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Pharmacognostical And Phytochemical Evaluation Of Haritaki *[Terminalia chebula Retz.]*

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Abstract:

Introduction- Haritaki *[Terminalia chebula Retz.] a member of the Combretaceae family,* h*as been used in traditional medicine since ancient times. With the exception of Lavana, Haritaki possesses five Rasas. Madhura is its Vipaka, and Ushna is its Veerya. These qualities enable the plant to execute a number of pharmacological activities, including Srotas-Shodhana, Rasayana, Medhya, Deepana, and Aampachana. Chebulic acid, gallic acid, corilagin, ellagic acid, chebulagic acid, chebulinic acid, triterpenoids, and anthraquinones are the primary phytochemicals found in Haritaki. Although several studies have been conducted on* Haritaki *[Terminalia chebula Retz.], there remains a lack of a comprehensive review focusing on its pharmacognostical, physicochemical, phytochemical, and chromatographic evaluations.* ***Aim And Objective***- *To conduct a thorough pharmacognostical, physicochemical, phytochemical, and chromatographic evaluation of* Haritaki *[Terminalia chebula Retz.].* ***Material And Methods***- *This study was designed to evaluate* Haritaki *[Terminalia chebula Retz.] through pharmacognostical, physicochemical, phytochemical, and chromatographic analyses to assess its quality, purity, and safety.* ***Observations And Results***- *The results obtained from the pharmacognostical, physicochemical, phytochemical, and chromatographic assessments were all found to be within the acceptable quality standards.* ***Conclusion***- *The tested sample of* Haritaki *[Terminalia chebula Retz.] demonstrated high quality and was confirmed to be pure, safe, and authentic.*

Keywords: Pharmacognosy, Phytochemicals,* Haritaki, *Terminalia chebula Retz.

Introduction:

Haritaki (*Terminalia chebula* Retz.), belonging to the **Combretaceae** family, has been utilized in traditional medicine since ancient times. Revered for its exceptional therapeutic potential and wide spectrum of biological activities, it is honored in Tibetan medicine as the "**King of Medicines**" and holds a premier position in the Ayurvedic *materia medica*. These attributes empower the plant to exert numerous pharmacological effects, including ***Srotas-Shodhana***, ***Rasayana***, ***Medhya***, ***Deepana*** and ***Aampachana***.[1]

Haritaki is believed to support longevity, prevent cellular degeneration, improve mental and physical well-being, and may delay or even reverse aspects of the aging process. In recent years, modern research has validated many of these traditional claims by identifying its bioactive compounds and pharmacological effects. Major phytochemicals present in *Haritaki* include **chebulic acid**, **gallic acid**, **corilagin**, **ellagic acid**, **chebulagic acid**, **chebulinic acid**, **triterpenoids** and **anthraquinones**. This review consolidates insights from both classical texts and modern scientific literature, offering a comprehensive overview of the pharmacological profile of *Terminalia chebula*.[2]

Taxonomy of Terminalia chebula Retz. [3]

- Latin Name- *Terminalia chebula*
- Kingdom- Plantae
- Subkingdom- Tracheobionata
- Super division- Spermatophyta
- Division- Magnoliophyta
- Class- Mangoliopsidadicotyledons
- Subclass- Rosidae
- Order- Myrtales
- Family- *Combretaceae*
- Genus- ***Terminalia***
- Species- ***chebula***

Properties *Raspanchak* [4]

Table-1: *Raspanchak* of *Haritaki (Terminalia chebula)*

Samhita/Nighantu	***Ras***	***Veerya***	***Vipak***	***Guna***
Charak[5]	*Kashaypradhanpanchras*	*Ushna*	*Madhur*	***Laghu, ruksha***
Sushrut[6]	*Kashaypradhanpanchras*	*Ushna*	*Madhur*	***Laghuruksha***
Ashtang Hridaya[7]	*Kashaypradhanpanchras*	*ushna*	*Madhur*	***Laghu,ruksha***
Adarsh Nighantu	*Kashaypradhanpanchras*	*Ushna*	*Madhur*	***Laghu,ruksha***
Bhavprakash Nighantu[8]	*Kashaypradhanpanchras*	*ushna*	*Madhur*	***ushna***
Raj nighantu[9]	*Lavanrahitpanchras*	-	-	-
Kaiyadev Nighantu[10]	*Kashaypradhanpanchras*	*ushna*	*Madhur*	***Rukshalaghu***
Madanpal Nighantu[11]	*Lavanrahitpanchras*	-	*Madhur*	***Ushna,ruksha***
Dhanvantari Nighantu[12]	***Lavanrahitpanchras***	-	-	***Ruksha***

