Research Article

www.ijrap.net

PHARMACOGNOSTICAL AND PHYSICOCHEMICAL EVALUATION OF CHITRAKA HARITAKI AVALEHA: A COMPOUND AYURVEDIC FORMULATION

Atara Achyuta[1]*, Manjusha R.[2], CR Harisha[3], Pandya Preeti[4], Shukla VJ[5]

[1]Ph D Scholar, Department of Shalakya Tantra, Institute for Postgraduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar, Gujarat, India

[2]Professor, Department of Shalakya Tantra, Institute for Postgraduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar, Gujarat, India

[3]Head, Pharmacognosy Laboratory, Institute for Postgraduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar, Gujarat, India

[4]Laboratory Assistant, Pharmacognosy Laboratory, Institute for Postgraduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar, Gujarat, India

[5]Head, Pharmaceutical Chemistry Laboratory, Institute for Post Graduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar, Gujarat, India

Received on: 22/04/14 Revised on: 02/06/14 Accepted on: 18/06/14

***Corresponding author**

Dr. Achyuta G. Atara, Final year Ph. D. Scholar, Department of Shalakya Tantra, Institute for post graduate teaching & research in Ayurveda, Gujarat Ayurveda University, Jamnagar-361 008 Gujarat India E-mail: achyutaa250@gmail.com

DOI: 10.7897/2277-4343.05356

ABSTRACT

Chitraka Haritaki Avaleha is a Leha Kalpana (semisolid preparation of drugs, prepared with addition of jaggery and boiled with prescribed decoction) specifically indicated for oral use in treatment of nasal disorders in Ayurveda. It is also indicated in various disorders like Kshaya (Pthisis), Kasa (Cough), Peenasa (Chronic rhinitis/sinusitis), Krimi (Helminthiasis / Worm infestation), Arsha (Haemorrhoids), Swasa (Asthma/dyspnoea) and Agnimandhya (Digestive impairment). In this study, effort has been made to overcome from the controversy regarding ingredients in the finished product of Chitraka Haritaki Avaleha and attempted to standardize the final product as per guidelines of API. In present study it has been used in Nasa Arsha (Nasal Polyposis). The presence of tannins, parenchyma cells, fibers, starch grains, pollen grains, acicular and prismatic crystals of calcium oxalate, rosette crystals, stone cells etc. were the characteristic features observed in the microscopy of prepared formulation. Physicochemical analysis showed that Ash value was 2.5 % w/w, pH was 5.80, Loss on drying was 23.5 % w/w, Alcohol soluble extractive value was 69 %, Water soluble extractive value was 61 % and 97.49 % level of Total sugar in Chitraka Haritaki Avaleha.

Keywords: Chitraka Haritaki Avaleha, Pharmacognosy, Pharmaceutical, Nasa Arsha.

INTRODUCTION

Chitraka Haritaki Avaleha is a Leha Kalpana (semisolid preparation of drugs, prepared with addition of jaggery and boiled with prescribed decoction) specifically indicated for oral use in Nasaroga Chikitsa by Chakradutta[1] and Bhaishajya Ratnavali[2]. It is also indicated in various disorders like Kshaya (Pthisis), Kasa (Cough), Peenasa (Chronic rhinitis/sinusitis), Krimi (Helminthiasis/ Worm infestation), Arsha (Hemorrhoids), Swasa (Asthma/dyspnoea) and Agnimandhya (Digestive impairment). In the present study it has been used in Nasa -Arsha (Nasal Polyposis). Nasal polyps are most commonly thought to be caused by allergy and recurrent sinus infection resulting into chronic inflammation to the mucous lining of the ethmoidal sinuses causes increased blood vessel permeability which in turn causes edema of the mucosa. Eventually this mucosa, which in effect is the lining of the ethmoids, prolapses out of the sinus. Repeated blowing of the nose encourages growth of the polyp[3]. An Aushadha (medicine) is one of the treatment modalities mentioned for the treatment of Arsha which can be applied for the disease Nasa Arsha (Nasal polyp). As per literature survey Chitraka Haritaki Avaleha has been used in Kasa and Dushta Pratishyaya, but not in Nasa Arsha. So this is the first study planned to evaluate the efficacy of Chitraka Haritaki Avaleha for its systemic action on Nasa Arsha. It is the need of the hour to come up with a standard formulation without compromising its effectiveness. Standardization of Ayurvedic drugs is taken up on priority basis these days. WHO has framed a code of Drug Manufacturing Practice in Ayurveda[4]. So, present work was selected as an initial attempt in this direction to confirm the standards of the prepared formulation Chitraka Haritaki Avaleha as per API[5]. With following aims and objectives pharmacognostical study of compound formulation Chitraka Haritaki Avaleha and physico-chemical analysis of Chitraka Haritaki Avaleha was carried out.

