

**A PHARMACEUTICO-ANALYTICAL STUDY OF SHIROROGAHARA LEPA AND IT'S
MODIFICATION INTO BALM****Dr. Aniket Khaire*, Dr. Sudhindra A.N, Dr. Aditya Samant**

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ABSTRACT

Shirorogahara Lepa is a classical Ayurvedic external preparation described for disorders of the head. The present work investigated its pharmaceutical preparation and modification into a semisolid balm intended to provide a convenient dosage form. **Aim:** To prepare Shirorogahara Lepa, Murchhita Tila Taila and Shirorogahara Siddha Taila, modify the medicated oil into Shirorogahara Balm, and document the reported pharmaceutico-analytical study. **Materials and Methods:** Six principal drugs—Shatavari, Neelotpala, Durva, Tila, Pippali and Punarnava—were used in the classical Lepa and Siddha Taila preparation. Tila Taila was subjected to Murchhana and then processed with Shirorogahara Kalka. The Siddha Taila was incorporated into a balm base containing petroleum jelly and beeswax, with camphor, cinnamon oil and preservative. Evaluation included organoleptic and physicochemical parameters, thin-layer chromatography, preliminary phytochemical screening, microbial count, heavy-metal analysis, thermal-stability testing, an MTT cytotoxicity study and shelf-life observations. **Results:** Murchhita Tila Taila yielded 605 mL with a recorded process loss of 55 mL, while Shirorogahara Siddha Taila yielded 470 mL with a recorded process loss of 10 mL. The final balm was recorded as 380 g in the solid state and 495 mL in the molten state. Reported balm parameters included pH 6.2, loss on drying 0.60%, specific gravity 0.93, acid value 4.6 mg KOH/g, melting point 41°C and refractive index 1.46 at 25°C. The Murchhita Tila Taila saponification value was 194 mg KOH/g and its refractive index was recorded as 0.9224 at 40°C. The formulation showed no separation in the reported centrifugation and thermal-stability tests, and the evaluated shelf-life parameters remained comparable through 12 months. **Conclusion:** The study documented the pharmaceutical sequence used to modify classical Shirorogahara Lepa into a semisolid balm and recorded its analytical, stability and cellular-evaluation findings.

KEYWORDS: Shirorogahara Lepa; Shirorogahara Balm; Murchhana; Siddha Taila; Sneha Kalpana; pharmaceutico-analytical study.**INTRODUCTION**

Ayurvedic pharmaceutics includes a range of dosage forms prepared according to the nature of the ingredients, the intended route of administration and the formulation principles described in classical texts. External dosage forms such as Lepa are used by local application, while Sneha Kalpana provides a lipid-based medium for processing medicinal substances. These dosage forms form an important part of Bhaishajya Kalpana and are prepared using procedures intended to obtain reproducible pharmaceutical characteristics.^[1,2]

Lepa Kalpana refers to preparations in which medicinal substances are reduced to a suitable form and mixed with an appropriate liquid medium to obtain a paste for

external application. Classical literature describes different forms and application principles of Lepa. Shirorogahara Lepa is described among formulations used for disorders of the head. The formulation selected for this study contained Shatavari, Neelotpala, Durva, Tila, Pippali and Punarnava in equal quantities.^[1,3]

Preparation of a classical Lepa as a paste can require preparation and handling at the time of use. Modification into a semisolid balm provides a different physical presentation intended to facilitate storage, portability and application. Such modification requires careful selection of the base and controlled incorporation of the medicated component so that the resulting product has consistent physical characteristics.

Murchhana is a preliminary pharmaceutical procedure applied to Sneha Dravya before preparation of medicated oil. In the present work, Tila Taila was subjected to Murchhana and subsequently used for preparation of Shirorogahara Siddha Taila with the herbal Kalka and Jala. The prepared Siddha Taila was then incorporated into a balm base consisting of petroleum jelly and beeswax, together with the other recorded formulation components.

Pharmaceutico-analytical evaluation is required to document the characteristics of raw materials, intermediate products and the final formulation. Organoleptic examination and physicochemical parameters provide basic quality information, while thin-layer chromatography provides a qualitative chromatographic profile. Microbial count and heavy-metal testing contribute additional quality-control information. Stability observations at specified intervals help document changes during storage.

The present study was therefore undertaken to document the pharmaceutical preparation of Shirorogahara Lepa and its modification into Shirorogahara Balm, together with the analytical parameters, thermal-stability observations, shelf-life evaluation and reported MTT cytotoxicity findings.

