Published online in http://ijam.co.in ISSN No: 0976-5921

International Journal of Ayurvedic Medicine, Vol 14 (4), 2023; 1026-1032

Development and Evaluation of Lavangadi Vati in the Form of Suspension- A Polyherbal Novel Liquid Dosage Form

Research Article

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Abstract

Introduction: The demand of the herbal medicine is increasing worldwide due to its lesser toxicity and side effects. Though so many formulations are there in *ayurveda*, the patient compliance for its palatability and acceptability need to consider. The present study focused on the modification of *lavangadi vati* into suspension, a liquid dosage form, which is effective in *prana vaha sroto vikaras* (disorders related to respiratory system) and standardising its quality parameters. Aims: To develop *lavangadi vati suspension* from the classical *lavangadi vati* dosage form and standardising the process by the evaluation of the micrometric properties, quality control parameters and TLC finger printing. Materials and Method: Among the six trials, the suspension containing *lavangadi vati churna* in a dose of 1gm/5ml and 4% sodium CMC as the suspending agent with a specific formula and using suitable excipients were selected as master formula. Result: As per the criteria *lavangadi vati* shown with particle size of 433.7nm, Haussner ratio with 1.06, Carr's index about 6% and angle of repose with 28. 77^0.*Lavangadi vati* suspension shown a pH in the normal range about 6.28 and having high sedimentation range and good redispersibility. Both the *vati* and modified suspension almost shown similar bands in TLC. Conclusion: After the evaluation of the various quality control parameters, prepared suspension having appropriate properties of a standard suspension without deviating from the classical *lavangadi vati* formulation.

Keywords: *Lavangadi vati,* Herbal Drug, Suspension, Standardization, Thin layer chromatography (TLC).

Introduction

Any substance which helps to bring the vitiated doshas back to normalcy and the body to a healthy state is known as *Bheshaja* (medicine). The proper route administration of medicine and proper dosage form results in optimum pharmacological utility of the drug. *Panchavidha kashaya kalpana* (primary medicinal preparation), *avaleha* (confectionary), *gutika* (tablet), *aristasava* (fermented preparation) etc are the are the basic dosage forms practising in *ayurveda* explained by the acharyas. These can be divided into solid, semisolid and liquid forms. The major hurdle facing by the *ayurvedic* physicians in the clinic practise is the appearance, non-palatability and non-portability of the *ayurvedic* medicine (1). Nowadays patients' compliance plays an important role in the efficacy of the medication. In *ayurvedic* pharmaceutics, the manufactures and the research development team has been continuously working for the improvement of dosage forms for making it palatable, increase shelf life, good appearance, easy to dispense and portable without hampering the therapeutic potency and utility.

In the current era, the world is affecting with infectious diseases particularly related to respiratory disease like asthma, bronchitis, tuberculosis and chronic obstructive pulmonary disease. Respiratory diseases account for upto one third of death in most of the countries(2).About 7.4% of the world population is currently live with a chronic respiratory condition which indicating nearly 545 million individuals are affected with premature morbidity and mortality (3).*Kasa* (cough) ,*swasa* (asthma) and *hikka* (hiccough) are the main diseases depicted under *pranavaha sroto vikaras* (respiratory disorders)in *ayurveda*.A bunch of *ayurvedic* formulations are effectively practising by the practioners, among them *lavangadi vati* is such an effective formulation giving promising result in account of *kasa* (cough), *pratisyaya* (running nose)and *swasa* (asthma) .It has been effectively given in case of *krimija kasa* (infectious cough) and proven to be useful in Covid-19 (4,5).

Liquid dosage forms are often the dosage forms of choice compared to solids, especially in the paediatric and geriatric population. The shelf life of suspensions is greater than that of solid dosage forms. Since for a drug to elicit the desired dosage response, it must be present in the form of a molecular dispersion (solution) at the site of action. They are also more effective due to faster absorption and high bio

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availability. They also offer ease in dosage calculation and palatability. *Churna* (powder) and *vati* (tablet) may clog the trachea sometimes, which is not applicable to suspensions. The purpose of development of herbal formulations is to provide the synergistic, potentiated, agonistic/antagonistic pharmacological agents to produce suitable therapeutic efficacy (6).