MATERIALS AND METHODS

The study involved the following operating procedures.

Collection, identification and authentification of raw drugs

The raw drugs except Honey and Jaggery were procured from the Pharmacy, Gujarat Ayurveda University, Jamnagar, Gujarat, India. Honey and Jaggery were procured from local market of Jamnagar, Gujarat, India. The ingredients and the part used are given in the Table 1. The raw drugs were identified and authenticated by the department of Dravyaguna and Pharmacognosy laboratory of IPGT and RA, Gujarat Ayurveda University, Jamnagar, Gujarat, India. The identification was carried out based on the morphological features,

organoleptic characters and powder microscopy of the individual drugs and formulation as per API standards for the authentification.

Preparation of the drug Chitraka Haritaki Avaleha at Pharmacy of Gujarat Ayurved University

Preparation of Yavakoota (Coarse powder)

Chitraka, Amalaki, Gudoochi and Dhashamoola were taken and made into coarse powder separately and then mixed to make a homogeneous mixture. Haritaki was taken as a whole tied in Potali and was kept embedded in whole process of decoction preparation for boiling. At the end of decoction preparation before filtration, Haritaki fruits were taken out and made into paste after removing the seeds.

Preparation of Kwatha (decoction)

Decoction preparation was done as per Sharangadhara Samhita[6]. One part of coarse powder was added with 4 parts of potable water and subjected to heat on medium temperature, until the volume was reduced to 1/4th of its initial quantity. The contents were filtered.

Preparation of Avaleha

In filtered decoction jaggery was added and cooking in medium flame was done in order to make 2 thread condensed sugar mixture when pressed between two fingers. Finally paste of Haritaki was mixed to make homogenous mixture. Then after fine powders of Prakshepa Dravyas were added and stirred continuously and vigorously to form a homogenous mixture. When whole mixture got cooled afterwards honey was added and mixture was finally mixed to get Chitraka Haritaki Avaleha.

Pharmacognostical evaluation

Organoleptic and Microscopic studies of the prepared drug were done as per the guidelines of Ayurvedic pharmacopoeia of India at Pharmacognosy Lab, I.P.G.T and R.A, Jamnagar, Gujarat, India. Little quantity of Avaleha dissolved in the distilled water and placed on slide adding with small quantity of water and observed under the microscope to get the microscopical characters of the ingredients of the Avaleha, then stained with Iodine solution and Sudan III. Microphotographs were taken under the corl zeiss trinocular microscope attached with camera[7]. The diagnostic features obtained were found to be complying with the standards mentioned at respective volumes of API.

Physicochemical analysis of the Chitraka Haritaki Avaleha

Chitraka Haritaki Avaleha was analyzed by using, qualitative and quantitative parameters as per guidelines at Pharmaceutical Chemistry Laboratory of I. P. G.T and R. A., Gujarat Ayurveda University, Jamnagar, Gujarat, India[8].

RESULTS

Pharmacognostical study of compound formulation-Chitraka Haritaki Avaleha

Organoleptic characters

The organoleptic characters and microscopic characters of Chitraka Haritaki Avaleha are depicted in Table 2.

Microscopic Evaluation

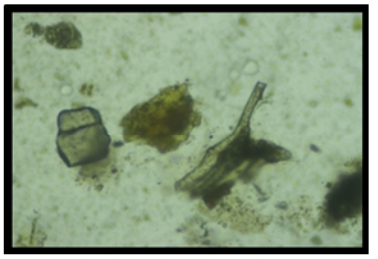
Chitraka Haritaki Avaleha showed presence of tannins, vessels with simple pits, groups of sclereids, spiral vessels, thin walled fibers, multiple simple and compound rounded to oval starch grains, connective and numerous golden yellow pollen grains having 1-3 protuberances, acicular crystals of calcium oxalate, cluster crystals of calcium oxalate, perisperm cells, endosperm cells, mesocarp cells, oil globules, prismatic crystals of calcium oxalate, vessels with bordered pits, thin-walled parenchymatous cells, rosette crystals of calcium oxalate, stone cells, pointed, stratified fibers and trichomes. (Photo Plate-1)

Physicochemical assay of Chitraka Haritaki Avaleha

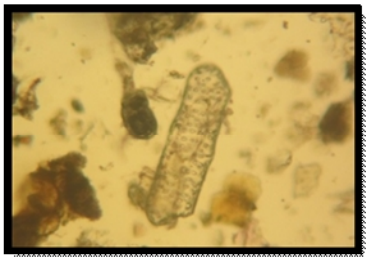
The prepared drug was analyzed for the physical and chemical parameters such as loss on drying, pH, ash value, sugar content, water soluble extract and alcohol soluble extract. The results are cited in Table 3.

