Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
JPP 2015; 4(1): 203-209
Received: 18-03-2015
Accepted: 20-04-2015

**Nidhin PS**
Research scholar, Department of Samhita and Siddhanta, SDM College of Ayurveda and Hospital, Hassan - 573201, Karnataka, India.

**Yaligar MG**
Associate Professor and Head, Department of Samhita and Siddhanta, SDM College of Ayurveda and Hospital, Hassan, Karnataka, India.

**Arun Raj GR**
Assistant Professor, Department of Kaumarabhritya (Ayurveda Pediatrics), SDM College of Ayurveda and Hospital, Hassan - 573201, Karnataka, India.

**Koppala Narayana Sunil Kumar**
Senior Research Officer, SDM Centre for Research in Ayurveda and Allied Sciences, Lakshmi Narayana Nagar, Kuthpady, Udupi - 574118, India.

**Ravi M**
Research Officer, SDM Centre for Research in Ayurveda and Allied Sciences, Lakshmi Narayana Nagar, Kuthpady, Udupi - 574118, India.

**Correspondence:**
**Nidhin PS**
Research scholar, Department of Samhita and Siddhanta, SDM College of Ayurveda and Hospital, Hassan - 573201, Karnataka, India.

# Standardization of Harithaki (*Terminalia chebula* Retz.) and Trivrit (*Operculina turpethum* L.) churna: Two important drugs used for purgation in Ayurveda

**Nidhin PS, Yaligar MG, Arun Raj GR, Koppala Narayana Sunil Kumar, Ravi M**

**Abstract**
Standardization of Ayurvedic formulations is most important for the establishment of its biological activity, its chemical profile and its quality assurance in production and manufacturing of herbal drugs. As such the standardization is a burning topic in Ayurvedic drug manufacture today. Most of the pharmaceutical industries are using substitute drugs instead of authentic drugs. So to prepare best quality drugs it is necessary to authenticate raw drugs. Keeping the current trend in mind, Harithaki (*Terminalia chebula* Retz.) powder and Trivrit (*Operculina turpethum* L.) powder were subjected for standardization procedures. From the current study, genuinity indicating parameters for both Harithaki churna (powder) and Trivrit churna were derived.

**Keywords:** Harithaki, *Terminalia chebula* Retz., Trivrit, *Operculina turpethum* L.

## Introduction
Approximately 85-90% of the world's population consumes traditional herbal medicines for their health care needs as per World Health Organization (WHO) [1-2]. WHO considers phytotherapy in its health program because these herbal drugs are safe, cost effective and most significantly people have faith in them [3]. WHO has even evolved guidelines for the validation of plant based drugs [4]. Standardization of Ayurvedic formulations is most important for the establishment of its biological activity, its chemical profile and its quality assurance in production and manufacturing of herbal drugs. As the usage of herbal medicines has increased, issues regarding their quality, safety, and efficacy have raised up [5]. As such the standardization is a burning topic in Ayurvedic drug manufacture today. Since Ayurvedic medicines come under the purview of Drugs and Cosmetics Act, there is increased general awareness about the necessity for developing standards for the purpose of quality control by the manufacturers as well as by the Drug control Authorities and for quality assurance to the public [6]. At present, the quantity of raw material is not sufficient in the market. Most of the pharmaceutical industries are using substitute drugs instead of authentic drugs. So to prepare best quality drugs it is necessary to authenticate raw drugs. Keeping the current trend in mind, Harithaki (*Terminalia chebula* Retz.) [7-10] powder and Trivrit (*Operculina turpethum* L.) powder were subjected for standardize procedures. From the current study, genuinity indicating parameters for both Harithaki [11] churna (powder) and Trivrit churna [12] were derived.

## Materials and Methods
Phytochemical tests like tests for alkaloids, steroids, saponins, tannins, flavonoids, phenol, coumarins, triterpenoids, carboxylic acid, resin, quinine and HPTLC were carried out as per the WHO guidelines [13], Ayurvedic Pharmacopoeia [14] and Indian Pharmacopoeia [15].

## Plant Material
Harithaki (*Terminalia chebula* Retz.) [16] powder (Batch no: 140088) Trivrit (*Operculina turpethum* L.) powder (Batch no: 120301) were collected from SDM pharmacy, Udupi, Karnataka state, India

## Methodology
The studies were done at SDM Centre for Research in Ayurveda and Allied Sciences, Kuthpady, Udupi, Karnataka state, India as per standard procedure.