Oral solutions, suspensions, syrups, elixirs etc., are prepared and used for the specific effects of the medicinal agents present in it. These medicinal agents are intended to provide systemic effects rapidly in the liquid dosage form by means of absorption throughout the GI tract rather than other oral dosage forms of the same medicinal agents. Since *Ayurvedic* formulations are compound formulations, suspension form can easily distribute the therapeutic action of various drugs incorporated in a single formulation.

Considering the above points, the present study is an attempt made to develop a new dosage form in the suspension form from the classical tablet *Lavangadi vati* and its evaluation.

Materials and Methods

Lavangadi vati contains *Lavanga*, *Maricha*, *Vibhitaka*, *Khadira* and *Babbula* in specific quantity as per [Table 1] (7). The raw materials were procured from GMP Certified Ayurveda Pharmacy and authenticated in AYUSH approved Drug Testing laboratory. The preparation of *lavangadi vati* into suspension form done at authenified analytical lab.

Table 1: Ingredients of *Lavangadi vati*

Sl No	Sanskrit Name	Botanical Name	Part Used	Ratio
1	*Lavanga*	*Syzygium aromaticum* (Linn.) Merr Myrtaceae	Dried floral bud	40gms
2	*Maricha*	*Piper nigrum* Linn Piperaceae	Fruit	40gms
3	*Vibhitaka*	*Terminalia bellarica* Roxb. Combretaceae	Pericarp	40gms
4	*Khadira*	*Acacia catechu* (Linn. f.) Willd. Leguminosae	Heart wood	120gms
5	*Babbula*	*Acacia arabica* Willd. Leguminosae	Stem bark	240gms

After proper identification and assessment of the quality, the raw drugs are are made into fine powdered separately and sieved through cloth (80-120 mesh).

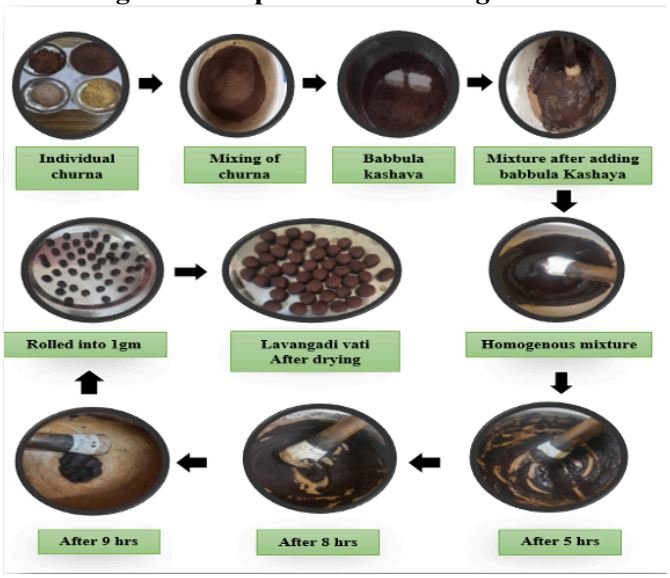
Preparation of *babbula kashaya*

Babbula kashaya (decoction) for *bhavana* process was prepared by using coarse powder of *babbula tvak* (bark) taken in quantity of 240gms and boiled with 3840ml of potable water and reduced to 480 ml (8).

Preparation of *lavangadi vati*

The *churna* (powder) is homogeneously triturated with *babbula kashaya* in *khalva yantra (*pestle and mortar). The quantity of *babbula* decoction taken as per general rule of *bhavana* (trituration). After it got the properties of pill consistency, it is rolled in the form of 1gm pills which is the recommended dose of *lavangadi vati* (9). The preparation as per [Figure 1].

