RESEARCH ARTICLE

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DEVELOPMENT AND EVALUATION OF VARIOUS ORAL HERBAL FORMULATIONS FOR ANTI-ASTHMATIC PLANT EXTRACT

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Abstract: To develop and evaluate herbal oral dosage forms (Conventional Tablet and Syrup) for ease of dispensing and consumption of dry powder of ethanolic extract of leaves of *Hiptage benghalensis* (L) Kurzz used to treat asthma and to check pharmacological effect of formulated dosage form by suitable experimental animal model. Tablet form was developed by wet granulation and direct compression methods to determine the more suitable method using various excipients like MCC, Lactose etc. By considering difficulty of solubility of herbal drugs in a vehicle, in one of the liquid class, decoction form of drugs in specific vehicle was used. Formulated dosage forms then subjected to evaluation of production quality by different methods stated as per official compendia. the evaluated formulation were than subjected to check for its efficacy by using experimental animal model like histamine and Ach induced bronchoconstriction in guinea pigs. Such evaluation has unique position in development of new herbal formulations. The prepared tablets were spherical puffy green colour with smooth surface having acceptable elegance. W_5 form of tablets was of good quality with regard to hardness, friability & weight variation. W_5 form of the tablets formulated with starch paste (6% w/v) as disintegrating agent & binder show disintegration within 549±0.57 second. The liquid oral herbal dosage forms like liquid oral prepared showed good elegance. The liquid oral evaluated for measurement of pH, specific gravity & stability. The final formulation found to have pH 6.94±0.023 and specific gravity 1.34±0.045 gm/ml. The results of stability study of final liquid oral form of drugs indicate the homogeneity of syrup without turbidity at storage temperature. Formulated dosage forms significant protection from histamine and Ach induced brocnchospasm when compared to control group and is comparable to crude extract of *Hiptage benghalensis* and marketed anti-asthmatic product.

Keywords: *Hiptage benghalensis*, Anti-asthmatic activity, Herbal formulation

INTRODUCTION

According to WHO, asthma is a disease characterized by recurrent attacks of breathlessness and wheezing, which vary in severity and frequency from person to person. It attacks all age groups but often starts in childhood. This condition is due to inflammation of the air passages in the lungs and affects the sensitivity of the nerve endings in the airways so they become easily irritated.

The currently used drugs for the treatment of asthma are so far from satisfactory as they provide only symptomatic relief; produce several adverse effects, like Muscle tremor and hypokalemia are major adverse effects of β_2 agonists. Theophyline has narrow therapeutic index and requires monitoring of drug levels.

Hence, ayurveda has recommended a number of drugs from indigenous plant sources for the treatment of asthma and allergic disorder, and have been successful in controlling these diseases as well. Some herbal drugs which are mainly used in treatment of asthma are, ***Albezzia Lebbeck, Euphorbia Hirta, Adhatoda Vasica,*** **and** ***Allium Capa.***

Madhavi lata (*Hiptage benghalensis*), native from India to the Philippines, is a vine like plant that is often cultivated in the tropics for its attractive and fragrant flowers. It is used medicinally in India. The bark, leaves and flowers are aromatic, bitter, acrid, astringent, refrigerant, vulnerary, expectorant, cardiotonic, anti-inflammatory and insecticidal. They are useful in burning sensation, wounds, ulcers, cough, and asthma.

MATERIALS AND METHODS

Materials

Hiptage Benghalensis fresh leaves collected from Ayurvedic udhyan, Gandhinagar. Micro crystalline cellulose was obtained from FMC biopolymers, USA. Ethanol, Acetone, Magnesium stearate and talc were obtained from S.D. fine chemicals, Mumbai.

Methods

Collection & authentication of plant

Fresh plant of *Hiptage benghalensis* was collected from ayurvedic udhyan, Gandhinagar. The plant identified and

authentified by Mr. Divyakant Patel, Assistant professor, Department of Pharmacognosy, Arihant School of Pharmacy & BRI, Adalaj. The plant was dried in shade and ground to get a coarse powder.