**1. HPTLC:** one gram of powdered samples were dissolved in 10 ml ethanol and kept for cold percolation for 24h and filtered. Five and ten µl of the above samples were applied on a pre-coated silica gel F254 on aluminum plates to a band width of 7 mm using Linomat 5 TLC applicator. The plate was developed in Toluene: Ethyl acetate: Formic acid (5:4: 0.1). The developed plates were visualized in UV 254, 366 and then derivatised with vanillin sulphuric acid reagent and scanned under UV 254 and 366 nm. $R_f$, colour of the spots and densitometric scan were recorded.

**Preliminary phytochemical tests**

**Tests for alkaloids**

**a. Dragendroff's test:** To a few mg of extract dissolved in alcohol, a few drops of acetic acid and Dragendroff's reagent were added and shaken well. An orange red precipitate formed indicates the presence of alkaloids.

**b. Wagners's test:** To a few mg of extract dissolved in acetic acid, a few drops of Wagner's reagent was added. A reddish brown precipitate formed indicates the presence of alkaloids.

**c. Mayer's test:** To a few mg of extract dissolved in acetic acid, a few drops of Mayer's reagent was added. A dull white precipitate formed indicates the presence of alkaloids.

**b. Hager's test:** To a few mg of extract dissolved in acetic acid, 3 ml of Hager's reagent was added, the formation of yellow precipitate indicates the presence of alkaloids.

**Tests for carbohydrates**

**a. Molisch's test:** To the extract, 1 ml of α-naphthol solution and conc. sulphuric acid were added along the sides of test tube. Violet colour formed at the junction of the two liquids indicates the presence of carbohydrates.

**b. Fehling's test:** A few mg of extract was mixed with equal quantities of Fehling's solution A and B. The mixture was warmed on a water bath. The formation of a brick red precipitate indicates the presence of carbohydrates.

**c. Benedict's test:** To 5 ml of Benedict's reagent, a few mg of extract was added, and boiled for two minutes and cooled. Formation of a red precipitate indicates the presence of carbohydrates.

**Test for steroids**

**a. Libermann-Burchard test:** To the extract dissolved in chloroform, 1 ml of acetic acid and 1 ml of acetic anhydride were added, then heated on a water bath and cooled. Few drops of conc. Sulphuric acid were added along the sides of the test tube. Appearance of bluish green colour indicates the presence of steroids.

**b. Salkowski test:** The extract was dissolved in chloroform and equal volume of conc. Sulphuric acid was added. Formation of bluish red to cherry red colour in chloroform layer and green fluorescence in the acid layer indicates the presence of steroids.

**Test for saponins:** To a few mg of extract, distilled water was added and shaken. Stable froth formation indicates the presence of saponin.

**Test for tannins:** To the extract, a few drops of dilute solution of ferric chloride was added, formation of dark blue colour shows the presence of tannins.

**Test for flavonoids: Shinoda's test:** To the extract in alcohol, a few magnesium turnings and few drops of conc. hydrochloric acid were added and heated on a water bath. Formation of red to pink colour indicates the presence of flavonoids.

**Test for phenol:** To the extract in alcohol, added two drops of alcoholic ferric chloride. Formation of blue to blue black indicates the presence of phenol.

**Test for coumarins**: To the extract in alcohol, a few drops of 2 N sodium hydroxide solution was added. Dark yellow colour formation indicates the presence of coumarins.

**Test for triterpenoids:** The extract was warmed with tin bits and few drops of thionyl chloride. Formation of pink colour indicates the presence of triterpenoids.

**Test for carboxylic acid:** Extract dissolved in water is treated with sodium bicarbonate. Brisk effervescence indicates the presence of carboxylic acid.

**Test for resin:** Few mg of the sample was mixed with water and acetone. Turbidity indicates the presence of resin.

**Test for quinine**: A few mg of alcohol extract was treated with 0.5% of sodium hydroxide. Deep coloration like pink, purple or red indicates the presence of quinine.

