



Research Article

PHARMACEUTICAL MODIFICATION OF KUSHTADI CHURNA INTO TOOTHPASTE FORM

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ABSTRACT

Kushtadi Churna is one of the classical formulations described in Chakradatta, Mukharoga adhikara which is used for problems related to tooth and gums. There is no research work has been carried out on the standardization and quality control aspects of Kushtadi Churna. In the present study, an attempt was made to prepare an elegant Toothpaste, from the already explained formulations in classics for pratisarana i.e. Kushtadichurna. It consists of two broad heading as- Pharmaceutical study and Analytical study. Detail description of the manufacturing process of Kushtadi Churna and its modified dosage form i.e. Kushtadi Toothpaste is prepared and pharmaceutical observations like duration, specific finding and yield obtained after the process etc. were recorded. After performing many trials and errors, a final composition of kushtadi toothpaste, which had good aroma, acceptable taste, elegance and the criteria which was eligible for toothpaste formulation was made final for the rest of the study. The analytical study was carried out for both kushtadi churna and its toothpaste. The evaluation criteria for toothpaste were done and the HPTLC study, Anti-microbial study as well as Culture Sensitivity Test, in which the toothpaste has given a good result. Therefore in consideration with the results obtained, it is seen that there is much difference in Pharmaceutical and Analytical study of Kushtadi Churna and its tooth paste and therefore both are having a good efficacy on oral bacteria's considering the results obtained after the analytical studies.

Keywords: Analytical study, Kushtadi churna, kushtadi toothpaste

INTRODUCTION

Standardization of Ayurvedic formulations is an important aspect of research in Indian system of medicine and essential for worldwide acceptance and globalization of Ayurveda. So, there is need of method development to ascertain standards for quality and purity of raw drugs as well as formulations to maintain their therapeutic efficacy.¹

Kushtadi Churna is one of the classical formulations described in Chakradatta, Mukharoga adhikara which is used for problems related to tooth and gums. It contains Kushta (*Saussurea lappa*), Darvi (*Berberis aristata*), Lodhra (*Symplocos recemosa*), Mustha (*Cyperus rotundus*), Manjishta (*Rubia cordifolia*), Katuka (*Picrorhiza kurroa*), Patha (*Cissampelos pareira*), Tejani (*Zanthoxylum alatum*) and Haridra (*Curcuma longa*).² There is no research work has been carried out on the standardization and quality control aspects of Kushtadi Churna. In present scenario, if a medicine is good and effective but not having attractive and good packing customer does not pays any attention over it. Considering this, attempt is made to convert this traditional medicament in Churna form to paste form i.e. Kushtadi Toothpaste.

Kushtadi churna³⁻⁶ is a less known medicament in mukharoga⁷ condition mentioned in the classical texts.

In the current scenario, people find it difficult for applying churna over the teeth as it is. So for better convenience and applicability, it has to be converted into a suitable dosage form. So keeping this in mind, the development of a new dosage form of kushtadi churna i.e. Toothpaste⁸ of Kushtadi churna and thereby developed its pharmaceutical and analytical profile.

MATERIALS AND METHODS

Collection of Raw Materials - All the raw drugs i.e. Kushta, Darvi, Lodhra, Mustha, Manjishta, Tiktha, Patha, Tejani and Haridra (Figure 1 to 9) were procured from pharmacy department of Parul Institute of Ayurved, Gujarat and authenticated by Department of Pharmacognosy, Parul Institute of Ayurveda, Parul University.

Detail description of the manufacturing process of Kushtadi Churna (Figure 10) and its Toothpaste (Figure 11) were prepared and pharmaceutical observations like duration, specific finding and yield obtained after the process etc. were recorded. This study were mainly focused on the following headings

- a. Preparation of Kushtadi Churna.
- b. Modification of the Churna into paste form.

Procedure: The whole process was divided into 2 parts.

Preparation of Kushtadichurna

Reference: Chakradatta (Mukha roga adhikar)

- A. Preparation of powder of ingredients.
- B. Mixing of measured quantity of ingredients.