AIM

To prepare Shirorogahara Lepa and modify it into Shirorogahara Balm, followed by pharmaceutico-analytical study.

OBJECTIVES

To prepare Shirorogahara Lepa from the six principal drugs.

To prepare Murchhita Tila Taila and Shirorogahara Lepa Siddha Taila using the recorded pharmaceutical procedures.

To modify Shirorogahara Siddha Taila into a semisolid balm formulation.

To record the organoleptic, physicochemical, chromatographic, phytochemical, microbial and heavy-metal findings available in the thesis.

To document thermal-stability, shelf-life and cytotoxicity findings reported for Shirorogahara Balm.

METHODOLOGY

The study was laboratory-based and comprised literary review, pharmaceutical preparation, analytical evaluation, stability assessment and documentation of the reported MTT cytotoxicity study. The methods and results presented below are based on the thesis and the previously supplied analytical information.

Study Plan

The work was undertaken in sequential stages: preparation of Shirorogahara Lepa; Murchhana of Tila Taila; preparation of Shirorogahara Siddha Taila; modification of the medicated oil into balm; and pharmaceutico-analytical evaluation of the raw materials and prepared formulation. Shelf-life observations were recorded at 0, 6 and 12 months.

Literary Sources

The classical formulation was referred to the Ayurvedic literature cited in the thesis, including Sharangadhara Samhita and other relevant classical texts. Modern analytical procedures and quality-control references were consulted as documented in the thesis. Full bibliographic details are included in the reference list where available.

Pharmaceutical Study

Procurement and Authentication

The raw drugs for Shirorogahara Lepa—Shatavari, Neelotpala, Durva, Tila, Pippali and Punarnava—and the drugs used for Tila Taila Murchhana—Manjishtha, Haridra, Lodhra, Musta, Nalika, Amalaki, Bibhitaki, Haritaki, Ketaki Pushpa, Vatankura and Hribera—were procured as Bharad/Akhand material from the local market. The drugs were authenticated by the Department of Dravyaguna Vigyan, Gomantak Ayurveda Mahavidyalaya and Research Centre, Shiroda, Goa. Tila Taila was procured from the local market and recorded as food-grade oil (FSSAI licence number 10014026000609). Before processing, the raw drugs were inspected individually and cleaned to remove dust, soil, stones and other foreign matter. The principal equipment used during the pharmaceutical procedures included a weighing balance, mechanical pulverizer, 80-number mesh sieve, Khalva Yantra, wide-mouth vessel, gas burner, Darvi/stirrer, clean cloth for filtration, measuring cylinder or volumetric flask, storage containers and packing material.

Preparation of Shirorogahara Lepa

Table 11: Ingredients and quantities used for Shirorogahara Lepa.

Sr. no.	Ingredient	Quantity
1	Shatavari	20 g
2	Neelotpala	20 g
3	Durva	20 g
4	Tila	20 g
5	Pippali	20 g
6	Punarnava	20 g
7	Water	Quantity sufficient
Total	Six powdered drugs	120 g

Preparation date: 7 April 2025; recorded duration: 1 hour. Shatavari, Neelotpala, Durva, Tila, Pippali and Punarnava were taken in equal quantities, 20 g each (total 120 g), with water quantity sufficient for preparation. The dried raw drugs were cleaned individually, dried adequately, pulverized separately and passed through an 80-number mesh sieve. Material retained on the sieve was re-pulverized and sieved again to improve recovery of fine powder. The six powders were weighed separately and transferred to a Khalva

Yantra, where they were mixed thoroughly. Water was added gradually in a quantity sufficient, and Mardana was continued until a uniform, smooth paste was obtained. Care was taken to prevent spillage from the Khalva Yantra and to avoid adding excess water. The prepared Lepa was transferred to a clean, airtight container; water was added as required when a portion was taken for analysis. The recorded finished-product characteristics were thick-paste appearance, brown colour, pleasant odour, bitter taste and smooth texture.

Table 12: Preparation record for Shirorogahara Lepa.

Parameter	Recorded details
Date	07/04/2025
Commencement time	11:00 a.m.
Completion date	07/04/2025
Duration	1 hour
Apparatus	Khalva Yantra, weighing balance, pulverizer and 80-number sieve
Processing	Cleaning, drying, separate pulverization, sieving, mixing and gradual addition of water with Mardana
Finished characteristics	Thick paste; brown; pleasant odour; bitter taste; smooth texture

Preparation of Murchhita Tila Taila

Table 13: Ingredients for Murchhita Tila Taila preparation.