Figure 1: Preparation of *Lavangadi vati*



Evaluation of quality control parameters

The formulation was analysed by their micrometric characters, appearance, pH, sedimentation volume, redispersibility, flow rate, rheological behaviour and particle size.

1. Micromertic properties of *lavangadi vati*

For the easiness of suspension preparation, *lavangadi vati* is powdered and its micrometric characters has been analysed.

a. Particle size

Particle size of *lavangadi vati churna* done by Horiba SZ 100. The size of 100 particles were measured and mean of the size was determined.

b. Determination of Bulk density and Tap density

The weighed mass (M) of the *lavangadi vati churna* was carefully added to the graduated measuring cylinder with the aid of a funnel. The initial volume was noted. The bulk volume is noted as V_b and mass weight as M. The weighed mass (M) of the *lavangadi vati churna* was carefully added to the graduated measuring cylinder with the aid of a funnel. The tapping apparatus set for 100 taps, in a graduated cylinder containing the sample bulk. The volume after 100 tap is noted as the minimum volume (Vt). So, the bulk density and tap density calculated and mentioned in [Table 3].

c. Flow properties

Angle of repose was determined by funnel method. It has been used as an indirect method to understand powder flow ability which is related to interparticle cohesion. A clean and dry funnel with round stem of 20-30 mm diameter with flat tit was taken and attached to the burette stand. A graph paper sheet placed below the funnel, and on a clean and dry

surface. The distance between lower tip of the funnel and sheet adjusted to some specified height. *Lavangadi vati churna* was poured from a funnel that can be raised vertically until maximum cone height(h), was obtained. Diameter (D) of the heap was measured. The angle of repose was calculated by formula. Now adjust the funnel to the tip of the powder blend carefully. Repeat the procedure and note down the reading. It should be repeated for five times to obtain the average reading. Tan = h/r therefore Angle of repose = tan-1(h/r) where, θ is the angle of repose, h is the height in cm and r is the radius and reading. The Haussner ratio calculated by dividing dividing tapped density with bulk density and expressed in ratio. The Carr's index is a major criterion to understand the flow properties. If it is greater than 25 is indicator of poor flow ability and below 15 of good flow ability. The analysis was mentioned in Table 3. (10)

Preparation of *lavangadi vati* suspension

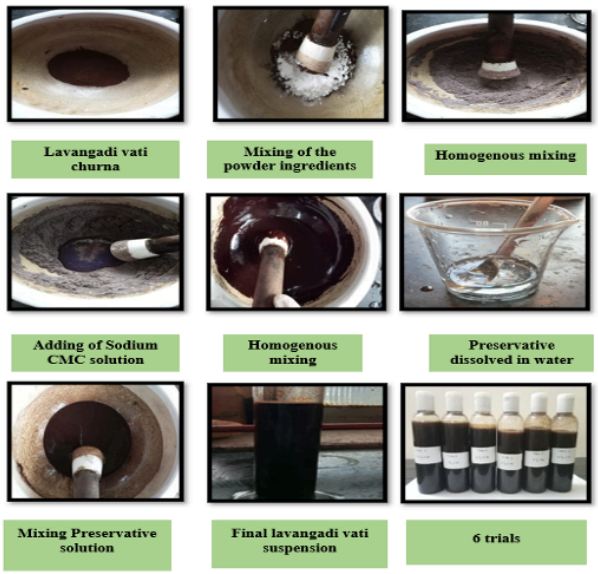
During the development of a new dosage from a classical *ayurvedic* formulation, in order to optimize the ingredients and their proportion and to meet the standard pharmaceutical suspension parameters various trial and errors were done to fix the proportion of *lavangadi vati*, sweetening agent and excipients. In the present work, preformulation studies has been carried out in six consecutive experiments to fix the concentration of suspending agent of *lavangadi vati* suspension after finalizing the quantity of *lavangadi vati*, sweetening agent and preservatives based on the initial trials as shown in [Table 2]. For the easiness of the preparation, *Lavangadi vati* has been powdered in the *khalwa yantra* and preparation done as shown in [Figure 2].