Preparation of plant extract

The coarse powder (500 g) of the dried plant was exhaustively extracted using 95% ethanol (2,000 ml) in a soxhlet extractor at a temperature of 60–70 ^{0}C (yield 3%, w/w). The extract was concentrated under reduced pressure to yield a syrupy mass and stored in air tight container in cool place and used throughout the project study.

Phytochemical analysis of plant extracts of *Hiptage benghalensis*

Preliminary phytochemical analysis

Shaded dried and powdered leaf samples were successively extracted with petroleum, benzene, chloroform and alcohol. The extracts were filtered and concentrated using vaccum distillation. The different extracts were subjected to qualitative tests for the identification of various phytochemical constituents as per standard procedure.[1]

Physico-chemical constant and fluorescence analysis

These studies were carried out as per the standard procedures. In the present study, the leaf powder was treated with 1.0 N aqueous sodium hydroxide and 1.0 N alcoholic sodium hydroxide, acids like 1.0 N hydrochloric acid and 50% sulphuric acid. These extracts were subjected to fluorescence analysis in visible/daylight and UV light (254nm & 365nm). Various ash types and extractive values were determined by following standard method.[1]

Alcoholic and aqueous extract of *Hiptage benghalensis* was subjected to standard chemical test for detection of different phytochemicals.[2-5]

FORMULATION OF HERBAL TABLETS CONTAINING PLANT EXTRACT

Preparation of herbal tablets by direct compression method

Herbal tablets containing plant extract were prepared by direct compression method. The composition of various formulations is given in Table 1. All ingredients were weighed accurately and mixed well in dry mortar. Microcrystalline cellulose was used as a disintegrating agent. Lactose was use as diluents. Talc and magnesium stearate were used as a lubricants. Tablets were

compressed each of 500 mg weight on a 10 station rotary tablet compression machine using 9 mm round flat punch. Tablet formulations prepared by direct compression method were coded as D1 to D3.

Preparation of herbal tablets by wet granulation method

Herbal tablets of plant extract were prepared by wet granulation method by using PVP K30 and starch mucilage with varying concentration (4% w/v, 6% w/v and 8% w/v) as binder. Composition is given in Table 2. All ingredients were weighed accurately and mix well in dry mortar. Talc and magnesium stearate were used as a lubricants. Granules were prepared by passing wet mass from 12 mesh standard sieve. Granules were dried and passed through 20 mesh standard sieve. Granules were mixed with lubricants. Tablets were prepared by compressing granules in rotary tablet compression machine using 9 mm flat punch. Tablet formulations prepared by wet granulation were coded as W1 to W6.

EVALUATION OF HERBAL TABLETS CONTAINING PLANT EXTRACT

Pre compression parameters[6-7]

The flow property of powder ready to compress was evaluated by measuring bulk density, tapped density, hausner's ratio, carr's index and angle of repose.

Post compression parameters[8-9]

Tablets were evaluated for hardness by using a Monsanto type hardness tester. Friability of the tablets was evaluated by a Roche Friabilator (Mumbai, India). Thickness of the tablets was measured by using Vernier calipers.

Weight variation

Randomly selected twenty tablets were weighed individually and together in a single pan balance. The average weight was noted and standard deviation calculated. The tablet passes the test if not more than two tablets fall outside the percentage limit and none of the tablet differs by more than double the percentage limit.

Disintegration test

Disintegration test was performed on 6 core tablets at 37 ± 0.5° C in 900 ml of distilled water using Electro lab disintegration tester (USP, Model ED2L).

FORMULATION OF ORAL HERBAL LIQUID FORMULATION CONTAINING PLANT EXTRACT[10]

Preparation of liquid oral

To prepare liquid oral form of plant extract of *Hiptage benghalensis*, following steps were carried out. It was prepared by decoction method.