Sr. no.	Ingredient	Quantity / composition
1	Murchhana Kalka	165 g
	Kalka drugs	Manjishtha, Haridra, Lodhra, Musta, Nalika, Amalaki, Bibhitaki, Haritaki, Ketaki Pushpa, Vatankura and Hribera
2	Tila Taila	660 mL
3	Jala	2640 mL

Preparation dates: 9–10 April 2025; processing was recorded over two days. The Murchhana Kalka (165 g) comprised Manjishtha, Haridra, Lodhra, Musta, Nalika, Amalaki, Bibhitaki, Haritaki, Ketaki Pushpa, Vatankura and Hribera. Tila Taila (660 mL) was taken in a wide-mouth vessel and heated over Mandagni. The prepared Kalka was added with continuous stirring to prevent it from adhering to or burning at the base of the vessel. Jala (2640 mL) was then added gradually with thorough stirring. The vessel was kept uncovered during heating, and the mixture was stirred slowly and continuously. On the first day, heating was continued until the mixture boiled well; it was then allowed to cool and the vessel was covered to protect the contents from dust. On the second day, heating and stirring were resumed, with care taken to prevent the Kalka from sticking to the vessel. Froth formation and its subsequent change, separation of

the Kalka, and formation of a Varti on rolling the Kalka between the fingers were observed. Madhyama Paka was identified by a soft Varti-like Kalka, the recorded froth at the end of Paka, absence of crackling when a small quantity of oil was exposed to flame, and the characteristic Gandha and Varna. The oil was removed from the heat, filtered through clean cloth and measured. The recorded yield was 605 mL from 660 mL of starting Tila Taila, with a reported process loss of 55 mL. The finished oil was described as liquid, light-brownish yellow, having a pleasant Taila odour and Snigdha texture. The recorded observation schedule included addition of Kalka at 1:30 pm, addition of water at 2:00 pm and boiling from approximately 2:45 pm on the first day; separation of Kalka was recorded at 11:00 am and Madhyama Paka at 1:30 pm on the second day.

Table 14: Time-wise observations during Murchhana of Tila Taila.

Process observation	Date	Time
Tila Taila at room temperature	09/04/2025	11:00 a.m.
Appearance of phena of Taila	09/04/2025	11:15 a.m.
Addition of Kalka	09/04/2025	1:30 p.m.
Addition of water	09/04/2025	2:00 p.m.
Boiling started	09/04/2025	2:45 p.m.
Disappearance of phena	09/04/2025	4:30 p.m.
Separation of Kalka	10/04/2025	11:00 a.m.
Madhyama Paka	10/04/2025	1:30 p.m.
Commencement–completion	09/04/2025–10/04/2025	2 days; source records 8 hours total

MURCHHANA DRAVYA
KALKA

TILA TAILA

TILA TAILA IN HEATING
VESSEL

ADDITION OF KALKA



INTERMEDIATE PHASE



MURCHHIT TILA TAILA



SIDDHI LAKSHANA MURCHHIT TILA TAILA

Preparation of Shirorogahara Siddha Taila**Table 15: Ingredients for Shirorogahara Siddha Taila preparation.**

Sr. no.	Ingredient	Quantity / composition
1	Shirorogahara Kalka	120 g
	Kalka drugs	Shatavari, Neelotpala, Durva, Tila, Pippali and Punarnava
2	Murchhita Tila Taila	480 mL
3	Jala	1920 mL

Preparation dates: 15–16 April 2025; processing was recorded over two days. Shirorogahara Kalka (120 g) was prepared from Shatavari, Neelotpala, Durva, Tila, Pippali and Punarnava by mixing the ingredients and adding only sufficient water to obtain a smooth Kalka. Murchhita Tila Taila (480 mL) was taken in a wide-mouth vessel and heated over Mandagni. The Shirorogahara Kalka was incorporated gradually with continuous stirring to prevent scorching or adhesion to the bottom of the vessel. Jala (1920 mL) was added with thorough stirring. The vessel was kept uncovered during

heating. On the first day, the mixture was heated until it boiled well, then allowed to cool and covered to prevent dust contamination. Heating was resumed on the second day, with continuous stirring to prevent the Kalka from sticking to the vessel. The mixture was monitored for changes in froth, separation of the Kalka and formation of a Varti when the Kalka was rolled between the fingers. Madhyama Paka was recorded when the Kalka formed a soft Varti, the reported froth change was observed, no crackling sound occurred when a small quantity of oil was exposed to flame, and the

characteristic Gandha and Varna were present. The vessel was removed from heat, and the prepared Siddha Taila was filtered through clean cloth and measured before storage in an airtight container. The recorded yield was 470 mL from 480 mL of Murchhita Tila Taila, with a reported process loss of 10 mL. The finished product was described as a liquid, brownish-yellow in

colour, with a pleasant odour recorded in the thesis and Snigdha texture. The observation schedule recorded Kalka addition at 1:30 pm, water addition at 2:00 pm and boiling from approximately 3:00 pm on the first day; separation of Kalka was recorded at 11:00 am and Madhyama Paka at 1:30 pm on the second day.