Despite the availability of a few reviews on this plant, there is a lack of comprehensive studies that encompass the pharmacognostical, physicochemical, phytochemical, and chromatographic evaluation of *Haritaki* [*Terminalia chebula* Retz.*]*.

Aim and Objective:

1. To perform pharmacognostical, physio-chemical, phytochemical and chromatography evaluation of *Haritaki* [*Terminalia chebula* Retz.*]*.

Material and Methods:

Sample Preparation: The powdered form of *Haritaki* [*Terminalia chebula* Retz.*]*

was processed through a vibro sifter to obtain a uniform particle size for testing. The evaluation procedures conducted included the following:

Pharmacognostical Study: An organoleptic evaluation was conducted using the unaided eye and a magnifying lens to assess characteristics such as color, odor, taste, and texture.

Powder Microscopy[13]: Microscopic analysis of the powdered drug was performed to aid in the identification of medicinal plant materials. The powder was treated with various chemical reagents to highlight specific cellular features. Although microscopy alone may not always provide definitive results, it serves as a valuable complementary tool when used alongside other analytical techniques.

Chemical Reagents Used for Staining:

- Safranin
- Dilute Ferric Chloride
- Methylene Blue
- Sudan Red III
- Iodine Solution
- Dilute Hydrochloric Acid (HCl)

Physicochemical Analysis:

The physicochemical properties of *Haritaki* [*Terminalia chebula* Retz.*]* were analyzed through the following assessments:

1. Determination of Moisture Content / Total Soluble Solids[13]: Moisture content was determined by placing 5 grams of the powdered sample in an oven set at 105°C for 5 hours. The sample was weighed at 30-minute intervals until its weight stabilized, indicating complete drying. After oven drying, the sample was cooled in a desiccator to room temperature before the final measurement.

Calculation Formula:

- Weight of empty Petri dish = W_1 (g)
- Weight of drug sample = X (g)
- Weight before drying (Petri dish + sample) = $W_3 = W_1 + X$
- Weight after drying = W_2 (g)
- **Loss on Drying (%)** = $((W_3 - W_2) \times 100) / X$

2. Determination of pH[14]: The pH of an aqueous extract of *Haritaki* [*Terminalia chebula* Retz.*]* was measured using a calibrated digital pH meter. This analysis provides insight into the solution's acidity or alkalinity.

Procedure:

- Calibration of the pH meter was performed using standard buffer solutions prepared by dissolving pH buffer tablets in 100 ml of distilled water.
- The meter was turned on and allowed to stabilize.
- The electrode was immersed in the buffer solutions for calibration.
- A 10% aqueous solution of the sample was prepared, and the pH was recorded by dipping the electrode into this solution.

3. Determination of Extractive Values[15]**:**

Water-Soluble Extractive Value- Five grams of powdered *Haritaki* [*Terminalia chebula* Retz.*]* were macerated with 100 ml of distilled water in a sealed flask for 24 hours. The mixture was shaken

intermittently for the first 6 hours using a rotary shaker and left undisturbed for the remaining 18 hours. The extract was filtered, and the filtrate was evaporated to dryness in a pre-weighed dish using a water bath. Final drying was done in an oven at 105°C to constant weight.

Calculations:

- Weight of drug sample = X (g)
- Weight of empty Petri dish = W_1 (g)
- Weight of dish with dried extract = W_2 (g)
- **Extractive Value (%)** = ((W_2 - W_1) × 100) / X

The procedure was performed in triplicate, and the mean value was calculated.

Alcohol-Soluble Extractive Value- This procedure followed the same steps as the water-soluble extractive determination, except alcohol was used as the solvent in place of water.