DISCUSSION

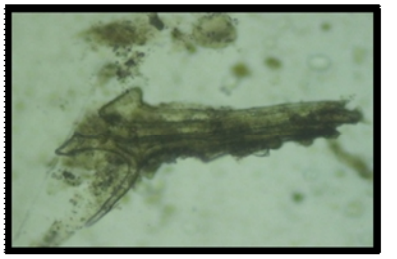
Microscopic identification of the botanical ingredients is a standard for statutory purposes in several solid and semi-solid compound formulations. In the present investigation, pharmacognostical and physico-chemical studies were conducted on Chitraka Haritaki Avaleha as per API guidelines. These studies revealed the presence of various important bioactive compounds and proved that these all are medicinally important too. The finished product proved all the ingredients were present in formulation. This showed genuinity and quality of Avaleha. Main ingredient of Chitraka Haritaki Avaleha is Haritaki which contains tannin. Tannins belong to the phenolic class of secondary metabolites[9]. Tannins such as chebulagic acid, chebulinic acid, tannic acid and gallic acid belong the hydrolysable group and are extensively used for medicinal purposes[10,11]. *Terminalia chebula* Retz. contains hydrolysable type of tannins. Tannic acid is used to produce tannate salts of certain anti-histamines and anti-tussives to impart increased stability or slow release properties to the API (active pharmaceutical ingredient). Further to this, tannic acid is the principle ingredient in anti-allergen sprays[12]. Orally, tannic acid applied directly can treat sore throat and tonsils and fever blisters. When consumed, tannic acid can medicate bleeding, persistent coughs, cancer etc[13]. A systematic review by Chung *et al.* (1998)[14] found that tannins have also been reported to exert many physiological effects, such as to accelerate blood clotting, reduce blood pressure, decrease the serum lipid level and modulate immune responses. Sclereids found in Haritaki, Amalaki and Guduchi help to prevent collapse of softer tissues at times of water stress. They are grouped with fibers under the general term sclerenchyma.