• **Shirorogahara Lepa Dravya Siddha Taila**



SHIROROGAHARA LEPA DRAVYA



TRITURATION IN KHALVAYANTRA



SHIROROGAHARA LEPA
DRAVYA KALKA



MURCHHITA TILA TAILA



MURCHHITA TILA TAILA
IN HEATING VESSEL



ADDITION OF KALKA



INTERMEDIATE PHASE



SHIROROGAHARA LEPA
SIDDHA TAILA

Time-wise observations during preparation of Shirorogahara Siddha Taila.

Process observation	Date	Time
Addition of Kalka	15/04/2025	1:30 p.m.
Addition of water	15/04/2025	2:00 p.m.
Boiling started	15/04/2025	3:00 p.m.
Separation of Kalka	16/04/2025	11:00 a.m.
Madhyama Paka	16/04/2025	1:30 p.m.
Commencement-completion	15/04/2025-16/04/2025	2 days; source records total duration as 7 hours

Modification into Shirorogahara Balm

Preparation date: 19 April 2025; recorded duration: 2 hours. The recorded formulation comprised Shirorogahara Siddha Taila (45%; 180 mL), petroleum jelly (25%; 100 g), beeswax (25%; 100 g), camphor and cinnamon oil together (4%; 16 g), and preservative (1%; 4 g). The ingredients were weighed or measured before processing. The petroleum jelly and beeswax base was placed in a stainless-steel vessel and heated with mixing until the base melted; the recorded heating temperature was up to 80°C. Shirorogahara Siddha Taila was incorporated and the mixture was stirred continuously until a uniform mixture was obtained. The mixture was then cooled to approximately 60°C, at which stage

camphor, cinnamon oil and the recorded preservative were incorporated and mixed thoroughly. The molten preparation was poured into clean, labelled containers while still fluid, allowed to cool at room temperature (recorded as approximately 28–30°C), and stored in airtight containers. The time-and-temperature record notes weighing at 11:00 am, heating/mixing at approximately 11:30 am, addition of camphor and preservative at approximately 12:30 pm, and final packing/storage at approximately 1:00 pm. The finished balm was recorded as 380 g in the solid state and 495 mL in the molten state; these measurements are retained separately as recorded.

Table 17: Composition and processing record of Shirorogahara Balm.

Component / step	Recorded quantity or condition
Shirorogahara Siddha Taila	45%
Petroleum jelly	25%
Beeswax	25%
Camphor and cinnamon oil	4%
Preservative	1%
Base melting temperature	Up to 80°C
Addition of camphor, cinnamon oil and preservative	At approximately 60°C
Pouring and cooling	Poured while molten; room temperature approximately 28–30°C
Date and duration	19/04/2025; 2 hours recorded
Final quantity	380 g solid; 495 mL molten

Table 1: Composition of Shirorogahara Balm.

Component	Proportion / quantity
Shirorogahara Siddha Taila	45% (180 mL)
Petroleum jelly	25% (100 g)
Beeswax	25% (100 g)
Camphor + cinnamon oil	4% (16 g)
Preservative	1% (4 g)

• **Shirorogahara Balm**



BEE WAX



GLYCERIN



SIDDHA TAILA

CINNAMON OIL
(EXCIPIENT)CAMPHOR POWDER
(EXCIPIENT)PRESEVATIVE
(SODIUM BENZOATE)

The final balm was recorded as 380 g in the solid state. Its corresponding molten-state volume was 495 mL. These are reported separately because mass and volume describe different physical quantities and different states of the preparation.

preliminary phytochemical screening, total microbial count, heavy-metal testing, thermal stability, MTT cytotoxicity and shelf-life assessment. Values below are reproduced from the available source data. Where a parameter was not reported for a given sample, it is not inferred.

Analytical Evaluation

The thesis reports organoleptic evaluation, physicochemical parameters, thin-layer chromatography,

ANALYTICAL STUDY

Table 2: Pharmaceutical observations and yields.

