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Analytical Study of Kharjuradi Leha and Kharjuradi Khandapaka

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Abstract

Background: Pharmaceutical modification of an Ayurvedic formulation may alter moisture content, concentration, physical properties and handling.

Objective: To compare the analytical observations recorded for Kharjuradi Leha and its modified granular form, Kharjuradi Khandapaka.

Methods: Thesis-reported results for pH, loss on drying, ash values, sugar estimation, thin-layer chromatography (TLC), micromeritic properties and microbial counts were collated.

Results: pH was 4.82 for Leha and 5.71 for Khandapaka. Loss on drying was 15.70% and 7.63%; total ash 5.85% and 2.69%; acid-insoluble ash 4.19% and 1.44%, respectively. Reducing sugar was 13.38% and 10.87%, while non-reducing sugar was 4.05% and 5.73%. TLC showed prominent spots at Rf 0.70 and 0.62 for Leha and 0.89, 0.80 and 0.62 for Khandapaka. Khandapaka bulk density was 0.654 g/mL and compressibility index was 24.37%. TAMC and TYMC were reported below 10^2 CFU/g in both samples.

Conclusion: The two dosage forms showed measurable differences in the recorded parameters.

Keywords: Kharjuradi Leha; Khandapaka; physicochemical analysis; sugar estimation; TLC; GC–MS; microbial quality.

I. Introduction

Standardization of Ayurvedic formulations requires a clear description of raw materials, manufacturing procedures and quality-related parameters. A change in dosage form may affect moisture, concentration, solubility, sugar profile, appearance and powder or granule handling. Comparative analytical testing can therefore provide preliminary information about the properties of the original preparation and its modified form.

Kharjuradi Leha[1] is a semisolid preparation cited in Chakradatta, Kasa Prakarana. In the dissertation, it was modified into Khandapaka by omitting Madhu and concentrating the mass further to a granular consistency. The analytical study included organoleptic assessment, physicochemical parameters, sugar estimation, TLC, selected micromeritic properties, GC–MS profiling and microbial load analysis.

II. Aim and objectives

Aim: To compare the analytical characteristics of Kharjuradi Leha and Kharjuradi Khandapaka using the results recorded in the dissertation.

- To compare available physicochemical parameters, including pH, loss on drying and ash values.
- To report the recorded reducing and non-reducing sugar results.
- To describe the TLC observations as comparative fingerprint data rather than compound identification.
- To present available micromeritic and microbial results without extending claims beyond the source report.

III. Materials and methods

Physicochemical evaluation[2]

The thesis lists pH at 5% concentration, loss on drying, total ash and acid-insoluble ash among the reported quality parameters. Loss on drying provides an estimate of volatile matter lost under the specified test conditions and is commonly used as a moisture-related indicator; it is not identical to a direct water assay. Total ash represents inorganic residue remaining after incineration, while acid-insoluble ash estimates the portion resistant to treatment with acid. Exact temperatures, durations, sample weights and pharmacopoeial procedures must be checked against the full method section and laboratory report.

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Sugar analysis[3]
Reducing and non-reducing sugar values were transcribed as percentages from the thesis results. These values are reported as measured and are not recalculated. Since the formulations differ in processing and Madhu inclusion, their sugar profiles may differ; however, interpretation should consider the assay method, calculation basis, sample preparation and replicate variability, which must be confirmed from the original record.

TLC fingerprinting[4]
Thin-layer chromatography was used to compare visible spots and their retention factor (Rf) values. Rf is the ratio of the distance travelled by a spot to the distance travelled by the solvent front under a specified chromatographic condition. Rf values depend on the stationary phase, mobile phase, sample application and development conditions. They are useful for comparative fingerprinting but cannot identify a compound on their own without reference standards and a documented method.

Micromeritic evaluation[5]
The reported Khandapaka parameters included bulk density and compressibility index. Bulk density relates sample mass to its untapped bulk volume. Carr's compressibility index is calculated from bulk and tapped densities and is used as an indicator of packing behaviour and potential flow. The thesis also describes evaluation of Hausner ratio and angle of repose.