The fifth trial selected as the master preformulation study and same preparation done with a concentration of 4gm of Sodium CMC with the addition of preservatives. Already the Sodium CMC solution of 4gms prepared and kept in 50ml warm water in order to increase the bulking of the suspending agent and mixed thoroughly to avoid lumps. In a ceramic *khalwa yantra*, equal quantity of the smoothly powdered *lavangadi vati* and mannitol were mixed properly. The dark brown coloured *lavangadi vati churna* when mixed with the mannitol becomes slightly whitish. Even the preservatives like sodium benzoate, methyl paraben and propyl paraben were added directly to this mixture and done homogenous mixing by triturating in clockwise direction. The 4% solution of Sodium CMC was added to it and mixed properly till the crackling sound was heard and the mixture attains the colloid form. The suspending agent prevent the aggregation of particles and it forms a film around the particles and reduces the interparticle attraction, thereby the churna remains in the dispersed state. Since it contains herbal drugs, preservatives in minimum quantity were essential to avoid the deterioration. The final volume was made by mixing with portable water in a measuring jar. The final *lavangadi vati* suspension with brown colour has been obtained. It was stored in air tight plastic container.

Table 2: Formulation of *Lavangadi vati* suspension

Sl. No	Ingredients	Role	T1	T2	T3	T4	T5	T6
1	**Lavangadi vati churna**	API	20gms	20gms	20gm	20gm	20 gm	20gm
2	**Mannitol**	Sweetening agent	20gms	20gms	20gm	20gm	20 gm	20gm
3	**Sodium CMC**	Suspending agent	0.5gms	1gm	2 gm	3 gm	4 gm	5gm
4	**Methyl paraben**	Preservative	0.05 gm	0.05 gm	0.05 gm	0.05gm	0.05 gm	0.05gm
5	**Propyl paraben**	Preservative	0.01gm	0.01gm	0.01gm	0.01 gm	0.01gm	0.01gm
6	**Sodium benzoate**	Preservative	0.5gm	0.5gm	0.5gm	0.5gm	0.5gm	0.5gm
7	**Water**	Solvent	60ml	60ml	60ml	60ml	60ml	70ml

Figure 2-Preparation of *Lavangadi vati suspension*



Quality control parameters of *Lavangadi vati suspension* (11,12)

The physico chemical characterisation of all the six trials has been done as shown in [Table 4]

1. Organoleptic characters: Qualitative estimation of any drug is grounded on its sensory profile which refers to observations by its Colour, Odour, Taste, and Touch. All the raw drugs, *babbula kashaya, lavangadi vati* and *lavangadi vati* suspension were subjected to organoleptic characters.

2. Sedimentation Volume: Sedimentation volume of the suspension imparts its important role in the physical stability. It is the ratio of ultimate volume (H_S) of the sediment to the initial volume (H_0) of the suspension. Normal value of sedimentation volume lies between 0 to 1 for any pharmaceutical suspension. In total, higher the sedimentation volume, the stable is suspension. The sedimentation volume of *lavangadi vati* suspension was

0.99 for 100ml suspension. The graphical representation of six trials given in [Figure 3].

3. Rheology: Flow rate of suspension was calculated by the time required for the suspension to flow through 10ml pipette. It was determined by the apparent viscosity by dividing the volume of pipette(ml) with flow rates of(seconds). Flow rate as directly related to the viscosity of suspension. Increase in viscosity will increase the time to flow the suspension.