Preparation of powder of ingredients

Ingredients

Table 1: Name of the ingredients, its Latin / English name, part used and their quantity

S. No.	Name of Drug	Latin / English Name	Part used	Quantity
1	Kushta	<i>Saussarea lappa</i>	Root	100 gm
2	Darvi	<i>Berberis aristata</i>	Root	100 gm
3	Lodhra	<i>Symplocos recemosa</i>	Bark	100 gm
4	Mustha	<i>Cyperus rotundus</i>	Rhizome	100 gm
5	Manjishta	<i>Rubia cordifolia</i>	Root	100 gm
6	Tiktha	<i>Picrohzia kurroa</i>	Rhizome	100 gm
7	Patha	<i>Cissampelos pareira</i>	Root	100 gm
8	Tejani	<i>Zanthoxylum alatum</i>	Bark	100 gm
9	Haridra	<i>Curcuma longa</i>	Rhizome	100 gm

Apparatus

Disintegrator, Pulveriser, Ulukhala Yantra, Mixer, Sieve of 80# and 150#, weight balance etc.

Mixing of measured quantity of ingredients

Table 2: Ratio of ingredients used during preparation of Kushtadi churna

S. No.	Name of the Drug	Batch (gm)
1.	Kushta	50 gm
2.	Daruharidra	50 gm
3.	Lodhra	50 gm
4.	Mustha	50 gm
5.	Manjishta	50 gm
6.	Patha	50 gm
7.	Tiktha	50 gm
8.	Tejabala	50 gm
9.	Haridra	50 gm
»	Total Wt.	450 gm

Procedure

Each raw drug is collected, washed and dried in the oven and later the drugs were pounded separately in Ulukhala yantra till converted into semi - coarse powder. Later this semi - coarse powders were put in disintegrator and pulveriser to make it into powder form. Then for more fine powder form to pass through fine mesh it was later powdered through Mixer for more fine powder. Then it is passed through 80# (for Churna) (Table 5) and 150# (for toothpaste) (Table 6) and accurately weighed according to batches. Then it was packed in air tight containers separately.

Procedure

Accurately weighed each powder drug was taken in steel vessel and mixed well manually. Prepared Churna was stored well in airtight container. (Table 7)

Observation

Once the powdering was done there was an aromatic smell coming from the churna and also there was a mild feeling of bitterness in the throat.

Observations

The colour of the Churna was light green - brownish.

Precautions

Usage of face mask and hair cap should be kept so that there won't be any contamination in the churna.

Precautions

- The contents should be thoroughly dried before mixing of churna.
- The Churna should be stored in an air-tight container to protect volatile principles and also increase its shelf life.

Preparation of Kushtadi toothpaste (Batch – 1, Batch – 2 and Batch - 3)

Reference: Anubhuta.

Aim: To design a method for the preparation of Kushtadi Toothpaste form from its churna

Table 3: Ingredients and their quantity used during preparation of Kushtadi toothpaste in different batches (Batch – 1, Batch – 2 and Batch - 3)

S. No.	Name of the Ingredients	Batches		
		KT 1	KT 2	KT 3
		Date of Initiation	20.07.2018	21.07.2018
		19.07.2018	20.07.2018	21.07.2018
	Date of Completion	19.07.2018	20.07.2018	21.07.2018
1.	Kushtadi churna (gm)	3 gm	8 gm	10 gm
2.	Calcium Carbonate (gm)	3.92 gm	6.72 gm	5.6 gm
3.	Sodium Lauryl Sulphate (gm)	0.07 gm	0.12 gm	0.1 gm
4.	Glycerine (ml)	1.54 ml	2.64 ml	2.2 ml
5.	Gum Tragacanth (gm)	0.105 gm	0.18 gm	0.15 gm
6.	Kushtadi kwatha (ml)*	1.35 ml	2.33 ml	1.94 ml
7.	Saccharine (gm)	0.007 gm	0.012 gm	0.01 gm
8.	Methyl Paraben (gm)	0.01 gm	0.01 gm	0.01 gm
9.	Clove oil (ml)	0.1 ml	0.1 ml	0.1 ml
10.	Peppermint oil (ml)	0.1 ml	0.1 ml	0.1 ml