Method of preparation of decoction

500 gm each of powder *Hiptage benghalensis* was taken. Powder was mixed with 4000 ml (4 litres) of water. The powdered material was boiled until total volume become one fourth of previous. After boiling liquid was cooled and filtered. Filtrate was taken to prepare final liquid oral form.

Method of preparation of simple syrup

850 gm of sucrose was dissolved in sufficient water to get 1000 ml of concentrated simple syrup. Then the solution was filtered. This simple syrup was used as vehicle.

Method of preparation of final liquid oral form

To prepare final liquid oral of *Hiptage benghalensis*, one part of decoction was mixed with five parts of simple syrup **(1: 5)**. Solubility was checked by observing the clarity of solution visually. The final liquid oral form of *Hiptage benghalensis* was then subjected to evaluation of production quality as per official standards.

EVALUATION OF ORAL HERBAL LIQUID FORMULATION CONTAINING PLANT EXTRACT[11-12]

The herbal syrup was evaluated for various parameters such as physical appearance (colour, odour and taste), pH, specific gravity and viscosity.

Determination of pH

The pH of herbal oral liquids was obtained by potentiometer. The pH method was calibrated using distilled water, buffer (at pH 4 and 9) pH till constant reading.

Determination of viscosity

Ostwald viscometer was used to determine the viscosity of all samples of oral liquid. The method was followed as per the standard procedure.

Determination of specific gravity

Pcynometer was used to determine the specific gravity at 25 ^{0}C. It was determined dividing the weight of sample (expressed in gm) by the weight of water (in ml).

Stability testing of oral herbal liquid dosage form

Stability study of prepared syrup was carried out for 3 days. The syrup was kept at different temperature and relative humidity for short term stability study at 4^{0}C, 47^{0}C and at room temperature. Humidity was kept

at 75% RH. The parameters checked were turbidity, colour and taste. Syrup was stored in ambered colour glass bottle.

PHARMACOLOGICAL EVALUATION OF PREPARED TABLETS AND SYRUP BY USING HISTAMINE AND ACH INDUCED BRONCHOSPASM IN GUINEA PIGS. (*IN VIVO*)

Selection of animals

Male albino rats of wistar strain, weighing 225-250 g and guinea pigs, 6-7 weeks old were used for study. All animals were housed at ambient temperature (22 ± 1°C), relative humidity (55 ± 5%) and 12/12 h light/dark cycle. Rats have access to standard pellet diet and water given ad libitum. Guinea pigs have access to standard pellet diet, tomatoes, grass and soaked black grains. The protocol of the experiment has been submitted to the IAEC as per the guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals (Protocol no. = ASP&BRI/AH/12/02), Ministry of Social Justice and Empowerment, Government of India for approval.

Studies on Acetylcholine and Histamine induced bronchospasm in guinea pigs

Procedure

Guinea pigs of either sex weighing 350 - 500 gm were selected and randomly divided into six groups each containing six animals. The drugs were administered orally in 0.5% sodium carboxy methyl cellulose (CMC). The single dose treatments were given one and half hour before the study.

Later the animals were exposed to an aerosol of 0.25% histamine and time for pre-convulsion state was noted for each animal. After about 15 days of wash out period, the same animals were given the above treatments and time for pre-convulsion state was noted for 0.5% acetylcholine bromide aerosol spray.

STATISTICAL ANALYSIS

Results were analyzed by one way analysis of variance (Dunnet's test) (n=6), were expressed as mean ± S.E.M. at the probability level of 95% and $P< 0.05$ was considered as significant.

RESULTS AND DISCUSSION

Qualitative phytochemical analysis of plant extracts of *Hiptage benghalensis*

Shaded dried and powdered leaf samples were successively extracted with petroleum, benzene, chloroform and alcohol. The

extracts were filtered and concentrated using vaccum distillation. The different extracts were subjected to qualitative tests for the identification of various phytochemical constituents as per standard procedure.