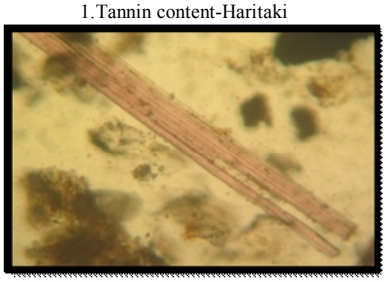
1.Tannin content-Haritaki



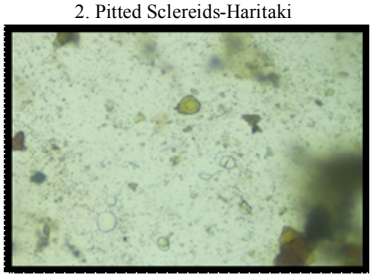
2. Pitted Sclereids-Haritaki



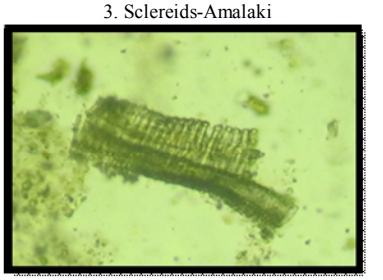
3. Sclereids-Amalaki



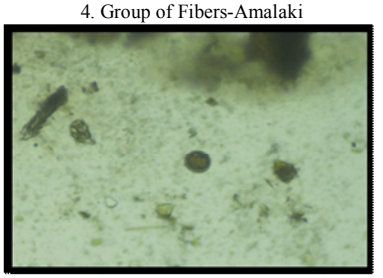
4. Group of Fibers-Amalaki



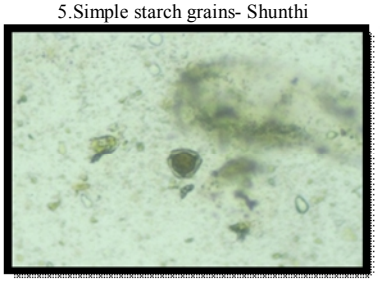
5.Simple starch grains- Shunthi



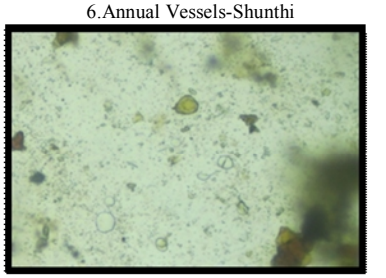
6.Annual Vessels-Shunthi



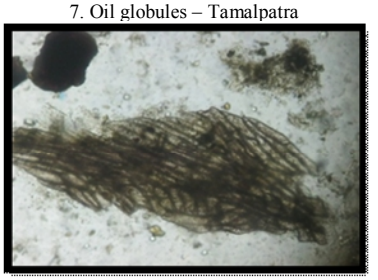
7. Oil globules – Tamalpatra



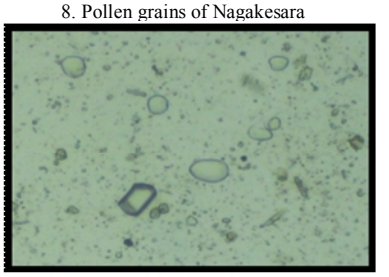
8. Pollen grains of Nagakesara



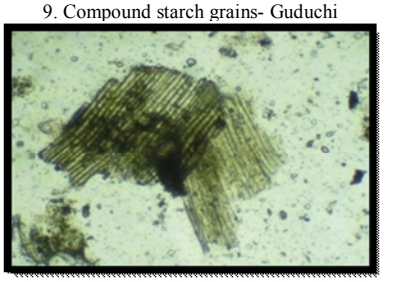
9. Compound starch grains- Guduchi



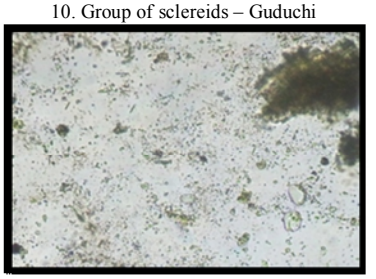
10. Group of sclereids – Guduchi



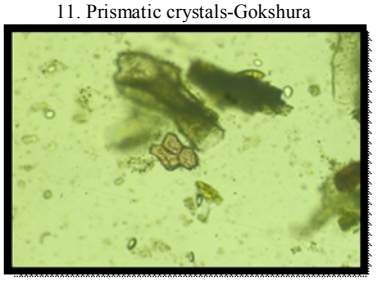
11. Prismatic crystals-Gokshura



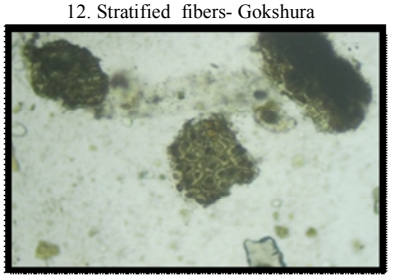
12. Stratified fibers- Gokshura



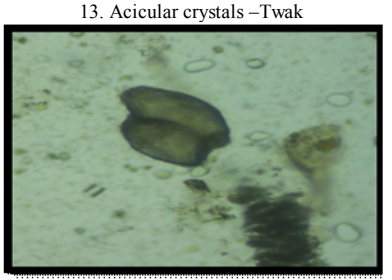
13. Acicular crystals –Twak



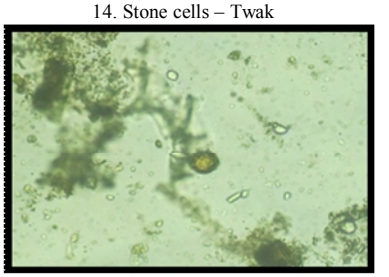
14. Stone cells – Twak



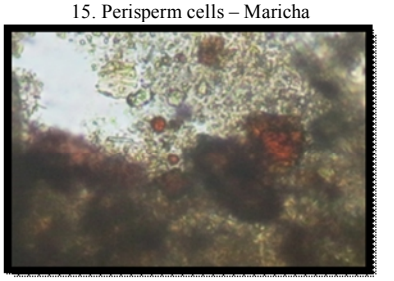
15. Perisperm cells – Maricha



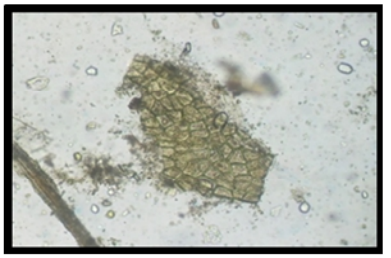
16. Mesocarp cell –Maricha



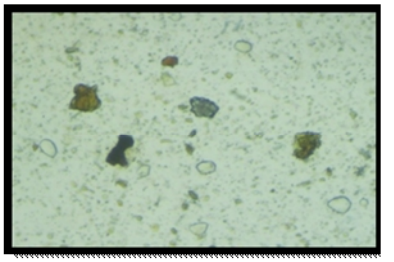
17. Oil globules-Pippali



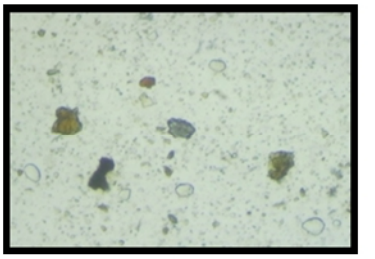
Oil globules-Pippali confirmed by sudan III