Note: * Additional kwatha is used in order to attain the consistency of toothpaste

Apparatus

Mortar pestle, Pipette, Spatula, Weight Balance, petri dish, Beaker, Measuring cylinder etc

Procedure

All the instruments including mortar pestle, pipettes, Measuring cylinders, Packaging etc. were disinfected initially. Kushtadi kwatha was prepared separately by adding all 9 ingredients in coarse powder form, to it 8 times of water was added and reduced to ¼ and was filtered using 4 layered cloth. Saccharine was taken and powdered initially as they are crystal like structures for proper mixing. Later, the powdered materials (1, 2, 3, 5, 7, 8) were taken together in mortar pestle and mixed well by trituration in a constant circular movement in the same direction. Then the liquid materials (4, 6, 9, 10) were added to it little by little with constant stirring and mixed well until the consistency is obtained. Then it was packed and stored in air tight containers. (Table 8)

Observation

- During trituration there was foaming in the 1st batch and comparatively less in the 2nd batch and totally nil in the 3rd batch. These were observed after the addition of liquid media in the presence of SLS for binding.

- There was no lump formation observed in the 1st batch but in 2nd and 3rd batch there were lump formation been observed because of adherence of aqueous molecule to gum tragacanthin.

Precaution

- The disinfection should be done properly to have a good shelf life of the final product.
- After mixing of powder all the liquid ingredients except kwatha were added with continuous stirring and kwatha should be added after the addition of the humectants (Glycerine).
- Gentle stirring should be practiced to reduce the foaming.

Note

Kushtadi Toothpaste prepared from the Batch 1 is considered for usage after considering the Homogeneity, spread ability, foam ability, consistency and pH.

Preparation of Kushtadi toothpaste. (Batch-1)

Reference: Anubhuta

Aim: To study the Analytical and Anti-microbial activity of Toothpaste

Table 4: Ingredients and their quantity used during preparation of Kushtadi toothpaste (Batch- 1)

S. No	Name Of The Ingredients	Batch
		KT 1
		(1 kg batch)
	Date of initiation	27.07.2018
	Date of completion	27.07.2018
1.	Kushtadi churna (gm)	330 gm
2.	Calcium Carbonate (gm)	120 gm
3.	Sodium Lauryl Sulphate (gm)	7 gm
4.	Glycerine (ml)	200 ml
5.	Gum Tragacanth (gm)	10 gm
6.	Kushtadi Kwatha (ml)*	330 ml
7.	Saccharine (gm)	0.9 gm
8.	Methyl Paraben (gm)	0.9 gm
9.	Clove oil (ml)	5 ml
10.	Peppermint oil (ml)	3 ml

Note

Additional kwatha is used in order to attain the consistency of toothpaste

Apparatus

Mortar pestle, Pipette, Spatula, Weight Balance, petri dish, Beaker, Measuring cylinder etc

Procedure

All the instruments including mortar pastel, pipettes, Measuring cylinders, Packaging etc. were disinfected. The fine powder of Gum tragacanth and Glycerine were triturated in mortar and pestle till smooth consistency then Churna was added to it and levigated well. The 1/3rd kwatha was taken and sodium saccharine and methyl paraben were soluble in it. This prepared solution was added in the above mixture and triturated well. Precipitated Calcium Carbonate was added to it. Remaining kwatha, peppermint oil and clove oil were added to it. Then SLS was added to it with gentle stirring to minimize the foaming. It was packed and stored in a collapsible tube by using the tube filling machine. (Table 9)

Observation

- By this procedure smooth shiny paste was obtained.
- There was no lump formation observed and the foaming was also drastically reduced.