**Results**

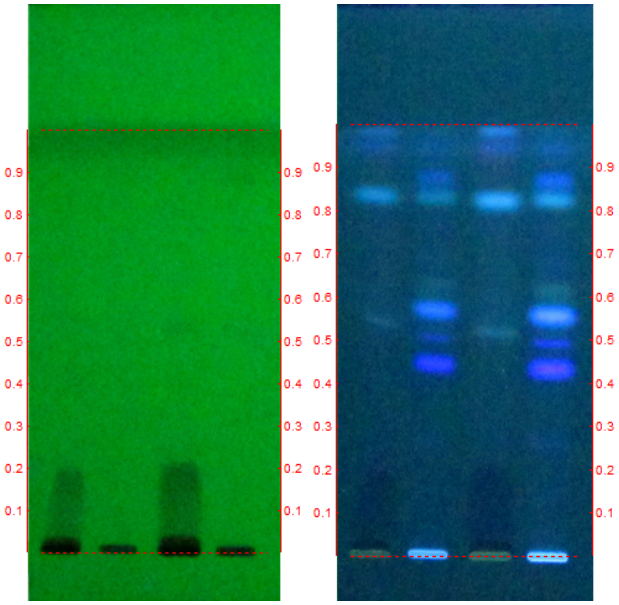
**Table 1:** Results of preliminary phytochemical tests

| Tests | Colour if positive | Harithaki Churna | Trivrit Churna |
|---|---|---|---|
| Alkaloids | | | |
| Dragendrof's test | Orange precipitate | Orange Red Solution | Orange Red Solution |
| Wagners test | Red precipitate | Reddish Brown Colour | Reddish Brown Colour |
| Mayers test | Dull white precipitate | Light Yellow Colour | Light Yellow Colour |
| Hagers test | Yellow precipitate | Yellow Colour | Light Yellow Colour |
| Steroids | | | |
| Liebermann- buchard test | Bluish green | Brown Colour | Green Colour |
| Salkowski test | Bluish red to cherry red | Reddish Brown at junction | Reddish Brown at junction |
| Carbohydrate | | | |
| Molish test | Violet ring | Violet ring | Violet ring |
| Fehlings test | Brick red precipitate | Brick red precipitate | Brick red precipitate |
| Benedicts test | Red precipitate | Red precipitate | Blue Colour |
| Tannin | | | |

| | | | |
|---|---|---|---|
| With $FeCl_3$ | Dark blue or green or brown | Brown colour solution | Light Green |
| Flavanoids | | | |
| Shinoda's test | Red to pink | Light Yellow colour | Pink Colour |
| Saponins | | | |
| With $NaHCO_3$ | Stable froth | No Froth formed | No Froth formed |
| Triterpenoids | | | |
| Tin and thionyl chloride test | Pink | Yellow precipitate | Brown Colour |
| Coumarins | | | |
| With 2 N NaOH | Yellow | Yellow precipitate | Yellow precipitate |
| Phenols | | | |
| With alcoholic ferric chloride | Blue to blue black, brown | Brown colour solution | Light Green Colour |
| Carboxylic acid | | | |
| With water and $NaHCO_3$ | Brisk effervescence | No brisk effervescence | No brisk effervescence |
| Resin | | | |
| With aqueous acetone | Turbidity | No Turbidity | No Turbidity |
| Quinone | | | |
| 5% NaOH | Pink/purple/red | Yellow precipitate | Brown Red |

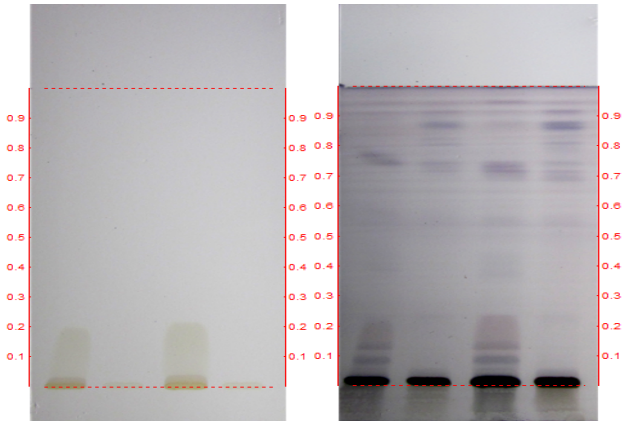
**Table 2:** Summary

| Test | Harithaki churna | Trivrit churna |
|---|---|---|
| Alkaloid | – | – |
| Carbohydrate | + | + |
| Carboxylic acid | – | – |
| Coumarins | + | + |
| Flavanoids | – | + |
| Phenol | + | – |
| Quinone | – | – |
| Resins | – | – |
| Steroid | + | + |
| Saponins | – | – |
| Tannin | + | + |
| Terpenoid | – | – |