18. Endosperm cells in surface view-Pippali

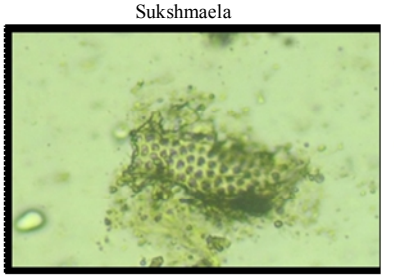


19.Cluster crystal of Calcium oxalate-Sukshmaela

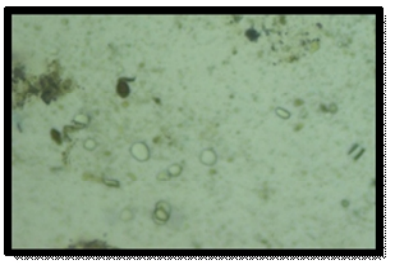


20. Starch grains – Chitraka

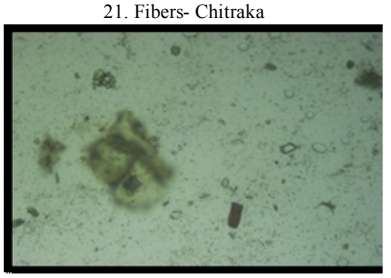
21. Fibers- Chitraka



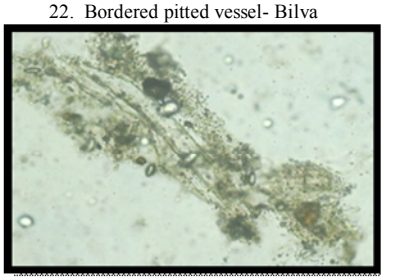
22. Bordered pitted vessel- Bilva



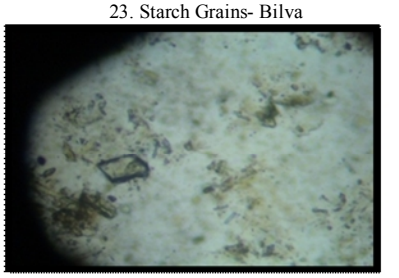
23. Starch Grains- Bilva



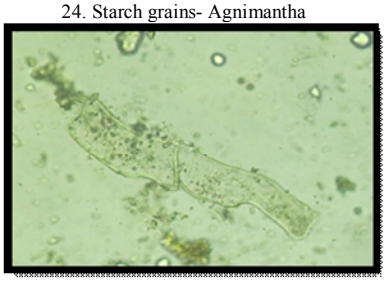
24. Starch grains- Agnimantha



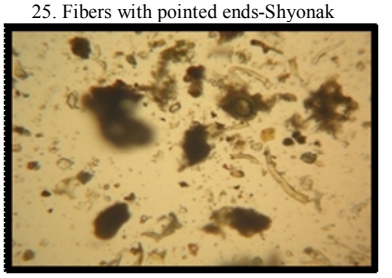
25. Fibers with pointed ends-Shyonak



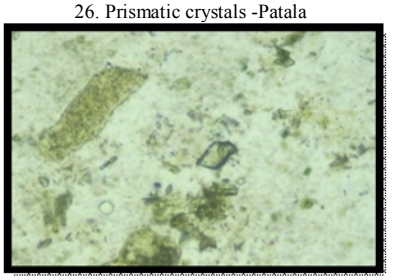
26. Prismatic crystals -Patala



27. Thin walled parenchyma- Gambhari

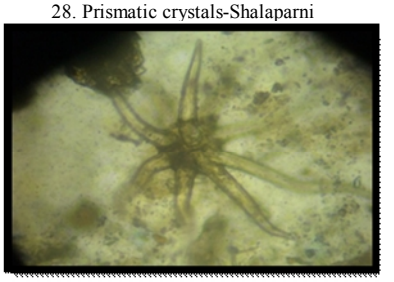


28. Prismatic crystals-Shalaparni

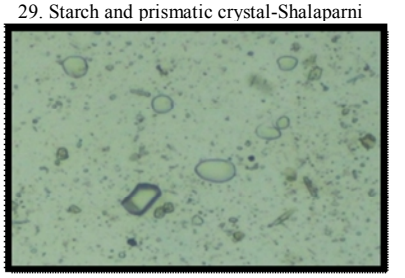


29. Starch and prismatic crystal-Shalaparni

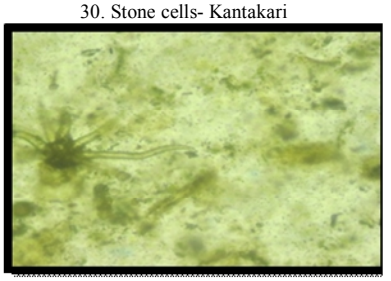
30. Stone cells- Kantakari



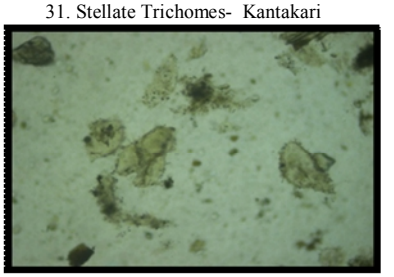
31. Stellate Trichomes- Kantakari



32. Round and oval starch grains – Brihati



33. Stellate Trichomes- Brihati



34. Parenchyma cells – Prishnaparni

Photo Plate 1: Microphotographs of Chitraka Haritaki Avaleha

Table 1: Ingredients of Chitraka Haritaki Avaleha

Drug	Botanical Name	Part used	Proportion
Chitrak moola coarse powder	*Plumbago zeylanica* Linn.	Root	5 kg.
Amalaki coarse powder	*Embelica officinalis* Gaertn.	Fruit	5 kg.
Guduchi coarse powder	*Tinospora cordifolia* Miers.	Stem	5 kg.
Bilva coarse powder	*Aegle marmelos* Carr.	Whole plant	500 g.
Agnimanth coarse powder	*Clerodendrum phlomidis* Linn.	Whole plant	500 g.