4. Viscosity: Viscosity is a property of a liquid, which is closely related to the resistance to flow. The kinematic viscosity of a liquid is equal to the quotient of the dynamic viscosity and the density of the liquid at the same temperature. Viscosity of liquid may be determined by any method that will measure the resistance to shear offered by the liquid. Absolute viscosity can be measured directly if accurate dimensions of the measuring instruments are known but it is more common practice to calibrate the instrument with a liquid of known viscosity and to determine the viscosity of the unknown fluid by comparison with that of the known. The rheological behaviour of the suspension is measured by Brookfield viscometer/CAP 2000+ viscometer with adequate quantity of sample using the spindle S-1 at rpm 50 under temperature of 25^{o} C with shear rate of 667 l/s.

5. Redispersibility: Redispersibility of suspension is important factor for physical stability. Suspensions are biphasic dosage form where solid drug is dispersed in liquid So lesser the time for dispersion, stable will be the suspension. In a measuring cylinder the suspension was allowed to settled. Then the mouth of the cylinder was closed and inverted through 180^{0} and the number of inversions necessary to restore the homogenous suspension has been calculated.

6. pH: The pH of the solution is analysed by digital pH meter. First calibration done in standard buffers i.e.,7.0,4.0 and 9.0.

7. Microbial limit test (13): A microbial limit test was performed as per I.P 2014 and given in [Table 5, Table 6]

Thin Layer Chromatography:

TLC study for *lavangadi vati* and its modified suspension form has been carried out as per the standard method. It is a technique in which an extract gets distributed between two phases, stationary (precoated Aluminium plates with Silica gel, etc) and mobile phase (various reagents). The solvents of the extracts were 99.9% ethanol. The different organic solvents or their mixtures were taken according to the solvent of the extract as the mobile phase. Then it was analysed in UV chamber under visible light, Short UV (254 nm), Long UV (366 nm). The mobile phase for was Toluene: Ethyl Acetate: Glacial Acetic Acid (8:2:0.1). (10). [Figure 4] [Table 7].

Results

Organoleptic characters

All the individual raw drugs and formulation in the present study passed the characteristic organoleptic properties as per the standards of API.It mainly indicates the physical properties and characteristic form of the drug especially colour, taste, odour and form which makes a drug specific for its identification. The *lavangadi vati* suspension was brown in colour, sweet taste and aromatic odour.

Table 3: Physico-Chemical Analysis of *Lavangadi Vati* in powder form

Parameters	Result
Particle size	433.7nm
Bulk density	0.546 gm/ml
Tapped density	0.581 gm/ml
Haussner ratio	1.06
Carr's index	6%
Angle of repose	28.77 degrees

Table 4: Physico chemical parameter of 6 trials of *Lavangadi vati* suspension

Parameters	T1 (0.5gms/ 5ml)	T2 (1gms/5ml)	T3 (2 gms/5ml)	T4 (3 gms/5ml)	T5 (4 gms/5ml)	T6 (5gms/5ml)
Colour	Brown	Brown	Brown	Brown	Brown	Brown
Odour	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic
Taste	Slightly bitter	Slightly bitter	Slightly bitter	Sweet	Sweet	Sweet
Consistency	Too thin	Too thin	thin	thin	Good	Thick
Fungal growth	Not seen	Not seen	Not seen	Not seen	Not seen	Not seen
Fermentation	Not seen	Not seen	Not seen	Not seen	Not seen	Not seen
Sedimentation volume	0.6	0.7	0.85	0.88	0.9	1.2
pH	6.12	6.23	6.47	6.48	6.23	6.86
Redispersion	8 Cycles	6 Cycles	5 Cycles	5 Cycles	4 Cycles	7 Cycles
Viscosity	1046cp	1597cp	2111cp	2602cp	2779 cp	3708 cp