Precaution

- The disinfection was done properly to have good shelf life of the final product.
- The proper trituration should be done to achieve smooth consistency.
- The gentle stirring should be practiced after addition of SLS to reduce the foaming.

Packaging of final product

- Following the initial 3 batches, the batch 1 of Kushtadi toothpaste was considered under implication for the processing of toothpaste as there was proper mixing, Good consistency, pH indication of 7-9 (appropriate for oral hygiene) and phase separation was also not seen.
- Based on the above said criteria the KT 1 batch's paste was prepared in a quantity of 1 kg and packed in Collapsible tubes manually provided from Vasu Pharma (R and D), Vadodara, for the purpose of Analytical evaluation of toothpaste.
- The tubes were than labelled with the labels obtained by digital graphics on the sticker paper and pasted on the tubes.

RESULTS

Methodology results

Table 5: Results obtained in the preparation of powder of ingredients of Kushtadichurna (sieve through 80# mesh no.)

S. No.	Churnas	Initial Wt.	Final Wt.	Loss of Wt.	% of Loss of Wt.
1.	Kushta	100 gm	85 gm	15 gm	15 %
2.	Daruharidra	100 gm	90 gm	10 gm	10 %
3.	Lodhra	100 gm	95 gm	05 gm	05 %
4.	Mustha	100 gm	90 gm	10 gm	10 %
5.	Manjishta	100 gm	90 gm	10 gm	10 %
6.	Patha	100 gm	85 gm	15 gm	15 %
7.	Tiktha	100 gm	95 gm	05 gm	05 %
8.	Tejabala	100 gm	85 gm	15 gm	15 %
9.	Haridra	100 gm	95 gm	05 gm	05%

Table 6: Results obtained in the preparation of powder of ingredients of Kushtadichurna (sieve through 150# mesh no.)

S. No.	Churnas	Initial Wt.	Final Wt.	Loss of Wt.	% of Loss of Wt.
1.	Kushta	100 gm	55 gm	45 gm	45 %
2.	Daruharidra	100 gm	65 gm	35 gm	35 %
3.	Lodhra	100 gm	60 gm	40 gm	40 %
4.	Mustha	100 gm	58 gm	42 gm	42 %
5.	Manjishta	100 gm	65 gm	35 gm	35 %
6.	Patha	100 gm	67 gm	33 gm	33 %
7.	Tiktha	100 gm	55 gm	45 gm	45 %
8.	Tejabala	100 gm	65 gm	35 gm	35 %
9.	Haridra	100 gm	75 gm	25 gm	25

Table 7: Results and observations obtained during preparation of Kushtadichurna

	Initial wt.	Final wt.	Loss of wt.	% of loss of wt.
Kushtadi Churna	450 gm	440 gm	10 gm	2.25

Table 8: Results and observation obtained during preparation of Kushtadi toothpaste (Batch-1, Batch -2 and Batch - 3)

	KT - 1	KT - 2	KT - 3
Initial wt.	13 gm	30 gm	35 gm
Final wt.	12 gm	28 gm	33 gm
Loss of wt.	1 gm	2 gm	2 gm
% of loss of wt.	7%	6%	5%

Table 9: Results and observations obtained during preparation of Kushtadi toothpaste (Batch-1)

	KT – 1 (1 kg Batch)
Initial wt.	1000 gm
Final wt.	960 gm
Loss of wt.	40 gm
% of loss of wt.	4%

Analytical results

Prepared samples are analyzed for evaluating analytical profile of same. It includes

- Organoleptic characters of Kushtadi Churna and Kushtadi Toothpaste.
- Physico-chemical constituents of Kushtadi Churna and Kushtadi Toothpaste.
- HPTLC analysis of Kushtadi Churna and Kushtadi Toothpaste.
- Microbial load and Bacterial Sensitivity test.