Shyonak coarse powder	*Oroxylum indicum* Vent.	Whole plant	500 g.
Patala coarse powder	*Steospermum sauveolens* DC.	Whole plant	500 g.
Gambahari coarse powder	*Gmelina arbora* Roxb.	Whole plant	500 g.
Shalaparni coarse powder	*Desmodium gangeticumi* DC.	Whole plant	500 g.
Prishnaparni coarse powder	*Uraria picta* Desv.	Whole plant	500 g.
Brihati coarse powder	*Solanum indicum* Linn.	Whole plant	500 g.
Kantakari coarse powder	*Solanum xanthocarpum* Birm.	Whole plant	500 g.
Gokshura coarse powder	*Tribulus terrestries* Linn.	Whole plant	500 g.
Guda	Jaggery	-	20 kg.
Haritaki	*Terminalia chebula* Retz.	Fruit	12 kg.
Shunthi choorna	*Zingiber officinale* Roxb.	Rhizome	748 g.
Maricha choorna	*Piper nigrum* Linn.	Fruit	748 g.
Pippali powder	*Piper longum* Linn.	Fruit	748 g.
Tvak powder	*Cinnamomum zeylanicum* Blume.	Bark	748 g.
Ela powder	*Elettaria cardamomum* Linn.	Fruit	748 g.
Patra powder	*Cinnamomum tamala* Nees and Eberm	Leaf	748 g.
Nagakesara powder	*Mesua ferrea* Linn.	Anthers	748 g.
Yavakshara powder	*Hordoleum vulgare*	-	92 g.
Madhu	Honey	-	1500 g.

Table 2: Organoleptic characters of Chitraka Haritaki Avaleha

Parameters	**Sample-** Avaleha
Color	Dark brown
Touch	Soft
Odor	Pleasant
Taste	Astringent, pungent

Table 3: Physico-chemical assay of Chitraka Haritaki Avaleha

S. No.	Analytical parameters	Results of Avaleha
1	Loss on drying	23.5 % w/w
2	Total Ash value	2.5 % w/w
3	Alcohol soluble extractive value	69 %
4	Water soluble extractive value	61 %
5	pH	5.80
6	**Sugar content**	
	Total sugar	97.49 %
	Non- reducing sugar	36.45 %
	Reducing sugar	61.04 %