At 254 nm At 366 nm

**Fig 1:** HPTLC photo documentation of ethanol extract of Harithaki churna & Trivrit Churna



At 540 nm After post derivatisation

track 1- Harithaki churna – 4 µl
track 2- Trivrit churna – 4 µl
track 3- Harithaki churna – 8 µl
track 4- Trivrit churna – 8 µl

**Solvent system: Toluene: Ethyl Acetate: Acetic Acid (5:4:0.1)**

**Table 3:** $R_f$ values of Harithaki Churna

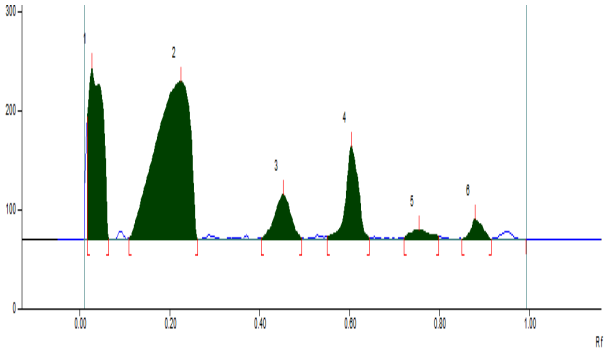
| At 254 nm | At 366 nm | At 540 nm | After post derivatisation |
|---|---|---|---|
| - | - | - | 0.05(L Violet) |
| - | - | - | 0.08(Violet) |
| - | - | - | 0.14(Violet) |
| 0.21(Green) | 0.21(F Blue) | 0.21(L Brown) | 0.21(L Violet) |
| 0.53(L Green) | 0.33(F L Green) | - | - |
| - | - | - | 0.37(L Violet) |
| - | - | - | 0.44 (L Violet) |
| - | 0.52(F L Green) | - | - |
| - | - | - | 0.55(L Violet) |
| - | - | - | 0.73(Violet) |
| - | 0.83(F Blue) | - | - |
| - | - | - | 0.87(L Violet) |
| - | 0.95(F L Blue) | - | 0.95(L Violet) |

*L-Light,F-Fluorescence

**Table 4:** $R_f$ values of Trivrit Churna

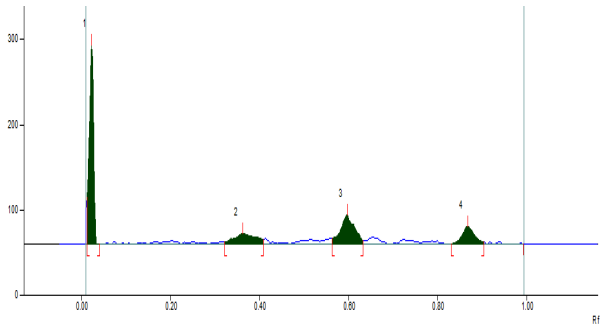
| At 254 nm | At 366 nm | At 540 nm | After post derivatisation |
|---|---|---|---|
| - | - | - | 0.05(L Violet) |
| - | - | - | 0.09(L Violet) |
| - | - | - | 0.13(L Violet) |
| - | - | - | 0.23(L Violet) |
| - | 0.27(F L Violet) | - | - |
| - | 0.45(F Violet) | - | - |
| - | 0.50(F Violet) | - | - |
| - | - | - | 0.55(L Violet) |
| - | 0.63(F L Green) | - | - |
| - | - | - | 0.72(L Violet) |
| - | - | - | 0.80(L Violet) |
| - | 0.83 (F Blue) | - | - |
| - | 0.87(F Violet) | - | 0.87(Violet) |
| - | - | - | 0.91(L Violet) |
| - | 0.94(F L Violet) | - | - |

*L-Light, F-Fluorescence



| Peak | Start Position | Start Height | Max Position | Max Height | Max % | End Position | End Height | Area | Area % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.02 Rf | 123.7 AU | 0.03 Rf | 172.3 AU | 34.50 % | 0.06 Rf | 0.2 AU | 3875.1 AU | 23.75 % |
| 2 | 0.11 Rf | 1.9 AU | 0.23 Rf | 158.8 AU | 31.80 % | 0.26 Rf | 0.4 AU | 8760.0 AU | 53.68 % |
| 3 | 0.40 Rf | 1.5 AU | 0.45 Rf | 44.7 AU | 8.96 % | 0.50 Rf | 1.1 AU | 1156.9 AU | 7.09 % |
| 4 | 0.55 Rf | 3.0 AU | 0.60 Rf | 93.6 AU | 18.74 % | 0.65 Rf | 1.5 AU | 1848.3 AU | 11.33 % |
| 5 | 0.72 Rf | 1.6 AU | 0.76 Rf | 10.0 AU | 2.00 % | 0.80 Rf | 3.3 AU | 309.9 AU | 1.90 % |
| 6 | 0.85 Rf | 0.2 AU | 0.88 Rf | 19.9 AU | 3.99 % | 0.92 Rf | 0.3 AU | 367.7 AU | 2.25 % |