Table 10: Organoleptic characters of Kushtadi Churna and Kushtadi Toothpaste

S. No.	Organoleptic characters	Kushtadi Churna	Kushtadi Toothpaste (KT 1)
1.	Colour	Light Green-brownish	Dark green - brownish
2.	Odour	Characteristic –Aromatic	Characteristic –Aromatic
3.	Taste	Astringent followed by mild Bitter	Sweet, followed by Astringent and lastly mild Bitter
4.	Touch	Smooth	Smooth

Table 11: Physico-chemical characters of Kushtadi Churna

S. No.	Physico-chemical characters	Kushtadi Churna
1.	Loss on Drying at 110 ° C	7.5 % w/w
2.	Total Ash	25.11 % w/w
3.	Water Soluble Ash	2.71 % w/w
4.	Acid Insoluble Ash	1.36 % w/w
5.	Water Soluble Extractive	27.02 % w/w
6.	Alcohol Soluble Extractive	24.46 % w/w
7.	pH Value	7
8.	Volatile Content	0.75 v/w

Table 12: Physico-chemical characters of Kushtadi Toothpaste

S. No.	Physico-chemical characters	Kushtadi Toothpaste (KT 1)
1.	Loss on Drying at 110 ° C	33 % w/w
2.	Total Ash	27.5 % w/w
3.	Water Soluble Ash	6.97 % w/w
4.	Acid Insoluble Ash	2.91 % w/w
5.	Water Soluble Extractive	39.24 % w/w
6.	Alcohol Soluble Extractive	33.45 % w/w
7.	pH Value	7.25
8.	Volatile Content	1.5% v/w
9.	Viscosity (by Brookfield)	64000 cP

Table 13: Quantitative Estimation of Kushtadi Toothpaste

S. No	Kushtadi Toothpaste (KT 1)	Quantitative Estimation
1.	Assay of Total Tannin	0.84 % w/w
2.	Assay of Calcium	9.14 w/w

Table 14: Toothpaste Criteria Evaluation

S. No	Kushtadi Toothpaste (KT 1)	Toothpaste Criteria Evaluation
1.	Spread ability	7 mm
2.	Foaming Index	75 ml
3.	Homogeneity	Good
4.	Abrasiveness	Absent
5.	Moisture content	38.50 %

HPTLC Fingerprinting of Kushtadi Toothpaste and Kushtadi Churna (Figure 12)

Table 15: HPTLC Chromatogram at 254 nm

Spot No.	Track 1	Track 2
1.	-	0.05
2.	-	0.10
3.	0.16	0.16
4.	-	0.25
5.	-	0.34
6.	-	0.43
7.	0.59	0.60
8.	0.81	0.82
9.	-	0.93

Note: Track T 1: Kushtadi Toothpaste; Track T 2: Kushtadi Churna

Table 16: HPTLC Chromatogram at 366 nm

Spot No.	Track 1	Track 2
1.	0.05	-
2.	0.36	0.36
3.	0.50	0.48

Note: Track T 1: Kushtadi Toothpaste; Track T 2: Kushtadi Churna

Table 17: HPTLC Chromatogram at 540 nm

Spot No.	Track 1	Track 2
1.	0.11	0.11
2.	-	0.18
3.	-	0.29
4.	0.34	0.34
5.	-	0.49
6.	0.68	0.69
7.	0.77	0.76
8.	-	0.89

Note: Track T 1: Kushtadi Toothpaste; Track T 2: Kushtadi Churna

Table 18: Microbial load and Bacterial Sensitivity test

S. No	Parameters	Results
1.	Total Plate Count	< 10 cfu/ g
2.	Total Yeast and Mould Count	Absent
3.	<i>E. coli</i>	Absent
4.	<i>Salmonella</i>	Absent
5.	<i>S. aureus</i>	Absent
6.	<i>P. aeruginosa</i>	Absent

Table 19: Bacterial Sensitivity Test

	Before brushing (30 minutes)	After brushing (1 hour)	Reduction % of oral bacteria
Colony count	1,00,000 - 80,000 cfu / ml	40, 000 - 36,000 cfu / ml	60 – 64 %