Their walls consist of cellulose, hemicellulose and lignin. Sclerenchyma provides the main structural support to a plant. Fibers found in Amalaki, Shyonak and Chitraka has high load-bearing capacity. Parenchyma generally constitutes the "filler" tissue in soft parts of plants. They allow the cells to store and regulate ions, waste products, and water. Tissue specialized for food storage is commonly formed of parenchyma cells. Sclereids, parenchyma and fibers are used to protect other cells[15]. Starch present in many drugs of Avaleha is the main form by which plants store carbohydrate and is a major photosynthetic product in many species[16]. Pollen in Nagakesara contains within itself sperm cells, complete with cell walls and plasma membranes. Function of pollen- Biotic and abiotic pollinator preference and fluid dynamics[17]. Calcium oxalate crystals found in Ela (cluster crystal), Gokshura, Patala, Shalaparni (prismatic crystal) and Twak (acicular crystals). Oxalic acid (ethanedioic acid), and its salts occur as an end product of metabolism in a number of plants. Oxalate is associated with metabolic disorders and infectious diseases[18]. The crystals are especially common in the cells bounding the air chamber of stomata which certainly require some mechanical support. In the case of acicular crystals, so prevalent in monocotyls, it is evident that they give elasticity as well as support against crushing pressure[19]. Perisperm cells and Endosperm cells are identical cells of Trikatu[20]. Mesocarp also is identical cell of Maricha[21]. In experimental studies oil of *Piper longum* Linn. produced more inhibition of edema than the standard anti inflammatory drug, ibuprofen. This activity appears to be significant as carrageenan induced paw edema was taken as prototype of exudative phase of inflammation, where development of edema being described as biphasic. The initial phase is attributable to release of various biochemicals, viz. histamine, 5-HT, various kinins in the first hour injection of carrageenan. A more pronounced second phase is related to the release of prostaglandin like substances in 2 to 3 h. The essential oil of *Piper longum* Linn. reduced the edema induced by carrageenan. Similar pathology occurs in nasal polyp[22]. Tamal has leaf oil the main constituent of which is eugenol (60 – 70 %, is a best

analgesic drug), cinnamaldehyde and benzaldehyde, respectively[23]. Trichomes of Kantakari and Brihati checks excess transpiration activity of the plant; hence retaining the chemical constituents of the raw drugs, trichomes observed in Brihati and Kantakari are identical characters[24]. The prepared drug was analyzed for the physical and chemical parameters such as loss on drying, ash value, pH, sugar content, water soluble extract and alcohol soluble extract. All the values obtained were compared with that prescribed in API and found within prescribed limits. Physicochemical standards such as total ash values and extractive values are useful in identification and authentication of the plant material. The total ash is particularly important in the evaluation of purity of drugs, i.e. the presence or absence of inorganic matter such as metallic salts and/or silica. Total ash value helps in determining both physiological ash (plant tissue) and non-physiological ash (extraneous matter like sand and soil). Extractive values help in determining the amount of active constituents and is done on plant materials in particular solvent for which as yet no suitable chemical or biological assay exists[25]. Presence of more moisture content in a sample can create preservation problem. Hence loss on drying was also selected as one of parameters. pH of Avaleha was 5.80 suggesting little acidic nature of the drugs. Since, the sample was in the form of Avaleha containing significant quantity of sugar, hence sugar estimation was considered as another parameter. Total sugar was found to be 97.49 % suggesting presence of considerable amount of sugar in the sample. The water-soluble extractive and methanol soluble extractive values were found to be 61 % and 69 % respectively, indicating considerable amount of polar compounds in the sample[26].

CONCLUSION

The ingredients were identified and authenticated phamacognostically and were used for the preparation of Chitraka haritaki avaleha. The formulation was subjected to pharmacognostical and physico-chemical studies. It is inferred that the formulation meets all the standards as reported in the API and useful for further documentation.

ACKNOWLEDGEMENTS

The authors are thankful to the authorities of IPGT and RA, and Gujarat Ayurveda University, Jamnagar, Gujarat, India for providing facilities to carry out the research work.