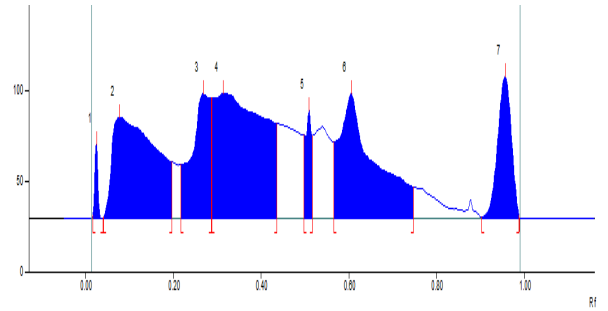
**Fig 2a:** Harithaki Churna at 254 nm



| Peak | Start Position | Start Height | Max Position | Max Height | Max % | End Position | End Height | Area | Area % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.01 Rf | 53.8 AU | 0.02 Rf | 233.2 AU | 77.67 % | 0.04 Rf | 0.0 AU | 1697.3 AU | 51.09 % |
| 2 | 0.32 Rf | 2.5 AU | 0.36 Rf | 12.9 AU | 4.29 % | 0.41 Rf | 5.0 AU | 438.3 AU | 13.19 % |
| 3 | 0.56 Rf | 6.9 AU | 0.60 Rf | 33.8 AU | 11.27 % | 0.63 Rf | 4.1 AU | 770.9 AU | 23.20 % |
| 4 | 0.83 Rf | 0.3 AU | 0.87 Rf | 20.3 AU | 6.76 % | 0.90 Rf | 2.6 AU | 415.8 AU | 12.52 % |

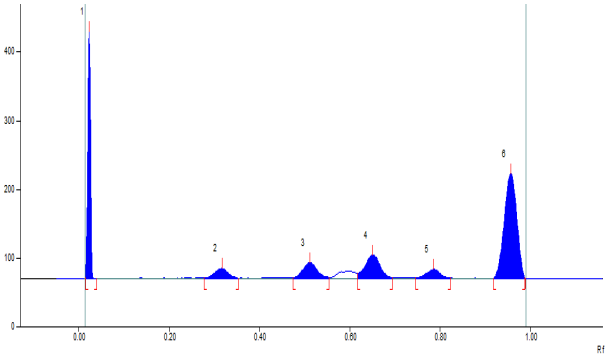
**Fig 2:b.** Trivrit Churna At 254 nm

**Fig 2:** Densitometric scan at 254nm



| Peak | Start Position | Start Height | Max Position | Max Height | Max % | End Position | End Height | Area | Area % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.02 Rf | 1.8 AU | 0.03 Rf | 40.6 AU | 9.27 % | 0.04 Rf | 0.0 AU | 209.8 AU | 1.14 % |
| 2 | 0.04 Rf | 0.7 AU | 0.08 Rf | 55.3 AU | 12.61 % | 0.20 Rf | 30.8 AU | 3947.3 AU | 21.47 % |
| 3 | 0.22 Rf | 29.5 AU | 0.27 Rf | 68.2 AU | 15.56 % | 0.29 Rf | 66.2 AU | 2130.5 AU | 11.59 % |
| 4 | 0.29 Rf | 66.1 AU | 0.31 Rf | 68.3 AU | 15.56 % | 0.44 Rf | 51.9 AU | 5649.1 AU | 30.73 % |
| 5 | 0.50 Rf | 45.5 AU | 0.51 Rf | 59.3 AU | 13.52 % | 0.52 Rf | 45.3 AU | 645.4 AU | 3.51 % |
| 6 | 0.57 Rf | 42.2 AU | 0.61 Rf | 68.6 AU | 15.64 % | 0.75 Rf | 17.3 AU | 4039.5 AU | 21.97 % |
| 7 | 0.90 Rf | 0.6 AU | 0.96 Rf | 78.2 AU | 17.83 % | 0.99 Rf | 1.9 AU | 1761.4 AU | 9.58 % |