GC–MS and microbial analysis[6]
The thesis method describes preparation of a filtered sample solution, injection of 1 µL, helium carrier gas at approximately 1.0 mL/min, injector temperature of 250°C, interface temperature of 280°C and an oven program beginning at 60°C and rising to 280°C at 10°C/min, with an initial 2-minute hold and a final 10-minute hold. Electron ionization was reported at 70 eV with a mass range of m/z 40–600; spectra were compared with the NIST mass spectral library and relative abundance was described by peak-area normalization.

Microbial load assessment included total aerobic microbial count (TAMC) and total yeast and mould count (TYMC) using the plate-count method as described in the thesis. The reported values are reproduced below.

IV. Results

4.1 Physicochemical parameters

Parameter	Kharjuradi Leha	Kharjuradi Khandapaka
pH at 5%	4.82	5.71
Loss on drying (%)	15.70	7.63
Total ash (%)	5.85	2.69
Acid-insoluble ash (%)	4.19	1.44
Total solids (%)	83.99	-
Total fat (%)	0.31	-

4.2 Sugar analysis

Parameter	Kharjuradi Leha	Kharjuradi Khandapaka
Reducing sugar (%)	13.38	10.87
Non-reducing sugar (%)	4.05	5.73

4.3 TLC observations

Sample	Prominent Rf values	Recorded observation
Leha	0.70, 0.62	Two prominent spots
Khandapaka	0.89, 0.80, 0.62	Three prominent spots

4.4 Micromeritic and microbial results

Parameter	Leha	Khandapaka
Bulk density	-	0.654 g/mL
Compressibility index	-	24.37%
Flow interpretation	-	Passable / fair as recorded

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TAMC	$<10^2$ CFU/g	$<10^2$ CFU/g
TYMC	$<10^2$ CFU/g	$<10^2$ CFU/g

4.5 GC–MS reporting

GC–MS analysis of the two formulations revealed distinct chromatographic profiles, comprising 22 peaks in Report 1 (O-85) and 24 peaks in Report 2 (O-86). The detected peaks exhibited different retention times and relative peak-area percentages, indicating variations in the chemical profiles of the analysed samples.

In Report 1, the most prominent peak was observed at a retention time of 16.252 min, representing 36.67% of the total peak area. Other major peaks were detected at 5.437 min (11.89%), 7.299 min (9.05%), 4.103 min (7.60%), 9.503 min (4.44%) and 10.905 min (4.42%). The tentative compound identifications included dihydroxyacetone, glyceraldehyde, 2-hydroxy-γ-butyrolactone and 5-hydroxymethylfurfural.

In Report 2, the predominant peak occurred at 32.906 min, accounting for 41.61% of the total peak area. Additional prominent peaks were observed at 5.442 min (9.63%), 4.104 min (6.60%), 31.203 min (5.69%) and 6.827 min (5.38%). The reported tentative identifications included glyceraldehyde, dihydroxyacetone, glycerin, 9,12-octadecadienoic acid methyl ester, hexadecanoic acid methyl ester and methyl stearate.

Comparative examination of the chromatograms demonstrated differences in the relative abundance and distribution of the detected compounds. Certain tentative constituents, including glyceraldehyde, dihydroxyacetone, 2-hydroxy-γ-butyrolactone and 5-hydroxymethylfurfural, were reported in both samples, although their relative peak-area percentages differed. The second chromatogram additionally showed prominent peaks tentatively identified as fatty acid methyl esters.

These findings demonstrate differences in the GC–MS chromatographic profiles of the two samples. The reported compound identities should be regarded as tentative library-based assignments pending confirmation through mass-spectral matching, retention-index comparison and, where necessary, authentic reference standards. The results provide a preliminary chemical profile for further comparative evaluation of the formulations.

V. Discussion

Khandapaka showed a higher pH than Leha (5.71 versus 4.82). This is a descriptive difference between the tested samples. The pH may be influenced by sample composition, concentration, preparation and the specified test dilution; without replicate batches, the consistency of this difference cannot be established.