REFERENCES

1. Chakrapanidutta, Nasarogadhikara 58th chapter, in Indradeva Tripathi, Chakradutta, Hindi commentary, Chaukhambha Sanskrit series, Varanasi. 3rd Edition; 1997. p. 346.
2. Bhaishajya Ratnavali, Nasarogadhikara 63rd chapter, by kaviraj Govinddas Sen (with Siddhiprada Hindi commentary by Prof Siddhinandan Mishra), Chaukhambha Surbharati Prakashan, Varanasi; 2009. p. 979.
3. Allergic Rhinitis and Nasal Polyps, 1.8th chapter, in Diseases of the Nose, Throat and Ear by Logan Turner, Edited by A.G.D. Maran, Published by K.M.Varghese Company, Dadar, Bombay, India, 10th Edition; 1988. p. 54.
4. Anonymous, Guidelines on safety monitoring and pharmacovigilance on herbal medicine (World Health Organization Geneva); 2003.
5. Anonymous, The Ayurvedic Pharmacopoeia of India, Part-2, Volume-1, Appendices, Ministry of Health and Family Welfare, Department of AYUSH, Government of India, New Delhi, 1st Edition; 2008. p. 16.
6. Sharangadhara, Kwathakalpana 9th chapter, in Madhyama Khanda, Sharangadhara Samhita (with Dipika and Goodharth Dipika commentary and edited with foot notes by Pandit Parsuram Shastri), Chaukhambha Surbharati Prakashan, Varanasi; 2006. p. 144.
7. Practical Pharmacognosy by Wallis TE, Published by J and A Churchill Ltd, Gloucester Place, London; 1953. p. 57-59.
8. CCRAS Anonymous, Parameters for qualitative assessment of Ayurveda and Siddha drugs, Part A, CCRAS, New Delhi; 2005.
9. Haslam E. Natural polyphenols (vegetable tannins) as drugs and medicines: possible modes of action, J. Nat. Prod 1996; 59: 205–215. http://dx.doi.org/10.1021/np960040+
10. Chen LT, Chen CS, Fen CH, Lin HF. Tannins and related compounds from Combretaceae plants, Chin. Pharm. J 2000; 52: 1–26.
11. Simran K, Grover IS, Majar S, Satwinderjeet K. Anti mutagenicity of hydrolyzable tannins from *Terminalia chebula* in *Salmonella typhimurium,* Mutat. Res 1998; 419: 169–179. http://dx.doi.org/10.1016/S1383-5718(98)00130-2
12. Lau Susanne, Wahn Julia, Schulz Gabriele, Sommerfeld Christine, Wahn Ulrich. Placebo-controlled study of the mite allergen-reducing effect of tannic acid plus benzyl benzoate on carpets in homes of children with house dust mite sensitization and asthma, Pediatric Allergy and Immunology 2002; 13(1): 31–6. http://dx.doi.org/10.1034/j.1399-3038.2002.00073.x
13. Tannic Acid in Handbook of Nonprescription Drugs by Covington TR, WebMD, Washington; 1996.
14. Chung King Thom, Wong Tit Yee, Wei Cheng I, Huang Yao Wen, Lin Yuan. Tannins and Human Health: A Review, Critical Reviews in Food Science and Nutrition 1998; 38(6): 421–64. http://dx.doi.org/10.1080/10408699891274273
15. Design in plants in Nature and Design by Cutler DF, Edited by Collins MW, Atherton MA, Bryant JA, WIT Press, Southampton, Boston; 2005. p. 95-124.
16. Plant Physiology, American Society of Plant Biologists, Vol. 142; 2006. p. 1343–1345.
17. Anna F Edlund *et.al.* Pollen and Stigma Structure and Function: The Role of Diversity in Pollination, The Plant Cell, Suppl 2004; 16: S84–S97.
18. Aly R Abdel Moemin *et.al.* Oxalate Content of Egyptian Grown Fruits and Vegetables and Daily Common Herbs, Journal of Food Research 2014; 3(3).
19. Briefer Articles, Albert Schneider. The Probable Function of Calcium Oxalate Crystals in Plants, Northwestern University School of Pharmacy, Chicago.
20. Anonymous, The Ayurvedic Pharmacopoeia of India, Part-1, Volume-1, 3, 4 Appendices, 1st Edi, Ministry of Health and Family Welfare, Department of AYUSH, Govt. of India. New Delhi; 2008.
21. Anonymous, The Ayurvedic Pharmacopoeia of India, Part-1, Volume-3, Appendices, 1st Edi, Ministry of Health and Family Welfare, Department of AYUSH, Govt. of India. New Delhi; 2008.
22. A Kumar *et.al.* Anti inflammatory Activity of *Piper longum* Fruit Oil; Indian Journal of Pharmaceutical Sciences 2009; 71(4): 454–456.
23. FMA. Cinnamon leaf oil. FMA Monographs, Volume 1. Washington, DC: Fragrance Materials Association of the United States; 1992. p. 5.
24. Harisha *et.al.* Pharmacognostical study on trichomes of solanaceae and its significance, Universal Journal of Pharmacy 2013; 02(01): 100-104.
25. Nasreen S *et al.* Assessment of Quality of *Tinospora cordifolia* (Willd.) Miers. (Menispermaceae): Pharmacognostical And Phyto - Physicochemical Profile, International Journal Of Comprehensive Pharmacy 2010; 5(03).
26. Thirunavukkarasu MS *et al.* A preliminary physico chemical assay of Goksura granules – a pilot study, International Journal of Ayurvedic Medicine 2010; 1(2): 100-108.

Cite this article as:

Atara Achyuta, Manjusha R., CR Harisha, Pandya Preeti, Shukla VJ. Pharmacognostical and physicochemical evaluation of Chitraka haritaki avaleha: A compound Ayurvedic formulation. Int. J. Res. Ayurveda Pharm. 2014;5(3):274-279 http://dx.doi.org/10.7897/2277-4343.05356