Raw materials



Figure 1: Kushta

Figure 2: Daruharidra

Figure 3: Mustha



Figure 4: Lodhra

Figure 5: Manjishta

Figure 6: Patha



Figure 7: Katuki

Figure 8: Tejabala

Figure 9: Haridra

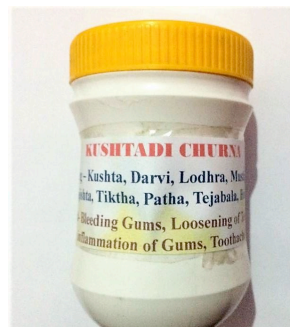
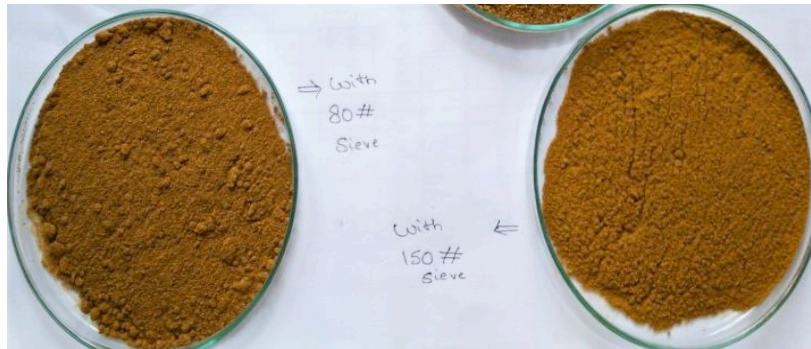