The detailed and systematic pharmacognostical evaluation would give valuable information for the future studies. The physico-chemical constant like ash and extractive values were determined (Table 4).

The result of Table 5 shows that phytochemical constituent of crude leaves extract and prepared formulation.

The result shows presence of Sterols, Saponins, Coumarins whereas absence of alkaloids in both crude plant extract and prepared formulations. This result confirms the preliminary phyto constituent in formulation as found in crude extract.

This similarity in preliminary phyto-constituents in both crude plant extract and prepared formulations supports comparable pharmacological activity of prepared pharmacological activity with crude ethanolic extract of *Hiptage benghalensis.*

These studies were carried out as per the standard procedures[59]. In the present study, the leaf powder was treated with 1.0 N aqueous sodium hydroxide and 1.0 N alcoholic sodium hydroxide, acids like 1.0 N hydrochloric acid and 50% sulphuric acid. These extracts were subjected to fluorescence analysis in visible/daylight and UV light (254nm & 365nm). Various ash types and extractive values were determined by following standard method.[59]

The results of various types of ash provided a basis to identify the quality and purity of the drug. In fluorescence analysis revealed that the powdered leaves of *Hiptage benghalensis* was treated various chemical reagents to give different colours (Table 6). Fluorescence is the phenomenon exhibited by various chemical constituents present in the plant material. Many phytocompounds fluoresce when suitably illuminated. The fluorescence colour is specific for each compound. A non-fluorescent compound may fluoresce if mixed with impurities that are fluorescent.

The fluorescent method is adequately sensitive and enables the precise and accurate determination of the analyze over a satisfactory concentration range without several time consuming dilution steps prior to analysis of pharmaceutical samples.

EVALUATION OF HERBAL TABLETS CONTAINING PLANT EXTRACT PREPARED BY DIRECT COMPRESSION

Pre compression parameters

The results of powder blend for direct compression is given in Table 7. From result it was found that the powder blend prepared for tablets have Angle of repose (31.25 ± 0.082 to 33.67 ± 1.70), Hauser's ratio (1.28 ± 0.23 to 1.32 ± 0.36) and Carr's index (15.53 ± 0.786 to 16.79 ± 0.654), which shows good flow property and compressibility of powder when compared with standard data of pre compression parameters .

Post compression parameters

The results of post compression parameters are given in Table 8. Tablets prepared using direct compression techniques were found within range of uniform thickness and acceptable weight variations limit as per Pharmacopoeial specifications.

Hardness was found in the range of 2-3 kg/cm^2 for all the batches of the tablets. The friability was found to be more than 1 so, direct compression method was not acceptable for the compression of the tablets.

EVALUATION OF HERBAL TABLETS CONTAINING PLANT EXTRACT PREPARED BY WET GRANULATION

Pre compression parameters

Results of pre compression parameters of granules are shown in Table 9. From result it was found that granules prepared for the tablets have Angle of repose (27.45 ± 0.45 to 32.36 ± 0.73), Hausner's ratio (1.15 ± 0.033 to 1.26 ± 0.012) and Carr's index (13.20 ± 0.034 to 20.92 ± 0.31), which shows good flow property and compressibility of granules when compared with standard data of pre-compression parameters.

Post compression parameters

Results of tablets prepared by wet granulation method are given in Table 10. Tablets prepared using direct compression techniques were found within range of uniform thickness and acceptable weight variations limit as per Pharmacopoieal specifications. Hardness was found in the range of 3-5 kg/cm^2 for all the formulation of the tablet and the friability for the same was found to be less than 1 indicating sufficient mechanical integrity and strength of the prepared tablets.

EVALUATION OF ORAL HERBAL LIQUID FORMULATION CONTAINING PLANT EXTRACT

Results of prepared liquid oral are given in Table 11. Syrup has sweet test and dark brown in colour.