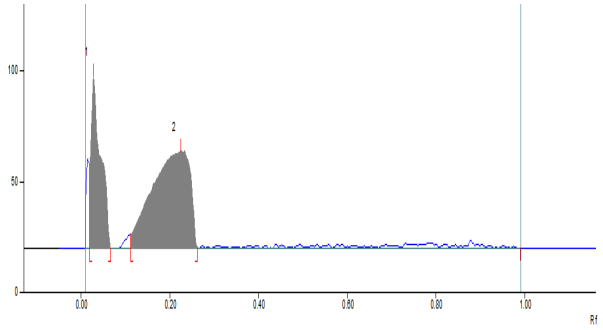
**Fig 3a:** Harithaki Churna at 366 nm



| Peak | Start Position | Start Height | Max Position | Max Height | Max % | End Position | End Height | Area | Area % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.02 Rf | 1.5 AU | 0.02 Rf | 360.1 AU | 60.07 % | 0.04 Rf | 0.2 AU | 1648.3 AU | 24.48 % |
| 2 | 0.28 Rf | 0.9 AU | 0.32 Rf | 14.8 AU | 2.48 % | 0.35 Rf | 0.5 AU | 328.0 AU | 4.87 % |
| 3 | 0.48 Rf | 1.4 AU | 0.51 Rf | 23.6 AU | 3.94 % | 0.55 Rf | 2.1 AU | 540.6 AU | 8.03 % |
| 4 | 0.62 Rf | 8.3 AU | 0.65 Rf | 34.2 AU | 5.70 % | 0.70 Rf | 1.9 AU | 834.5 AU | 12.39 % |
| 5 | 0.75 Rf | 1.1 AU | 0.79 Rf | 13.6 AU | 2.27 % | 0.82 Rf | 0.8 AU | 307.7 AU | 4.57 % |
| 6 | 0.92 Rf | 0.4 AU | 0.96 Rf | 153.2 AU | 25.55 % | 0.99 Rf | 2.1 AU | 3073.5 AU | 45.65 % |

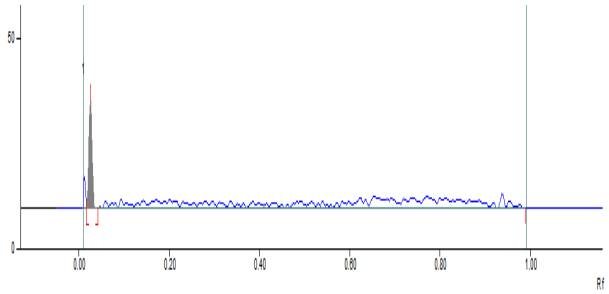
**Fig 3b:** Trivrit Churna at 366 nm

**Fig 3:** Densitometric scan At 366 nm



| Peak | Start Position | Start Height | Max Position | Max Height | Max % | End Position | End Height | Area | Area % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.02 Rf | 37.9 AU | 0.03 Rf | 77.5 AU | 63.93 % | 0.07 Rf | 0.0 AU | 1245.2 AU | 31.55 % |
| 2 | 0.11 Rf | 6.2 AU | 0.23 Rf | 43.7 AU | 36.07 % | 0.26 Rf | 0.3 AU | 2701.2 AU | 68.45 % |