4. Determination of Ash Values

Total Ash- Five grams of powdered *Haritaki* [*Terminalia chebula* Retz.*]* were uniformly distributed in a silica crucible and incinerated in a muffle furnace at 450°C for approximately 6 hours, or until the sample was carbon-free. The crucible was then cooled in a desiccator and weighed.

Calculation:

- Weight of empty crucible = A_1 g
- Weight of the sample = X g
- Weight of crucible with ash = A_2 g
- **Total Ash (%)** = [A2 - A1 /X] x 100”

Acid-Insoluble Ash- The total ash was boiled with 25 ml of 2M hydrochloric acid for 5 minutes. The insoluble matter was filtered through a Gooch crucible, washed thoroughly with hot water, and ignited at a temperature not exceeding 450°C for 15 minutes. After cooling in a desiccator, the crucible was weighed.

Calculation:

- Weight of the sample = X g
- Empty Gooch crucible = G_1 g
- Crucible with insoluble ash = G_2 g
- Acid-insoluble ash = $G_3 = G_2 – G_1$
- **Acid-Insoluble Ash (%)** = G3/X×100”

Water-Soluble Ash- To determine the water-soluble ash, the total ash was boiled with 25 ml of distilled water for 5 minutes. The insoluble residue was collected in a Gooch crucible, washed with hot water, and ignited at a temperature not exceeding 450°C for 15 minutes. The insoluble matter was weighed, and its value was subtracted from the total ash to calculate the water-soluble ash.

Calculation:

- Weight of the sample = X g
- Total ash = A g
- Empty crucible = G_1 g
- Crucible with insoluble ash = G_2 g
- Weight of insoluble ash = $G_3 = G_2 – G_1$
- Water-soluble ash = $G_4 = A – G_3$
- **Water-Soluble Ash (%)** = A – [(G3)/X] x 100”

Phytochemical Screening[16]**:**

Qualitative phytochemical tests were performed on both aqueous and

alcoholic extracts of *Haritaki* [*Terminalia chebula* Retz.*]* to detect the presence of bioactive constituents.

Tests for Carbohydrates:

- **Molisch's Test:** A purple ring at the interface after adding Molisch's reagent and concentrated sulfuric acid indicates carbohydrates.
- **Benedict's Test:** Heating the extract with Benedict's reagent results in colored precipitates (green to brown) confirming reducing sugars.
- **Fehling's Test:** A red precipitate after boiling the extract with Fehling A and B confirms reducing sugars.

Tests for Alkaloids:

- **Dragendorff's Test:** Orange precipitate indicates alkaloids.
- **Wagner's Test:** Reddish-brown precipitate confirms alkaloids.
- **Hager's Test:** Orange-yellow precipitate indicates the presence of alkaloids.

Test for Amino Acids:

- **Ninhydrin Test:** A blue or yellow coloration upon heating indicates free amino acids.

Tests for Proteins:

- **Biuret Test:** Violet or pink color indicates proteins.
- **Xanthoproteic Test:** Yellow color after adding nitric acid confirms proteins.
- **Millon's Test:** A white precipitate turning pink indicates proteins.

Test for Saponins:

- **Foam Test:** Stable honeycomb-like froth confirms the presence of saponins.

Test for Glycosides:

- **Borntrager's Test:** Reddish-pink color after treatment with benzene and ammonia indicates glycosides.

Test for Phenolic Compounds:

- **Ferric Chloride Test:** Green or blue color after warming with ferric chloride confirms phenolic compounds.

Test for Steroids:

- **Salkowski Reaction:** Red coloration after treatment with chloroform and sulfuric acid indicates steroids.

Tests for Tannins:

- **Ferric Chloride Test:** Deep green or blue coloration suggests tannins.
- **Lead Acetate Test:** Precipitate formation confirms tannins.
- **Potassium Dichromate Test:** Dark coloration indicates tannins.

Chromatographic Study[17]:

Chromatography, particularly Thin Layer Chromatography (TLC), was employed to separate and identify the chemical constituents of *Haritaki* [*Terminalia chebula* Retz.*]* extracts.

TLC Plate Specifications:

- Plates: Pre-coated Silica Gel 60 F_{254} with fluorescent indicator
- Dimensions: 10 cm × 2 cm
- Thickness of coating: 0.25 mm

Plate Activation:

- Plates were heated in a hot air oven at 105°C for 1.5 hours prior to use.

