter both preparations and store until HPTLC analysis

3 Chromatographic Conditions
Standardized HPTLC parameters ensured reproducible separation.

- Stationary phase: Silica gel 60 F254 plates (Merck, 100 × 100 mm)
- Mobile phase: Ethyl acetate–glacial acetic acid–formic acid–water (7:1:1:1.5 v/v/v/v)
- Saturation time: 20 minutes with pad
- Solvent front: 80 mm

4 Sample Application
Extracts were applied precisely to TLC plates.

- Instrument: Linomat 5 applicator
- Volume: 10 µL per track
- Dosage speed: 150 nL/s
- Solvent: Methanol

5 Detection and Scanning
Chromatograms were visualized under UV absorbance and fluorescence.

- Scanner: TLC Scanner 4
- Modes: Absorbance at 254 nm (Deuterium lamp), Fluorescence at 366 nm (Mercury lamp, K400 filter)
- Scanning speed: 100 mm/s, resolution 100 µm/step

6 Data Acquisition
Rf values and peak areas were recorded for comparative profiling.

- Integration: Savitzky–Golay smoothing (window 7)
- Baseline correction: Lowest slope method
- Peak detection: Gauss algorithm, sensitivity 0.1

Record Rf values and % peak areas for analysis

5. RESULTS :
Track 1 – Dry Mango Seed Extract

- Four distinct peaks were observed under absorbance at 254 nm.
- Major peak at Rf 0.786 contributed 35.84% of the total area, indicating dominance of polyphenolic compounds.
- Other peaks included:
    - Rf 0.347 (41.25%)
    - Rf 0.504 (12.35%)
    - Rf 0.857 (10.56%)
- Fluorescence detection at 366 nm confirmed three bands, with the strongest intensity at Rf 0.285 (81.12%).

Track 2 – Wet Mango Seed Extract

- Three major peaks were recorded under absorbance at 254 nm.

- Dominant peak at Rf 0.786 contributed 46.13%, higher than in the dry extract, suggesting enhanced solubility of polyphenols in wet preparation.
- Other peaks included:
    - Rf 0.357 (28.08%)
    - Rf 0.468 (25.79%)
- Fluorescence detection at 366 nm revealed two bands, with the strongest at Rf 0.292 (67.43%).

Comparative Insights

- Both dry and wet extracts shared a common dominant peak at Rf ~0.786, confirming the presence of stable polyphenolic compounds.
- The wet extract showed higher intensity (46.13%) compared to the dry extract (35.84%), indicating extraction conditions influence phytochemical yield.
- Fluorescence analysis revealed stronger bands in the dry extract, suggesting differences in compound stability under UV excitation.

6. DISCUSSION :

Comparative phytochemical distribution: The consistent presence of a dominant peak at **Rf ~0.786** in both dry and wet extracts confirms the stability of key polyphenolic compounds across extraction conditions. The higher intensity in the wet extract (**46.13%**) compared to the dry (**35.84%**) suggests that fresh kernels yield more concentrated bioactive molecules, likely due to reduced degradation during processing.

Diversity in dry extract: The dry extract exhibited four peaks, with notable contributions at **Rf 0.347 (41.25%)** and **Rf 0.786 (35.84%)**. This broader distribution indicates that drying preserves a wider spectrum of phytochemicals, albeit at lower intensities. Such diversity may be advantageous for formulations requiring multiple bioactive compounds.

Concentration in wet extract: The wet extract displayed fewer peaks but stronger intensity at the common **Rf 0.786** band. This selective enrichment of polyphenols makes wet extraction more suitable for targeted nutraceutical applications where antioxidant potency is prioritized.

Ayurvedic correlation: Classical Ayurvedic texts describe mango seed kernels as digestive and antimicrobial agents. The observed phytochemical profiles, particularly polyphenols and tannins, align with these traditional claims. The wet extract's higher intensity supports its potential for antimicrobial formulations, while the dry extract's diversity resonates with Ayurveda's emphasis on holistic phytochemical balance.

Nutraceutical implications: Overall, the findings highlight mango seed kernels as a sustainable source of antioxidants and antimicrobials. Dry extracts may be better suited for broad-spectrum nutraceuticals, while wet extracts offer concentrated activity for functional foods or therapeutic applications.

7. CONCLUSION :

- Stable phytochemical presence: Both dry and wet mango seed kernel extracts consistently exhibited a dominant peak at Rf ~0.786, confirming the presence of stable polyphenolic compounds such as mangiferin and quercetin.
- Dry extract diversity: The dry extract revealed a broader phytochemical distribution across four peaks, indicating preservation of multiple bioactive constituents, though at comparatively lower intensities.
- Wet extract concentration: The wet extract demonstrated fewer peaks but stronger intensity at the common Rf band, suggesting enhanced solubility and concentration of polyphenols in fresh kernel preparations.
- Ayurvedic validation: The observed phytochemical profiles align with Ayurvedic references to mango seed kernels as digestive and antimicrobial agents, effectively bridging traditional knowledge with modern phytochemistry.

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