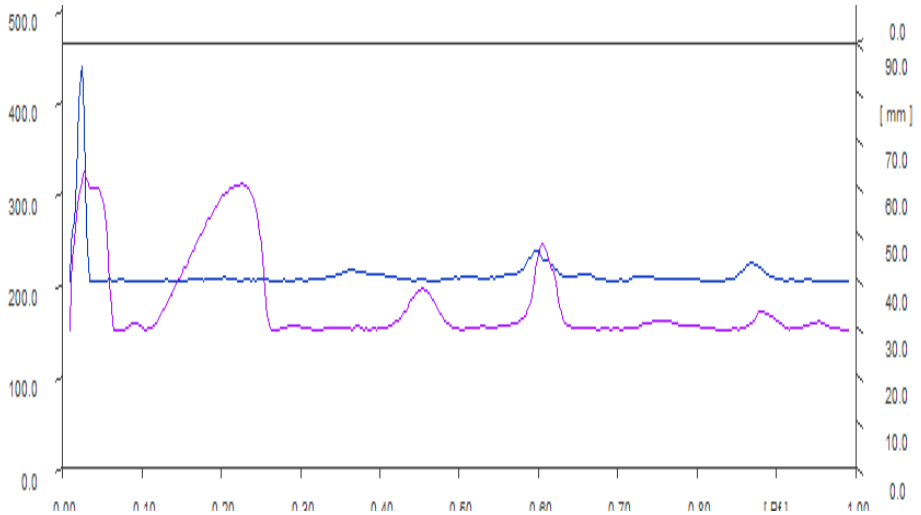
**Fig 4a:** Harithaki Churna at 540 nm



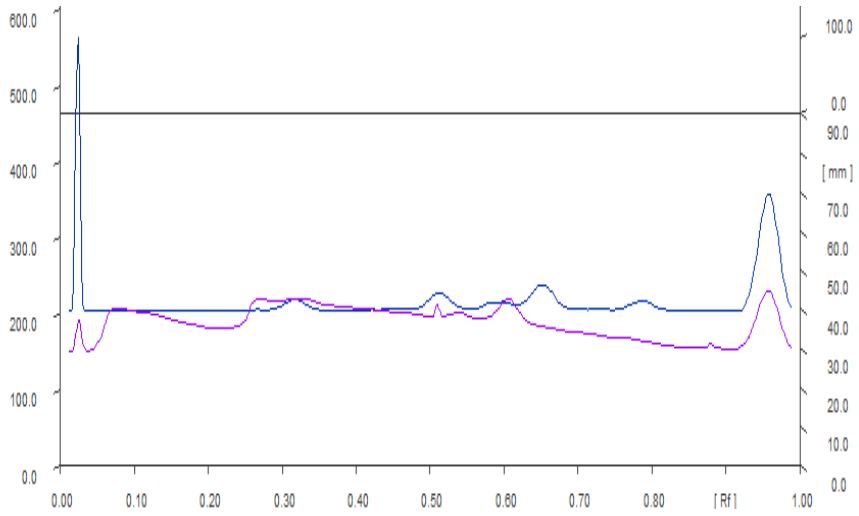
| Peak | Start Position | Start Height | Max Position | Max Height | Max % | End Position | End Height | Area | Area % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.02 Rf | 1.7 AU | 0.03 Rf | 25.7 AU | 100.00 % | 0.04 Rf | 0.1 AU | 133.5 AU | 100.00 % |

**Fig 4b:** Trivrit Churna at 540 nm

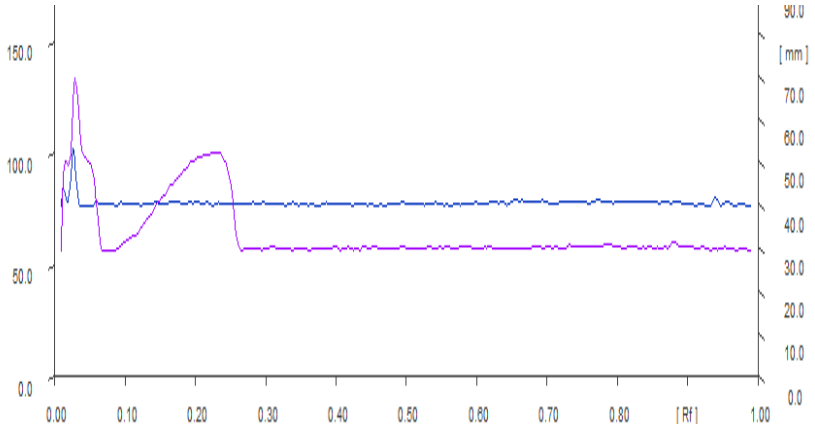
**Fig 4:** Densitometric scan At 540 nm



At 254 nm




At 366 nm




At 540 nm

**Fig 5:** 3-D Display of All the samples

## Discussion

The phytochemical tests carried out serve as preliminary test for the standardization of the formulation. Tests such as tests for alkaloids, steroids, saponins, tannins, flavonoids, phenol, coumarins, triterpenoids, carboxylic acid, resin, quinine, HPTLC, results of TLC photodocumentation, the unique Rf values, densitometric scan and densitogram obtained at different wavelengths can be used as fingerprint to identify both the herbal drugs, Harithaki (*Terminalia chebula* Retz.) powder and Trivrit (*Operculina turpethum* L.) powder.

## Conclusion

Proper Ayurvedic drug standardization requires rational approach and in this regard fundamental aspects of Ayurvedic drug should be preserved. Main obstacle in Ayurvedic drug standardization is the identification of biological source of the drug. The active constituent may vary according to geographical source of the drug and it may not be easy to standardize drug chemically. The parameters used in this work ensure the quality control of raw material, processed powder. The results obtained through this study were quick, reproducible and could be used for routine monitoring of raw material. Both Harithaki (*Terminalia chebula* Retz.) powder and Trivrit (*Operculina turpethum* L.) powder are endowed with various biological properties and hence efforts have been made here to provide scientific data on the same.