Preparation	Observation / yield
Shirorogahara Lepa	Thick brown paste; pleasant odour; bitter taste; smooth texture
Murchhita Tila Taila	605 mL; recorded process loss 55 mL
Shirorogahara Siddha Taila	470 mL; recorded process loss 10 mL
Shirorogahara Balm	380 g in solid state; 495 mL in molten state

Table 3: Physicochemical evaluation of prepared formulations.

Parameter	Murchhita Tila Taila	Shirorogahara Siddha Taila	Shirorogahara Balm
pH	Not reported	Not reported	6.2
Loss on drying	0.3%	Not reported	0.60%
Specific gravity	0.917	0.919	0.93
Saponification value (mg KOH/g)	194	191	162 (recorded in shelf-life table)
Refractive index	0.9224 at 40°C	1.468 at 40°C	1.46 at 25°C
Acid value (mg KOH/g)	1.96	1.91	4.6
Melting point	Not reported	Not reported	41°C
Rancidity test	Not rancid	Not rancid	Not reported

Note: The values for Murchhita Tila Taila and the final balm retain the confirmed and recorded values supplied for the manuscript. The thesis shelf-life table records the balm saponification value as 162 mg KOH/g; this is presented separately from the confirmed intermediate-oil value.

Table 4: Thin-layer chromatography profile.

Parameter	Reported result
Extraction solvent	Methanolic
Plate	Precoated silica gel 60F254 plate (E. Merck)
Mobile phase	Toluene : ethyl acetate : glacial acetic acid (5:4.5:0.5)
Visible light	Rf 0.18, 0.25, 0.24 (green), 0.25 and 0.79 (yellow)
UV 254 nm	Three spots: Rf 0.70 (sky blue), 0.75 (yellow-blue), 0.83 (sky blue)
UV 365 nm	Rf 0.39, 0.75 (yellow), 0.12, 0.21 (green), 0.05, 0.10, 0.33 (blue), 0.17 (black)
After iodine vapour derivatization	Three spots: Rf 0.57, 0.75 and 0.90 (yellow)

Table 5: Total microbial count of raw drugs and Shirorogahara Balm.

Sample	Total microbial count (CFU/g)
Shatavari	0.5×10^3
Neelotpala	2.9×10^3
Durva	6.3×10^3
Tila	3.5×10^3
Pippali	17.6×10^3
Punarnava	4.8×10^3
Manjishtha	2.13×10^3
Haridra	1.03×10^3
Lodhra	0.57×10^3
Musta	2.03×10^3
Nalika	3.06×10^3
Amalaki	5.73×10^3
Bibhitaki	2.3×10^3
Haritaki	0.33×10^3
Ketaki Pushpa	1.1×10^3
Vatankura	4.37×10^3
Hriber	2.93×10^3
Shirorogahara Balm, 0 month	0.46×10^3 CFU/g
Shirorogahara Balm, 6 months	0.46×10^3 CFU/g (as recorded in prior manuscript)
Shirorogahara Balm, 12 months	0.46×10^3 CFU/g (as recorded in prior manuscript)

The thesis lists the raw-drug counts as shown above and records a balm count of 0.46×10^3 . The 6- and 12-month entries are shown according to the previously compiled

manuscript; confirm these time-point values against the original laboratory report before submission.

Table 6: Heavy-metal analysis of raw drugs.

Sample	Lead (Pb), ppm	Cadmium (Cd), ppm	Mercury (Hg), ppm	Arsenic (As), ppm
Shatavari	1.163	0.028	0.077	0.083
Neelotpala	2.277	0.070	0.053	0.373
Durva	1.106	0.046	0.076	0.945
Tila	1.755	0.014	0.006	0.580
Pippali	1.894	0.029	0.051	0.330
Punarnava	1.407	0.049	0.075	1.179
Manjishtha	0.117	0.054	0.089	0.131
Haridra	1.169	0.069	0.046	0.075
Lodhra	1.617	0.060	0.080	0.589
Musta	2.328	0.054	0.026	1.158
Nalika	2.429	0.066	0.046	0.539
Amalaki	2.900	0.024	0.026	0.911
Bibhitaki	2.657	0.077	0.049	0.658
Haritaki	2.131	0.046	0.010	0.352
Ketaki Pushpa	0.588	0.010	0.006	0.380

Vatankura	0.851	0.062	0.059	1.153
Hriber	0.693	0.020	0.010	0.230

Table 7: Permissible limits cited in the thesis.