Figure 3: Setting behaviour of the six trials

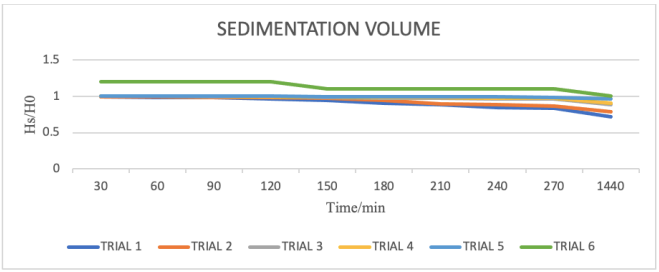


Table 5: Microbial Limit Test of *Lavangadi vati* and Suspension

S. No	Organism	*Lavangadi Vati*	*Lavangadi Vati* Suspension
1	E. Coli	Absent	Absent
2	S. Aureus	Absent	Absent
3	P. Aeruginosa	Absent	Absent
4	S. Abony	Absent	Absent

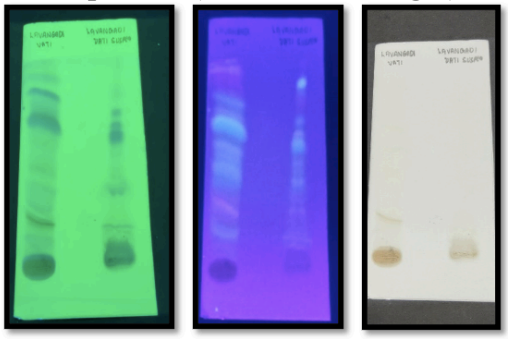
Table 6: Microbial limit test (Quantitative)of *Lavangadi Vati and Suspension*

S. NO	Microorganisms	*Lavangadi vati*	*Lavangadi vati* suspension
1	Total Bacterial Count	11cfu/ml (within permissible limit)	14cfu/ml (within permissible limit)
2	Total Fungal Count	06cfu/ml (within permissible limit)	06cfu/ml (within permissible limit)

Table 7: Rf values of *Lavangadi vati* and suspension

Raw Drugs	Visible light	Rf Short wave length 254nm	Rf Long wave length 356nm
Lavangadi Vati ASE	0.27	0.14, 0.27, 0.33, 0.41, 0.47, 0.73, 0.77, 0.84, 0.91, 0.97	0.14, 0.20, 0.29, 0.38, 0.44, 0.55, 0.58, 0.64, 0.70, 0.77, 0.92, 0.98
Lavangadi Vati Suspension ASE	-	0.16, 0.19, 0.34, 0.41, 0.47, 0.5, 0.58, 0.64, 0.70, 0.78, 0.88, 0.92, 0.95	0.09, 0.11, 0.23, 0.28, 0.33, 0.39, 0.48, 0.55, 0.58, 0.61, 0.66, 0.73, 0.79, 0.92, 0.94

Figure 4 TLC Study of *Lavangadi vati* and Suspension (LV left & LVS right)



(a) 254nm **(b) 366 nm** **(c) 550 nm**

Discussion

As a part of globalisation, *ayurveda* also flourishing throughout the world. According to the modern era, *Panchavidha kashaya kalpana* can be classified into solid dosage form, semi solid dosage form and liquid dosage forms. For the purpose of acceptability through all age group, with the help of modern machineries, packaging and preservatives etc dosage modification has to be encouraged without reducing the efficacy. The current study of development of *lavangadi vati* suspension and its evalution was a novel dosage form change which can be given to all age group without altering its efficacy and dosage. The dosage of *lavangadi vati* is 1gm, which was incorporated in same dose in 5 ml *lavangadi vati* suspension.

For the easiness of the preparation, *lavangadi vati* has been powdered in the pestle and mortar. Since smooth powder obtained no wastage and the physico-chemical parameters has been checked. It shown a particle size of 433.7nm, bulk density of 0.546gm/ml, tapped density of 0.581gm/ml, Haussner ratio of 1.06, Carr's index of 6% and angle of repose of 28.77^0 means excellent flow character which is a major helping parameter in the suspension preparation.

Since *lavangadi vati* is not sweet, various trial and errors done for the fixing of sweetening agent, since the main aim of *lavangadi vati* suspension is for patient compliance especially paediatric and old age. Apart from mannitol all other sweetening agent like sucrose, sorbitol made the preparation bitter taste while combining with the aromatic taste of the formulation. As a sweetening agent tried with honey, but it caused fermentation. When tried with Stevia, a natural sweetener, it caused more bulking and got deteriorated early. So, mannitol was fixed as the sweetening agent.