Mobile Phase Composition:

- Tolune: ethyl acetate: Formic acid (2:5:1.5)

Test Sample:

- Alcoholic extract of *Achyranthes aspera* Linn.

Visualization:

- Developed chromatograms were exposed to iodine vapour for spot detection.

Rf Value Calculation:

- **Rf =** Distance travelled by solute ÷ Distance travelled by solvent front

Results and Observation:

The observations and the results of the present study are tabulated below.

Pharmacognostical Analysis:

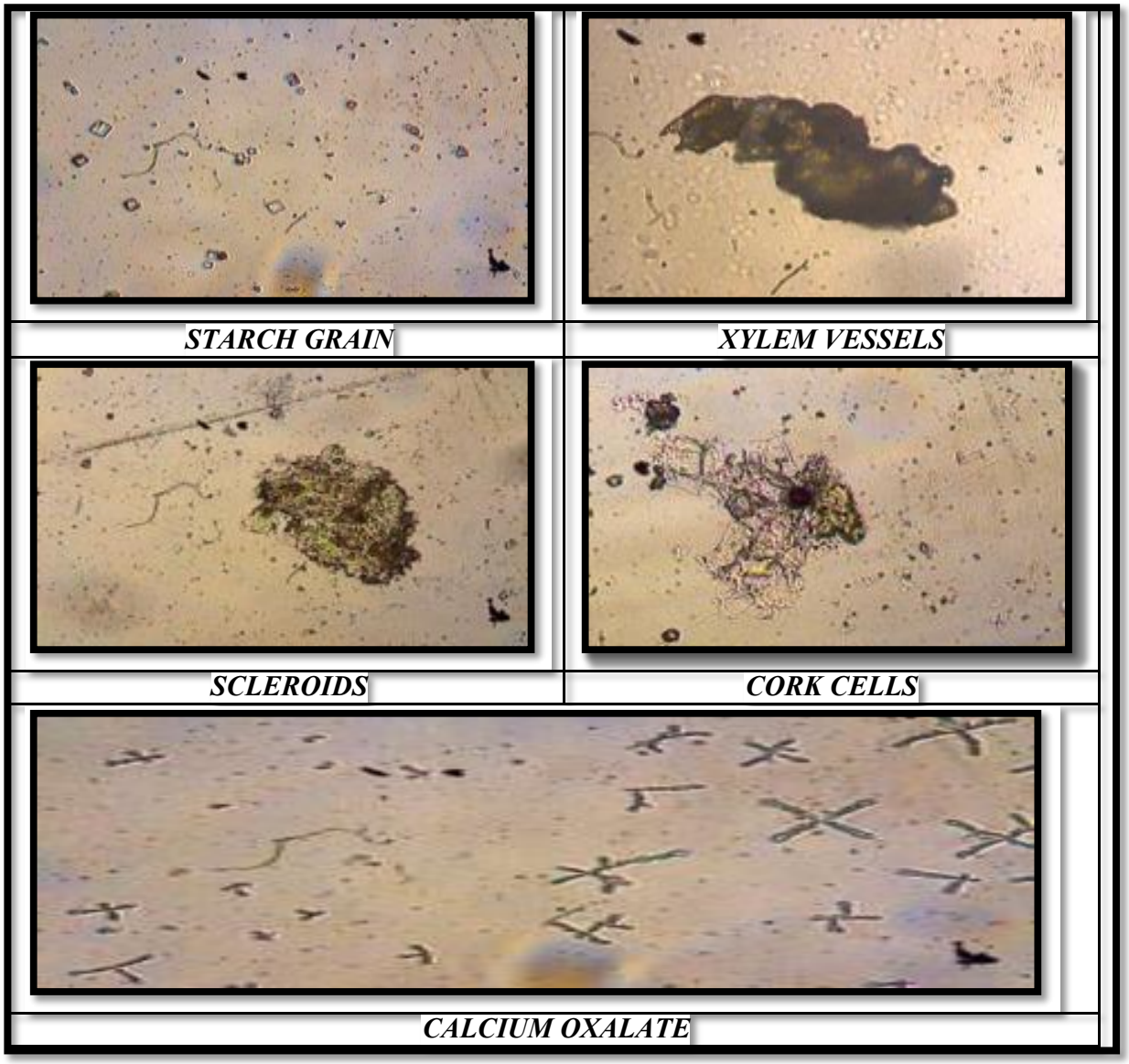
Photo-01- Macroscopic study of *Haritaki* [*Terminalia chebula* Retz.]