Analyte	Permissible limit used
Lead (Pb)	≤ 10 ppm
Cadmium (Cd)	≤ 0.3 ppm
Arsenic (As)	≤ 3 ppm
Mercury (Hg)	≤ 1 ppm

The thesis reports that the listed raw-drug samples were within the cited permissible limits. These limits are reproduced as stated in the thesis and should be checked

against the exact regulatory reference before journal submission.

Table 8: Qualitative phytochemical screening reported for raw drugs.

Sample	Tannins	Alkaloids	Flavonoids	Glycosides
Shatavari	Present	Present	Present	Present
Neelotpala	Present	Present	Present	Present
Durva	Present	Present	Present	Present
Tila	Present	Present	Present	Present
Pippali	Present	Present	Present	Present
Punarnava	Present	Present	Present	Present
Manjishtha	Present	Present	Present	Present
Haridra	Present	Present	Present	Present
Lodhra	Present	Present	Present	Present
Musta	Present	Present	Present	Present
Nalika	Present	Present	Present	Present
Amalaki	Present	Present	Present	Present
Bibhitaki	Present	Present	Present	Present
Haritaki	Present	Present	Present	Present
Ketaki Pushpa	Present	Present	Present	Present
Vatankura	Present	Present	Present	Present
Hriber	Present	Present	Present	Present

Table 9: Thermal-stability evaluation of Shirorogahara Balm.

Test	Condition / standard	Reported observation	Result
Description	Yellowish-tan/light-beige semisolid balm in jar	Yellowish-tan/light-beige semisolid balm texture in jar	Pass
Centrifuge test	3500 rpm for 2 hours	No separation; product reported stable	Pass
Thermal stability	45°C for 30 days	No separation; product reported stable	Pass

Table 10: Shelf-life observations of Shirorogahara Balm.

Parameter	0 month	6 months	12 months
Appearance	Creamy paste	Creamy paste	Creamy paste
Colour	Light brown to dark brown	Light brown to dark brown	Light brown to dark brown
Odour	Characteristic pleasant odour of menthol and camphor	Characteristic pleasant odour of menthol and camphor	Characteristic pleasant odour of menthol and camphor
Texture	Smooth, semisolid, non-gritty	Smooth, semisolid, non-gritty	Smooth, semisolid, non-gritty
Loss on drying	0.60%	0.60%	0.60%
pH	6.2	6.2	6.2
Spreadability	Uniformly spreadable	Uniformly spreadable	Uniformly spreadable
Consistency	Uniform and smooth	Uniform, smooth and	Uniform, smooth and

		free of lumps	free of lumps
Washability	Moderately washable	Moderately washable	Moderately washable
Acid value	4.6	4.6	4.6
Saponification value	162 mg KOH/g	Not reported in table	Not reported in table
Specific gravity	0.93	0.93	0.93
Melting point	41°C	41°C	41°C
Refractive index	Not reported in table	1.46 at 25°C	1.46 at 25°C
Total microbial count	0.46×10^3	0.46×10^3 (confirm source report)	0.46×10^3 (confirm source report)

Table 18: pH values of raw drugs and prepared formulations reported in the thesis.

Sample	pH
Shatavari	5
Neelotpala	5.3
Durva	6.0
Tila	6.0
Pippali	5.5
Punarnava	6.5
Manjishtha	5.5
Haridra	6.5
Lodhra	5.5
Musta	6
Nalika	5.5
Amalaki	3.5
Bibhitaki	4.5
Haritaki	3.8
Ketaki pushpa	6
Vatankura	5.5
Hriber	6
Shirorogahara Lepa	6.5
Murchhita Tila Taila	Not reported
Siddha Taila	Not reported
Shirorogahara Balm	6.2

Table 19: Loss on drying values reported in the thesis.

Sample	LOD (% w/w)
Shatavari	3.8
Neelotpala	6
Durva	8
Tila	5
Pippali	9
Punarnava	7
Manjishtha	8
Haridra	6
Lodhra	6
Musta	8
Nalika	9
Amalaki	7.5
Bibhitaki	7
Haritaki	8
Ketaki pushpa	9
Vatankura	8.5
Hriber	9
Shirorogahara Lepa	7.4
Murchhita Tila Taila	0.3
Shirorogahara Balm	0.6

Table 20: Total ash values of raw drugs and Shirorogahara Lepa.