Before the preparation of suspension, guttability and swelling index has been checked and inferred that *lavangadi vati* after putting in water immediately sinks, redisperse easily while shaking means good wetting capacity, so no need of adding wetting agents and good suspension can be prepared. By checking the swelling index, it inferred less swelling of the powder particles, so need of suspending agent is essential to adjust the volume of a concentrated suspension.

As a suspending agent, Gum tragacanth was used in initial trial, but it was causing unstable formulation and early deterioration. In this formulation, Sodium CMC was selected as the suspending agent after the trial. In order to attain the correct viscosity and for avoiding caking of the suspension six trials at various concentration of Sodium CMC has been carried out. Trials carried out by adding preservatives like methyl paraben, propyl paraben and sodium benzoate in recommended quantity since the suspension was prepared in aqueous media and contains herbal drugs. Since the aroma of *lavanga* was there, no need of flavouring agents.

The first trial was done with at the lowest concentration of Sodium CMC about 0.5gms/100ml but with the addition of preservatives. But the formulation

was rejected due to white sedimentation, less viscous after 7 days, caking and more time taking for redispersion. The second trial was done with a higher concentration of Sodium CMC about 1gm/100ml with the addition of preservatives. But the formulation was rejected due to caking, white sedimentation, less viscous after 2 weeks and more time taking for redispersion. The third trial was done with a concentration of sodium CMC about 2 gm with the addition of preservatives. But the formulation was rejected due to less viscous, white sedimentation after 2 weeks and cake formation property. The fourth trial was done with a concentration of sodium CMC about 3gm/ 100ml with the addition of preservatives. But the formulation was rejected white sedimentation after 2 weeks. The fifth trial was done with a concentration of sodium CMC about 4gm/100ml with the addition of preservatives. It had a good consistency, viscosity of 2779 cp, pH of 6.28, sedimentation volume of 0.9 and redispersed with 4 cycles with medium shaking. Therefore, this formulation accepted. The sixth trial was done with a concentration of sodium CMC about 5gm/ 100ml with the addition of preservatives. In the starting of the preparation only the suspension was too much thick, difficult to stir and pouring out from the measuring cylinder. After 2 weeks also more viscous, redispersion after 7 to 8 cycles. It has taken too much time for flowing out of the measuring cylinder. Formation of white shreds like pieces after 1month. So, this trial was rejected. [Table 4]

All the individual raw drugs and formulation in the present study passed the characteristic organoleptic properties as per the standards of API.It mainly indicates the physical properties and characteristic form of the drug especially colour, taste, odour and form which makes a drug specific for its identification. *Lavangadi vati* is reddish brown, strongly aromatic, pungent slightly sweet whereas *lavangadi vati* suspension was brown in colour, sweet taste and aromatic odour.

Particle size plays a major role to know the uniform distribution of drug substance in a powdered mixture of formulation to ensure uniformity in dose. So, it can be considered as an important physical property which ensures the stability and bioavailability. Particle size of *babbula kashaya churna* was 80 mesh size, Individual churna were 120mesh size, *lavangadi vati* was 433.7µm. The smaller the particle size there will be greater rate of absorption, bioavailability and thereby increase the solubility of even poorly soluble drugs (14). The physical properties of *lavangadi vati* has been carried out and all under standard values. The physical properties of *lavangadi vati* in the *churna* form which was made for the easiness of preparation has been analysed and interpreted that, as per the criteria of flow properties, *lavangadi vati churna* have excellent flow properties.