Table-02: Organoleptic characters of dried *Haritaki* [*Terminalia chebula* Retz.]

S. No	Parameters	Observations
1	Color	Yellowish - brown
2	Odor	Characteristic
3	Taste	Astringent
4	Texture	smooth, Leathery

Powder microscopy: The presence of fibres, starch, crystals, oil glands and parenchyma were observed as shown in Figure.

Photo-02- Powder Microscopy of *Haritaki* [*Terminalia chebula* Retz.]



Physiochemical Analysis:

Moisture content of sample:

Table-03: Moisture content of sample of ***Haritaki* [*Terminalia chebula* Retz.]**

S.NO.	Weight of sample	Weight of container	Weight after drying with container	Weight after drying without container	Value%
1.	4.9803 gm	60.8575 gm	65.2701 gm	4.4126 gm	**11.4%**

pH value of sample:

Figure -03- pH value of sample **of *Haritaki* [*Terminalia chebula* Retz.*]***

Table-04: pH value of sample of ***Haritaki* [*Terminalia chebula* Retz.*]***

S.NO.	Sample	pH
1.	*Haritaki* [*Terminalia chebula* Retz.*]*	**3.9**

Extractive value of sample:

Figure -04: Extractive value of sample **of *Haritaki* [*Terminalia chebula* Retz.*]***

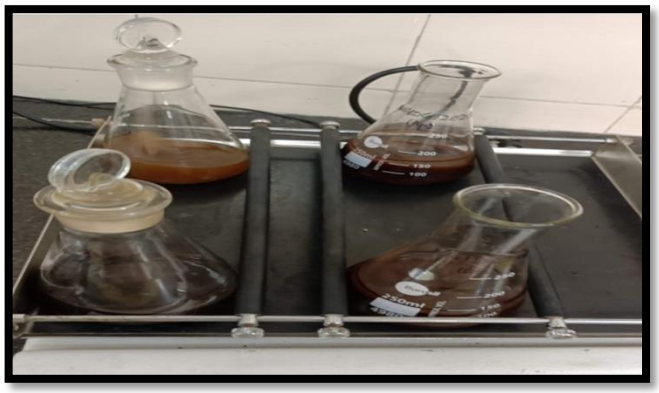


Table-05: Extractive value of sample of ***Haritaki* [*Terminalia chebula* Retz.*]***

S.NO.	Extractive values	Sample weight	Beaker weight	Beaker +extract weight	Extract weight	Extract value (%)
1.	Alcohol soluble extractive Value	5.0119 gm	138.21gm	139.9842 gm	1.7742 gm	**35.40 %**
2.	Water soluble extractive value	5.0120 gm	146.023 gm	147.8148 gm	1.7918 gm	**35.75 %**

Ash value of sample:

Figure -05: Ash value of sample **of *Haritaki* [*Terminalia chebula* Retz.*]***

Table-06: Total Ash value of sample of ***Haritaki* [*Terminalia chebula* Retz.*]***

S.NO.	A1	X	A2	Total ash (%)
1.	39.7840 gm	4.9770 gm	40.2369 gm	**9.1 %**

Table-07: Acid Insoluble Ash value of sample of ***Haritaki* [*Terminalia chebula* Retz.*]***

S.NO.	X	G1	G2	G3	Total ash (%)
1.	4.9770 gm	39.7840 gm	39.9084 gm	0.1244 gm	**2.5%**

Table-08: Water Soluble Ash value of sample of ***Haritaki* [*Terminalia chebula* Retz.*]***

S.NO.	X	A	G1	G2	G3	Total ash (%)
1.	5.0058 gm	0.7217 gm	31.5600 gm	31.8754 gm	0.3154gm	**6.3%**