Sample	Total ash (% w/w)
Shatavari	3.34
Neelotpala	9.52
Durva	4.94
Tila	6.35
Pippali	6.11
Punarnava	6.85
Manjishtha	4.78
Haridra	6.33
Lodhra	9.07
Musta	4.82
Nalika	8.55
Amalaki	3.2
Bibhitaki	5.68
Haritaki	3.86
Ketaki pushpa	10.4
Vatankura	3.85
Hriber	6.23
Shirorogahara Lepa	3.0

Table 21: Acid-insoluble ash values of raw drugs and Shirorogahara Lepa.

Sample	Acid-insoluble ash (% w/w)
Shatavari	0.35
Neelotpala	3.75
Durva	0.61
Tila	0.85
Pippali	0.53
Punarnava	1.25
Manjishtha	0.45
Haridra	0.66
Lodhra	0.84
Musta	1.04
Nalika	1.06
Amalaki	0.93
Bibhitaki	0.76
Haritaki	0.79
Ketaki pushpa	0.65
Vatankura	0.84
Hriber	1.15
Shirorogahara Lepa	0.8

Table 22: Water-soluble extractive values of raw drugs and Shirorogahara Lepa.

Sample	Water-soluble extractive (% w/w)
Shatavari	47.79
Neelotpala	21.82
Durva	21.54
Tila	5.35
Pippali	32.63
Punarnava	6.6
Manjishtha	19.85
Haridra	13.14
Lodhra	16.65
Musta	11.47
Nalika	8.11
Amalaki	53.26
Bibhitaki	36.06
Haritaki	64.13

Sample	Water-soluble extractive (% w/w)
Ketaki pushpa	10.6
Vatankura	11.04
Hriber	10.88
Shirorogahara Lepa	31

Table 23: Extractive values listed as “Acid Soluble Extract Values” in the thesis.

Sample	Reported extractive value (% w/w)
Shatavari	11.37
Neelotpala	4.64
Durva	5.81
Tila	21.26
Pippali	6.32
Punarnava	2.56
Manjishtha	5.89
Haridra	8.48
Lodhra	10.16
Musta	5.96
Nalika	3.76
Amalaki	41.59
Bibhitaki	9.28
Haritaki	30.81
Ketaki pushpa	19.1
Vatankura	5.55
Hriber	6.17
Shirorogahara Lepa	18

Table 24: Lipid-related physicochemical parameters and rancidity findings.

Parameter	Murchhita Tila Taila	Shirorogahara Siddha Taila	Shirorogahara Balm
Specific gravity	0.917	0.919	0.93
Saponification value (mg KOH/g)	194	191	162 (recorded in balm shelf-life table)
Iodine value (g I ₂ /100 g)	42.25	112	Not reported
Peroxide value (meq O ₂ /kg)	4	3	Not reported
Refractive index at 40°C	0.9224	1.468	Not reported at 40°C
Acid value (mg KOH/g)	1.96	1.91	4.6 recorded for balm
Rancidity test	Not rancid	Not rancid	Not reported

Table 25: Organoleptic characteristics recorded for Shirorogahara Balm during preparation.

Attribute	Recorded observation
Appearance	Thick creamy balm
Colour	Pale yellow
Odour	Pleasant odour of excipient
Texture	Smooth
Quantity obtained	380 g; 495 mL by volume

IN VITRO CELL LINE STUDY – MTT ASSAY

The thesis describes an MTT cytotoxicity assay performed using human keratinocyte HaCaT cells. The report identifies the test sample as SB2025 and characterizes the balm as non-toxic and highly cytocompatible toward normal HaCaT cells. Quantitative cell-viability values, tested concentrations, exposure duration, control details and assay conditions are not included here because the available thesis narrative does not provide those numerical details. The cytotoxicity statement is limited to the reported qualitative findings.

RESULTS**Pharmaceutical observations**

The recorded pharmaceutical sequence comprised preparation of the classical Lepa, Murchhana of Tila Taila, preparation of Shirorogahara Siddha Taila and incorporation of the Siddha Taila into a semisolid balm base. Murchhita Tila Taila yielded 605 mL, and Shirorogahara Siddha Taila yielded 470 mL. The final balm was recorded as 380 g in the solid state and 495 mL in the molten state.

Physicochemical and chromatographic findings

The recorded physicochemical values for the intermediate oils and final balm are presented in Table 3. The final balm showed pH 6.2, loss on drying 0.60%, specific gravity 0.93, acid value 4.6 mg KOH/g, melting point 41°C and refractive index 1.46 at 25°C. Murchhita Tila Taila had a recorded saponification value of 194 mg KOH/g and refractive index of 0.9224 at 40°C. TLC showed spots under visible light, ultraviolet illumination at 254 nm and 365 nm, and after iodine-vapour derivatization.