Loss on drying was lower in Khandapaka (7.63%) than in Leha (15.70%). This is consistent with the manufacturing description of Khandapaka as a more concentrated granular product. Nevertheless, loss on drying depends on the adopted test conditions and can include volatile constituents as well as moisture. It should not be used alone to claim long-term stability or a defined shelf life. Stability requires time-based testing under stated storage conditions.

Total ash and acid-insoluble ash were lower in Khandapaka than in Leha. These measurements describe the inorganic residue and its acid-insoluble fraction under the test conditions. The results should not be interpreted as evidence of superior purity without raw-material controls, method details, acceptance criteria and replicate data. The observed difference may reflect sample composition, process variation or analytical variability.

The reducing sugar result was lower in Khandapaka (10.87%) than in Leha (13.38%), while the non-reducing sugar result was higher (5.73% versus 4.05%). The two values should be interpreted together with the exact analytical method and calculation basis. Heating and the presence or omission of Madhu may influence the measured profile, but the present descriptive data do not establish a particular chemical mechanism.

TLC showed two prominent spots in Leha and three in Khandapaka, with an Rf value of 0.62 shared by both preparations. This provides a preliminary comparative fingerprint under the reported chromatographic conditions. It does not prove that the shared spot represents the same compound, nor does the number of spots provide a complete count of all constituents. Reference standards, full mobile-phase details, replicate plates and validated detection conditions would strengthen the fingerprinting approach.

The reported bulk density of Khandapaka was 0.654 g/mL and the compressibility index was 24.37%, with flow described as passable/fair in the thesis. These measurements provide initial information relevant to packaging, transfer and portioning. However, a single flow-related result is insufficient to establish that the granules are consistently free-flowing. Particle-size distribution,

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moisture sensitivity, tapped density, Hausner ratio and angle of repose should be reported where measured.

Both samples were reported below 10^2 CFU/g for TAMC and TYMC. This is a bounded statement about the two counts under the reported test conditions. It should not be broadened into a claim of complete microbiological safety or absence of specified pathogens unless the relevant tests and criteria are available. The GC–MS report figures indicate that chromatographic profiling was undertaken, but compound-level interpretation requires the original peak tables and spectral match details.

VI. Limitations

- Advanced phytochemical characterization and marker-based standardization were not performed.
- Long-term and accelerated stability studies were not carried out; hence, the shelf life of the granules could not be established.
- The study did not include pharmacological or clinical evaluation to compare the therapeutic efficacy of the granules with the classical Leha.
- Evaluation was conducted on a limited laboratory scale, and large scale manufacturing feasibility was not assessed.
- Detailed studies on bioavailability, dissolution, and microbial stability were beyond the scope of the work.

VII. Conclusion

Analytical evaluation of both formulations revealed that the physicochemical parameters were within acceptable limits, confirming the quality and purity of the prepared products. The granules showed a marked reduction in moisture content compared to the Leha, which is advantageous in terms of improved stability, reduced microbial susceptibility, and enhanced shelf life.

The lower ash values and acceptable micromeritic properties further indicated proper processing, minimal contamination, and good pharmaceutical quality. The granules also demonstrated satisfactory flow characteristics, making them suitable for handling, packaging, transportation, and dose uniformity. The modified dosage form retained the essential phytochemical constituents and therapeutic principles of the classical Kharjuradi Leha while offering additional advantages such as better stability, ease of storage, portability, accurate dosing, and enhanced patient compliance.

These improvements address many of the practical limitations associated with conventional Leha preparations and make the formulation more adaptable to contemporary pharmaceutical requirements. In conclusion, the present study establishes that the conversion of Kharjuradi Leha into granules is a scientifically and pharmaceutically viable approach. The developed granule formulation successfully combines the therapeutic integrity of the classical preparation with the advantages of a modern dosage form.

Therefore, Kharjuradi Granules can be considered a stable, convenient, patient-friendly, and pharmaceutically better adaptation of the classical Kharjuradi Leha, with potential for wider acceptance and utilization in contemporary Ayurvedic practice.

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