## Acknowledgement

Authors are highly grateful to the constant support of Dr. Mallika KJ, Dean (Academics), SDM College of Ayurveda, Hassan and Dr. Girish KJ, Research co-ordinator, SDM College of Ayurveda, Hassan. The Authors thank Dr. B. Ravishankar, Director, SDM Centre for Research in Ayurveda and Allied Sciences for providing the facilities for their guidance.

## References

1. Arun Raj GR, Shailaja U, Prasanna N Rao, Ajayan S, Nivya P Thomas. Review on the contribution of Ura-Marunnu, a traditional baby care practice in southern India. The Pharma Innovation 2014; 2(11):42-70.
2. Kimmatkar N, Thawani V, Hingorani L, Khiyani R. Efficacy and tolerability of Boswellia serrata extract in treatment of osteoarthritis of knee-a randomized double blind placebo controlled trial. Phytomed 2003; 10:3-7.
3. Waddar S, Gopi KBJ, Rao PN, Raj AGR, Waddar S. Standardization of Mulaka (*Raphenus sativus* Linn.) Kshara: a herbal alkaline preparation. Journal of Pharmacognosy and Phytochemistry 2014; 3(1):108-110.
4. Chaudhary RR. Herbal medicine for human health. World Health Organization, Geneva, CBS Publishers and distributors LTD; New Delhi, 1999.
5. Arun Raj GR, Shailaja U, Rao PN, Sharanesh T, Gokul J.

Review on the contribution of Dashapushpa, a traditional medicine in the management of cancer. Global J Res. Med. Plants & Indigen. Med 2013; 2(9):656-663.
6. Somanathan AR, Sadanandan K, Damodaran NP. Standardisation of Ayurvedic medicines - Dasamulam Kasayam. Ancient Science of Life 1989; 9(2):54-60.
7. Raj GRA, Shailaja U, Rao PN, Ajayan S. Review on the concept of Immunomodulation in Ayurveda with special emphasis on Prakara yoga. Int J Pharm Sci Res 2014; 5(4):1116-23.
8. Arun Raj GR, Shailaja U, Rao Prasanna N. Preventive medicine in children: An Ayurvedic Approach Highlighting Native Vaccinations. IJIRD 2013; 2(6):886-893.
9. Shailaja U, Rao Prasanna N, Arun Raj GR, Mallannavar V. Effect of Kumarabharana rasa on chronic tonsillitis in children: A pilot clinical study. Int. J. Res. Ayurveda Pharm. 2013; 4(2):153-157.
10. Arun Raj GR, Shailaja U, Rao Prasanna N, Mallanavar V. Review on the therapeutic efficacy of an Ayurvedic compound drug in chronic tonsillitis in children. Unique journal of pharmaceutical and biological sciences 2013; 1(2):2-11.
11. Arun Raj GR, Shailaja U, Parikshit Debnath, Subhadip Banerjee, Prasanna N Rao. Exploratory studies on the therapeutic effects of Kumarabharana Rasa in the management of chronic tonsillitis among children at a tertiary care hospital of Karnataka. Journal of Traditional and Complementary Medicine, 2014, 1-5.
12. Kohli KR, Nipanikar SU, Kadbhane KP. A comprehensive review on Trivrit [*Operculina turpethum* syn. *Ipomoea turpethum*]. International Journal of Pharma and Bio Sciences 2010; 1(4):443-452.
13. WHO. Quality Control Methods for Medicinal Plant Materials. Geneva: AITBS Publishers and Distributors, Delhi, 2002, 65-67.
14. The Ayurvedic Pharmacopeia of India, Govt. of India, Min. of Health and Family Welfare, Department of Ayurveda, Yoga and Homoeopathy (Ayush), New Delhi, Part-1; edition 2001; 1(5):1.
15. Indian Pharmacopoeia, (Ministry of Health and Family Welfare, Government of India, New Delhi) 2010; I:10-146.
16. Arya TU, Shailaja U, Arun Raj GR, Sharvari S Deshpande. Exploratory study on the efficacy of Panchatiktaka ghrita in the management of atopic dermatitis in children. Int. J. Res. Ayurveda Pharm 2014; 5(4):412-418.