STABILITY TESTING OF ORAL HERBAL LIQUID DOSAGE FORM

The result of stability study is shown in Table 12. The results of stability study of syrup indicate no change in colour, taste of herbal liquid dosage form. No turbidity was found

The physical parameters like colour, odour, specific gravity, hydrogen ion concentration and viscosity for the formulated herbal cough syrup are mention in Table 11. Five samples of 500 ml of herbal oral liquids developed with various concentrations of *Hiptage benghalensis* studied throughout the period by its applicable parameters and it reveals that there was no any major change in values as shown in Table 12 that proves a good stability. The yellowish brown colored oral liquids with pleasant odor having appropriate sweet taste were obtained. A clear solution was obtained and passes through an appropriate filter.

The pH value of herbal oral liquids was obtained by potentiometer. The pH of all samples was in the range of 6.0 – 7.9. The specific gravity of all the samples was in the range of 1.33 to 1.55. The viscosity of herbal oral liquids when tested by Ostwald viscometer was in the range of 190 to 195 cps throughout the period of stability.

PHARMACOLOGICAL EVALUATION OF PREPARED TABLETS AND SYRUP BY USING HISTAMINE AND ACH INDUCED BRONCHOSPASM IN GUINEA PIGS. (*IN VIVO*)

Pretreatment with Marketed tablet, marketed syrup, and crude ethanolic extract of Hiptage benghalensis increased Pre Convulsion Time in guinea pigs in both histamine and ach induced bronchoconstriction. (Table 13, Figure 1, 2)

This increased pre-convulsion time was significant when compare to control group and was comparable to marketed tablet and marketed syrup group.

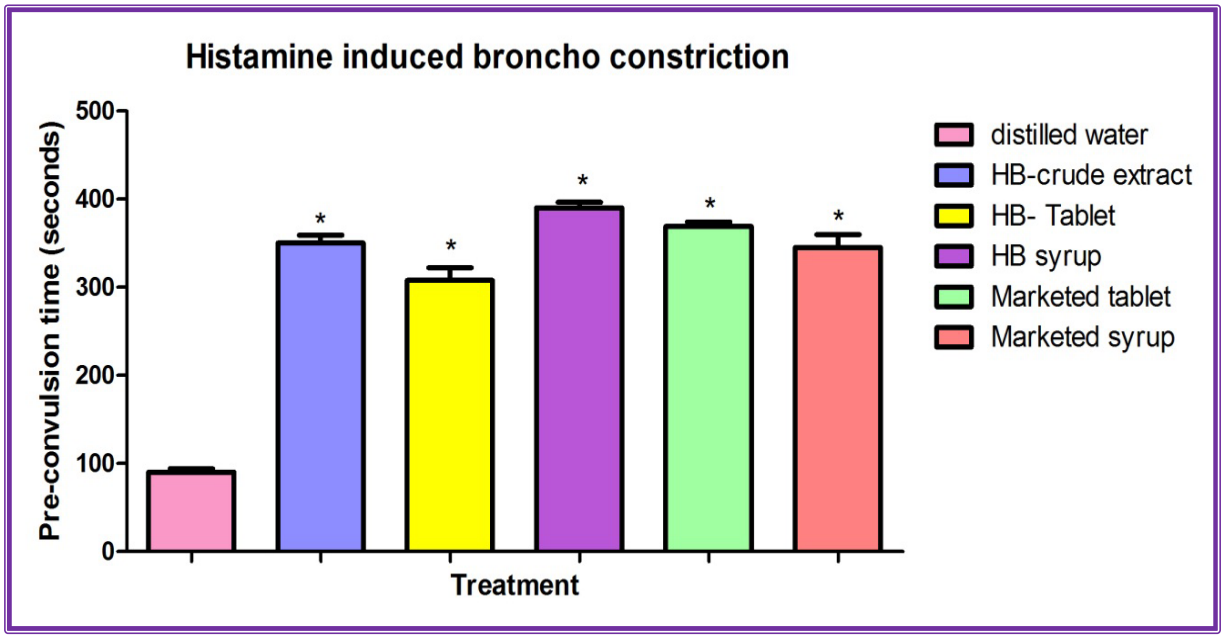

Figure 1 Average pct in various treatment groups of g.pigs with histamine induced bronchoconstriction