The specific gravity of the *babbula kashaya* and *lavangadi* suspension were 1.005,1.090 respectively. This indicate both *babbula kashaya* and *lavangadi vati* suspension were not neutrally buoyant in water. pH estimation helped to analyse the nature of solution whether it is acidic/alkaline/neutral which plays a major role in the physical and chemical stability of product. The pH of *babbula kashaya* was 3.56, *lavangadi vati* was 5.44 (10% aqueous solution) and *lavangadi vati* suspension was 6.28, which is acceptable and doesn't cause irritation since the normal range of pH of oral solution is 5-8 (15). The result of pH indicates with the change of development of formulation the pH changed from acidic to alkaline.

As per the [Figure 4],the graphical study of the settling behaviour of all the six trials, the Sedimentation volume of trial 5 is showing constant pattern, which indicate the suspension is stable. Lavangadi *vati* suspension was characterized by high sedimentation volume of 0.997 which lies in standard range (0-1), the suspension may be flocculated suspension. Sedimentation volume method is one of the basic quality controls assessment criteria to analyse the physical stability of the suspension. *Lavangadi vati* suspension has good redispersibility with good consistency. Redispersibility also considered as major physical parameter for understanding flocculated and deflocculated suspension. *Lavangadi vati* suspension redisperse in 4 cycles (3-6 cycles). The peculiarity of flocculated suspension is quick redispersibility, loosely packed particles and doesn't form hard cakes, which are perfectly imparted in case of *lavangadi vati* suspension. The suspension containing herbal powders and 0.4% concentration of Sodium CMC shows the optimum quality of the suspension with regards to the consistency and redispersibility. Viscosity is an important flow property of suspension which is considering in case of storage and administration of the medicine. The viscosity of *lavangadi vati* suspension done by Brookfield viscometer and shown 2779cp (100 to 4000cp). Viscosity is directly proportional to the concentration of suspending agent. Especially in case of *lavangadi vati* suspension, Sodium CMC, the suspending agent act as the only viscosity enhancement factor. [Table 4]

Most of the medicinal plants carry a great number of bacteria and moulds apart from additional contamination and microbial growth due to improper practise of harvesting, handling and production. Here the microbial limit test of *lavangadi vati* and *lavangadi vati* suspension for the detection of four different microorganisms *like Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Salmonella ebony* and the result were complying under API limits. [Table 5, Table 6]

An ideal suspension should be such a way that suspended particles must not settle rapidly and sediment at the bottom and particle should not form a hard cake on settling; The settling must be redispersed immediately by moderate amount of shaking as it is important for the uniformity of dose. The viscosity of the suspension should be such that the preparation can be easily poured. Suspension should be chemically, physically and microbiologically stable and free from gritting particles and should have pleasing odour, colour and palatability. *Lavangadi vati* suspension developed in the current study fulfils these all criteria without

hampering the classical *lavangadi vati* tablet efficacy (16).

The Rf values were noted in UV chamber under visible light, short wave and long wave and values were almost nearer to the standards. When compared to aqueous extract, alcoholic extract of *lavangadi vati* and its suspension form shown maximum bands under long and short wave which indicating the polarity of the functional group. *Lavangadi vati* has shown around 10 bands in 254nm and 12 bands in 356nm and lavangadi vati suspension shown 13 bands in 254nm and 15 bands in 356nm, both shown almost similar bands. [Table 7]. This indicates there was minimal loss of constituents in developed suspension.

Conclusion

Pancha vidha kashaya Kalpana (primary preparation) are the basic methods of preparation of *ayurvedic* formulation. Even though these dosage forms are easy to administer, most of the solid dosage medications are prescribed with *anupana* in liquid forms. Suspensions are a good media which can gather more solid contents than any of the other liquid preparations. Since *Lavangadi vati* is specially mentioned for *pranavaha sroto vikaras*(respiratory system disorders), it can be easily administered in suspension form to increase its rapid therapeutic action and give more dose in divided form in all age group. So, the developed liquid dosage form, *lavangadi vati* suspension can be used as an alternative for the oral administration instead of tablet form without the alteration of efficacy.

Financial support and sponsorship: Nil

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