Phytochemical Study:

Figure 06: Phytochemical study of *Haritaki* [*Terminalia chebula* Retz.*]*

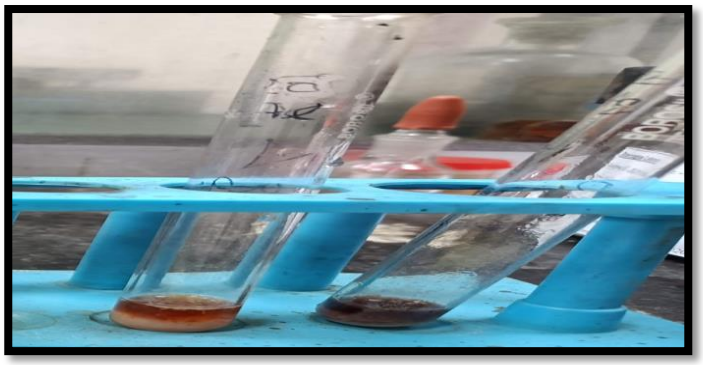


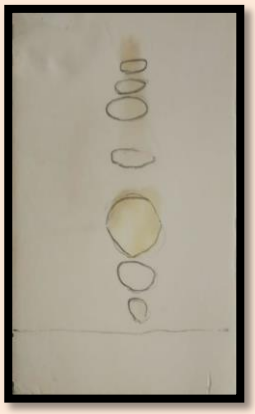
Table-09: Observations of Phytochemical parameters of *Haritaki* [*Terminalia chebula* Retz.*]*

Phytochemicals	Tests	Aq. Ext of Apamarga	Al. Ext of Apamarga
Carbohydrates	1.1-Molish test	-	+
	1.2- Benedict test	+	-
	1.3-Fehling test	+	+
Alkaloids	2.1-Dragendorff test	+	+
	2.2-Wagner test	+	+
	2.3-Hager test	-	-
Amino acids	3.1- Ninhydrine test	+	-
Proteins	4.1-Biuret test	+	-
	4.2-Xanthoprotic test	+	+
	4.3- Millon test	+	+
Saponin	5.1-Foam test	+	-
Glycosides	6.1- Borntrager test	-	-
Phenolic Compound	7.1- Phenolic test	+	+
Steroids	8.1- Salkowaski test	+	-
Tannins	9.1-Fecl3	+	+
	9.2- Lead acetate	+	+
	9.3-Pot. Dichromate	+	+

Chromatography Study:

Visualization was done under normal light and Iodine.

Table-10: Results of TLC of *Haritaki* [*Terminalia chebula* Retz.*]*

Distance of solvent	R F Value	IMAGE
5.0	0.32	
	0.45	
	0.63	
	0.78	
	0.87	
	0.89	
	0.93	

Discussion:

- **Pharmacognostical Study**: The sample falls within acceptable organoleptic parameters. As illustrated in Table-02 and Photos 01 and 02, microscopic examination confirmed the presence of fibers, starch granules, crystals, and oil glands.
- **Physicochemical Analysis**: The sample demonstrates good stability, as indicated by its normal

moisture content. The total ash value falls within standard limits, supporting the sample's authenticity and purity. Additionally, extractive values within the prescribed range suggest the absence of adulteration or exhausted plant material.

- **Phytochemical Screening**:
  - *Aqueous Extract*: Tested positive for carbohydrates, alkaloids, amino acids, proteins, saponins, steroids, phenolic compounds and tannins.
  - *Alcoholic Extract*: Indicated the presence of carbohydrates, alkaloids, proteins, phenolic compounds, and tannins.
- **Chromatographic Analysis**: Thin Layer Chromatography (TLC) of the alcoholic extract revealed distinct bands at Rf values of 0.32, 0.45, 0.63, 0.78, 0.87, 0.89 and 0.93.

Conclusion:

On the basis of the observations, results and discussions it has been concluded that the present sample of ***Haritaki* [*Terminalia chebula* Retz.]** is within all the standards of quality. All the Pharmacognostical, Physiochemical, Phytochemical and Thin Layer Chromatography study helped in identification and authentication of the sample of ***Haritaki* [*Terminalia chebula* Retz.].**

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