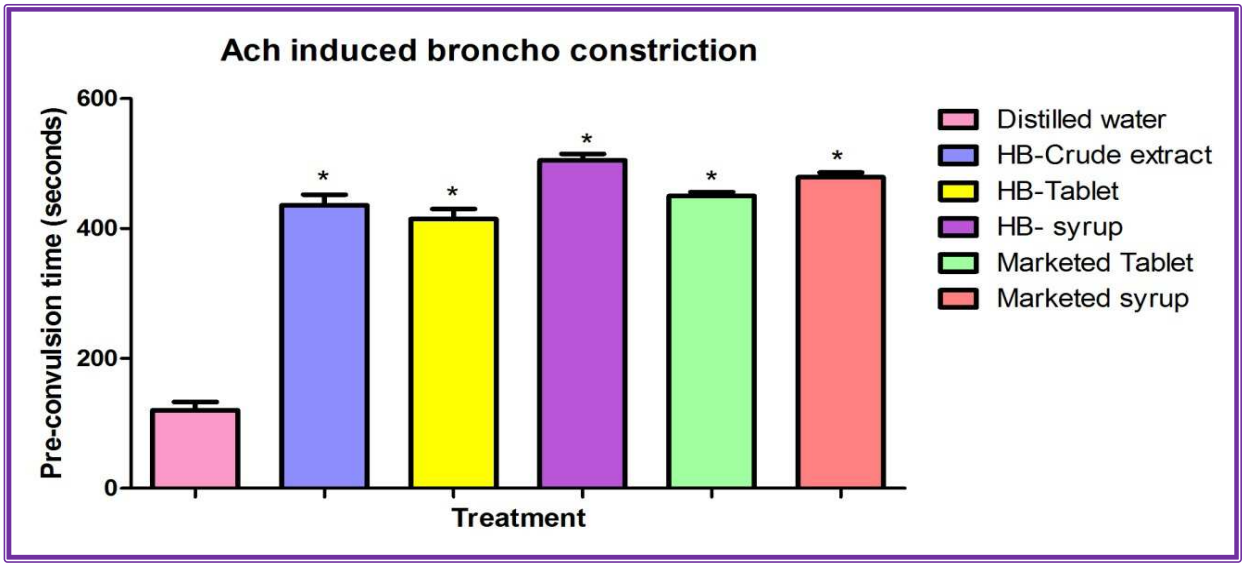

Figure 2 Average pct in various treatment groups of g.pigs with histamine induced bronchoconstriction.

CONCLUSION

Oral herbal dosage forms of extracts of the leaves of *Hiptage benghalensis* (L) Kurzz in combination like Tablets and liquid oral showed good elegance & palatability.

Tablet dosage forms are of good quality with regards to characteristics like hardness, friability and weight variation and disintegration time. Liquid dosage forms like liquid oral having good stability on storage. Formulations with herbal extracts are effective for asthma but there is need for carrying out studies to determine additional benefits and underlying mechanisms.

Thus it can be concluded that these oral herbal dosage forms could be suitable dosage form for *Hiptage benghalensis* (L) Kurzz leaves extract.

The tablets formulated by wet granulation using 6 % w/v starch paste showed the best result and selected as an optimized formulation.