Figure 10: Kushtadi Churna



Figure 11: Kushtadi Toothpaste

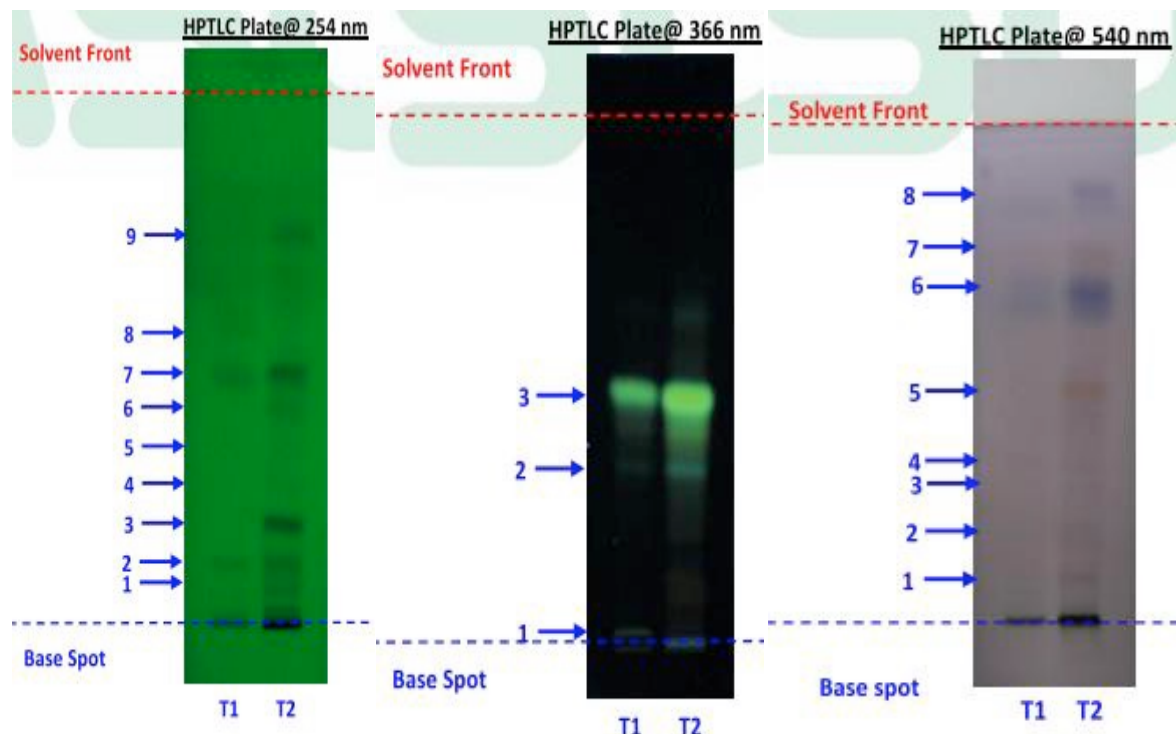


Figure 12: HPTLC Plate

T1 – Kushtadi Toothpaste and T2 – Kushtadi Churna

DISCUSSION

Based on the plan of study the main aim of this research i.e. Pharmaceutical Development of toothpaste of kushtadichurna and its analytical profile was carried out systematically as described under the materials and methods.

Pratisarana⁹ is one of the methods which are used abundantly for the treatment of mukharogas. The term pratisarana kalpana especially churna¹⁰ which is similar to manjan kalpana is available in the samhitas. Pratisarana kalpana is having the superiority over other dosage forms used for mukharogas, because of its bioavailability and its strength for the removal of diseases as well as to maintain the healthiness of oral cavity.

Kushtadi churna, a classical formulations, from Chakradatta, its ingredients are very much useful in treating the dental problems as well as maintaining oral hygiene. Kushtadi churna consists of herbal ingredients providing mild abrasiveness and polishing effect; Tejabala¹¹ and Daruharidra¹² are effective against toothache and Bleeding gums; Kushta¹³ imparts the aromatic, thereby ignores the Bad breath. The contents of kushtadi churna provide antibacterial activity as well as stability of tooth, pain and from bleeding. So in short not even a single thing is missing for the well-nourished and multipurpose care of the teeth, gums and oral hygiene.

At the trial phase of formulation out of 3 different batches of kushtadi toothpaste that were prepared with the usage of different ratios of ingredients due to the problem like homogeneity, spread ability and foam ability, two batches (KT – 2 and KT - 3) were discarded and only a single batch (KT - 1) was selected for next step.

The organoleptic characters of both the kushtadi churna and toothpaste were almost the same from its colour, odour, taste

(mildly sweet in toothpaste because of addition of saccharine) and form.

In the physicochemical parameters also both the churna and paste were showing almost similar values in consideration except a bit higher in LOD for the toothpaste because of its moisture content. The formulated toothpaste had undergone various criteria for the evaluation of its parameters and had shown good results in most of it. Kushtadi Toothpaste was having a Good Homogeneity, Abrasiveness was absent, and Foaming index, Spread ability, and Moisture Content were within range.

The results attained after comparing with both the churna and toothpaste it was found that the active phyto-constituents are more sensitive for both in 366 nm and 540 nm UV radiation. On examining with the Bacterial sensitivity and microbiological study it was seen that the total colony count of bacteria's from oral region had drastically reduced in toothpaste, seen after 24 h of incubation at 37° C under aerobic and CO₂ enriched atmosphere. There was total absence of *E. coli*, *salmonella*, total yeast and mould count for the toothpaste when done the colony count for Microbial load.

CONCLUSION

In the present study, an attempt is made to prepare an elegant Toothpaste from the already explained formulations in classics for pratisarana i.e. Kushtadichurna. After performing many trials and errors, a final composition of kushtadi toothpaste, which had good aroma, acceptable taste, elegance and the criteria which was eligible for toothpaste formulation was made final for the rest of the study. As there is No published pharmaceutical and physico – chemical profiles of kushtadichurna and Kushtadi toothpaste are available in the online and also in any other thesis work till date; current observations can be considered as standard for future studies.

Therefore in consideration with the results obtained, it is seen that there is much difference in Pharmaceutical and Analytical study of Kushtadi Churna and its tooth paste and therefore both are having a good efficacy on oral bacteria's considering the results obtained after the analysis and also from the culture sensitivity test. So on the basis of these entire tests it can be said that Kushtadi paste is having certain therapeutic efficacy almost equivalent to Kushtadi Churna.

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