Microbial, heavy-metal and stability findings

The raw-drug microbial counts and reported heavy-metal concentrations are presented in Tables 5 and 6. The thesis states that the heavy-metal values were within the permissible limits cited in the study. The balm showed no separation in the reported centrifugation test at 3500 rpm for 2 hours or after exposure to 45°C for 30 days. The reported organoleptic and selected physicochemical characteristics were comparable during the 0-, 6- and 12-month observations.

Cytotoxicity findings

The available cytotoxicity report describes the balm as non-toxic and highly cytocompatible toward normal HaCaT human keratinocyte cells. No numerical assay results are added beyond those stated in the supplied report.

DISCUSSION

The pharmaceutical process followed the sequence of Lepa preparation, Murchhana of Tila Taila, preparation of Shirorogahara Siddha Taila and modification into a balm. This sequence retained the six principal drugs as the herbal basis of the formulation while changing its physical presentation from a paste/oil pathway into a semisolid product.

The recorded yield of Murchhita Tila Taila was 605 mL from the 660 mL starting quantity, with a recorded process loss of 55 mL. Subsequent processing of 480 mL Murchhita Tila Taila with 120 g Shirorogahara Kalka and 1920 mL Jala yielded 470 mL Siddha Taila. The final balm quantity was documented as 380 g in the solid state and 495 mL in the molten state; these values should not be used interchangeably because they represent mass and volume in different states.

The final balm's reported pH, loss on drying, specific gravity, acid value, melting point and refractive index provide a set of formulation-specific quality parameters. The recorded oil values, including the confirmed saponification value of 194 mg KOH/g for Murchhita Tila Taila and refractive index of 0.9224 at 40°C, provide intermediate-product characteristics. Any discrepant values between different thesis tables should be checked against the original laboratory reports before final submission.

The TLC profile showed multiple spots under visible light, UV 254 nm, UV 365 nm and iodine-vapour derivatization. These observations document a qualitative chromatographic profile of the tested sample. The results are reported as observed and are not interpreted as quantitative measurement of individual marker compounds.

The thesis presents microbial counts for the principal Lepa drugs and additional raw ingredients. The recorded values vary across the samples, with Pippali reported at 17.6×10^3 CFU/g and Haritaki at 0.33×10^3 CFU/g. The reported balm count was 0.46×10^3 . The 6- and 12-month counts should be verified against the original laboratory report because the source thesis tables do not clearly reproduce all time-point entries in the same format.

The heavy-metal table reports lead, cadmium, mercury and arsenic concentrations for 17 raw-drug samples. The thesis states that the tested samples complied with the limits cited in the study. The individual results and limits are retained in tabular form to allow transparent review rather than relying only on a general statement.

The thermal-stability report records no separation after centrifugation at 3500 rpm for 2 hours and after exposure to 45°C for 30 days. Shelf-life observations at 0, 6 and 12 months show comparable reported appearance, colour, odour, texture, pH, loss on drying, acid value, specific gravity and melting point. The thesis describes the formulation as having an expected shelf life of one year based on the available stability data.

The cytotoxicity section is limited to the qualitative wording available in the supplied thesis/report, which describes the balm as non-toxic and highly cytocompatible toward normal HaCaT cells. No additional numerical findings have been inferred.

CONCLUSION

Shirorogahara Lepa was prepared using Shatavari, Neelotpala, Durva, Tila, Pippali and Punarnava and was processed through Murchhana of Tila Taila and preparation of Shirorogahara Siddha Taila before incorporation into a semisolid balm base containing petroleum jelly and beeswax, with camphor, cinnamon oil and preservative. Murchhita Tila Taila yielded 605 mL with a recorded process loss of 55 mL, while Shirorogahara Siddha Taila yielded 470 mL with a recorded process loss of 10 mL. The final balm was recorded as 380 g in the solid state and 495 mL in the molten state.

The study documents the formulation's reported physicochemical parameters, TLC profile, raw-drug microbial counts, heavy-metal analysis, thermal-stability findings and shelf-life observations at 0, 6 and 12 months. The reported thermal-stability tests showed no separation under the specified conditions. The supplied

cytotoxicity report described the formulation as non-toxic and highly cytocompatible toward normal HaCaT cells. These findings provide a documented pharmaceutico-analytical profile of the modified Shirorogahara Balm.

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