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Table 1

Composition of herbal tablets prepared by direct compression method

Ingredients (mg)	D_1	D_2	D_3
Plant Extract	200	200	200
MCC	140	165	190
Lactose	150	125	100
Mg. Stearate	5	5	5
Talc	5	5	5
Total weight (mg)	**500**	**500**	**500**

Table 2

Composition of herbal tablets prepared by wet granulation method

Ingredients (mg)	W_1	W_2	W_3	W_4	W_5	W_6
Plant Extract	200	200	200	200	200	200
MCC	140	165	190	140	165	190
Lactose	130	95	60	130	95	60
PVP K-30	20	30	40	-	-	-
Starch Paste	-	-	-	20	30	40
Mg. Stearate	5	5	5	5	5	5
Talc	5	5	5	5	5	5
Total weight (mg)	**500**	**500**	**500**	**500**	**500**	**500**

Table 3

The following schedule of treatment will be administered

Sr No.	Treatment	Dose mg/kg	No. of Animals	Rout of administration
1	Distilled water	-	6 G.Pigs	Oral
2	HB-Crude Extract	200 mg/kg p.o.	6 G.Pigs	Oral
3	HB-Tablet	200 mg/kg p.o.	6 G.Pigs	Oral
4	HB-Syrup	200 mg/kg p.o.	6 G.Pigs	Oral
5	Marketed tablet (Bresol)	1 tablet	6 G.Pigs	Oral
6	Marketed Syrup (Askon)	1ml	6 G.Pigs	Oral

Table 4

Extractive and ash values of *Hiptage benghalensis.*

Parameter	Determined value (%w/w)
Extractive values	
Ethanol soluble	19.23% ± 1.21
Water soluble	23.54% ± 1.31
Ash value	
Total ash	7.93% ± 0.34
Acid insoluble	2.98% ± 0.43
Water insoluble	1.46% ± 0.21
Sulfated ash	12.85% ± 0.69

***Values are mean ± SD, (n=3)**

Table 5

Phytochemical analysis of crude extract and prepared dosage forms.

Chemical Constituents	Crude Plant extract	Prepared Tablet	Prepared Syrup
Alkaloids	-ve	-ve	-ve
Sterols	+ve	+ve	+ve
Saponins	+ve	+ve	+ve
Coumarins	+ve	+ve	+ve

Table 6

Fluorescence Analysis of the Powdered Leaf of *Hiptage Benghalensis*.[16]

Powdered drug	Visible/Day light	Short UV light (254nm)	Long UV light (365nm)
Powder as such	Light yellow	Yellowish green	Yellow
Powder + 1N NaOH(aqueous)	Wine red	Greenish yellow	Greenish yellow
Powder + 1N NaOH(alcoholic)	Green	Light green	Dark green
Dark green	Yellowish pink	Light yellow	Golden yellow
Powder + 50% H2SO4	Wine red	Green	Dark green

Table 7

Evaluation of powder blends for direct compression.

Formulation code	Bulk density* (gm/ml)	Tapped density* (gm/ml)	Carr's index* (%)	Hausner's ratio*	Angle of repose*
D1	0.53 ± 0.20	0.69 ± 0.020	23.15 ± 0.24	1.31 ± 0.033	33.67 ±1.70
D2	0.52 ± 0.035	0.67 ± 0.031	21.97 ± 0.18	1.28 ± 0.23	31.25 ±0.82
D3	0.57 ± 0.25	0.76 ± 0.027	24.57 ± 0.32	1.32 ± 0.36	32.68 ± 1.40

***Values are mean ± SD, (n=3)**

Table 8

Evaluation of tablets prepared by direct compression.

Formulation code	Thickness* (mm)	Diameter* (mm)	Hardness* (kg/cm^2)	Friability* (%)	Disintegration Time* (Second)	Weight Uniformity test
D_1	5.31 ± 0.015	9.47	2 ± 0.5	2.20 ± 0.57	32 ± 2.5	Pass
D_2	5.30 ± 0.036	9.47	2.5 ± 1.0	2.5 ± 0.62	20 ± 1.7	Pass
D_3	5.33 ± 0.017	9.47	2 ± 0.5	1.13 ± 0.18	29 ± 2.0	Pass

***Values are mean ± SD, (n=3)**

Table 9

Evaluation of granules prepared by wet granulation method.

Parameter	Bulk density* (gm/ml)	Tapped density* (gm/ml)	Carr's index*(%)	Hausner's Ratio*	Angle of repose* (º)
W_1	0.54 ± 0.22	0.68 ± 0.23	20.58 ± 0.01	1.25 ± 0.18	32.36 ± 0.73
W_2	0.53 ± 0.37	0.67 ± 0.32	20.89 ± 0.012	1.26 ± 0.012	30.69 ± 1.90
W_3	0.52 ± 0.14	0.65 ± 0.047	20.92 ± 0.31	1.25 ± 0.026	31.37 ± 0.77
W_4	0.30 ± 0.015	0.37 ± 0.15	18.50 ± 0.022	1.22 ± 0.17	29.05 ± 1.10
W_5	0.32 ± 0.01	0.37 ± 0.012	13.20 ± 0.034	1.15 ± 0.033	27.45 ± 0.45
W_6	0.31 ± 0.017	0.37 ± 0.019	16.20 ± 0.20	1.19 ± 0.012	28.39 ± 1.20

***Values are mean ± SD, (n=3)**

Table 10

Evaluation of tablets prepared by wet granulation method

Parameter	W_1	W_2	W_3	W_4	W_5	W_6
Thickness* (mm)	5.28 ± 0.03	5.30 ± 0.04	5.36 ± 0.02	5.35 ± 0.03	5.30 ± 0.03	5.34 ± 0.02
Diameter* (mm)	9.47	9.47	9.47	9.47	9.47	9.47
Hardness* (kg/cm^2)	3.0 ± 1.0	3.5 ± 1.0	3.5 ± 0.0	4.5 ± 0.5	5.0 ± 0.5	4.5 ± 0.0
Friability* (%)	0.98 ± 0.25	1.53 ± 0.12	1.29 ± 0.27	0.12 ± 0.07	0.08 ± 0.20	0.14 ± 0.01
Disintegration Time* (Second)	262 ± 0.5	319 ± 2.0	380 ± 0.47	412 ± 1.0	549 ± 0.57	624 ± 0.57
Weight Uniformity test	Pass	Pass	Pass	Pass	Pass	Pass

***Values are mean ± SD, (n=3)**

Table 11

Evaluation of herbal syrup containing *Hiptage benghalensis.*

Parameter	Observation
Colour	Dark brown
Odour	Characteristics
Taste	Sweet
pH*	6.94 ± 0.023
Viscosity*(cps)	192.66 ± 2.51
Sp. gravity* (gm/ml)	1.34 ± 0.045
Turbidity	Opaque

***Values are mean ± SD, (n=3)**

Table 12

Stability study of liquid oral herbal dosage form

Time (hr)	Temperature (^{0}C)	Turbidity	Colour	Taste
24	4	No turbidity	No change	Sweet
24	R.T	No turbidity	No change	Sweet
24	47	No turbidity	No change	Sweet
48	4	No turbidity	No change	Sweet
48	R.T	No turbidity	No change	Sweet
48	47	No turbidity	No change	Sweet
72	4	No turbidity	No change	Sweet
72	R.T	No turbidity	No change	Sweet
72	47	No turbidity	No change	Sweet

Table 13

Animal study of herbal formulations

Treatment	Dose	Average Pre Convulsion Time in Sec.	
	mg/kg	**Histamine**	**Ach**
Distilled water	-	90.2 ± 3.806	120.2 ± 12.67
HB-Crude Extract	200mg/kg p.o.	350 ± 9.011	435.7 ± 16.46
HB-Tablet	200mg/kg p.o.	307.8 ± 9.011	414 ± 15.71
HB-Syrup	200mg/kg p.o.	390 ± 6.563	505 ± 10.13
Marketed(Bresol) Tablet	1 tablet	369.2 ± 4.875	450 ± 6.083
Marketed(Askon) Syrup	1ml	345 ± 14.74	479 ± 7.367