ISSN 2456-3110
Vol 1 · Issue 4
Nov-Dec 2016

Journal of Ayurveda and Integrated Medical Sciences

www.jaims.in

JAIMS

Charaka Publications

Indexed

ISSN: 2456-3110 ORIGINAL ARTICLE Nov-Dec 2016

Pharmaceutico – Analytical Study of *Chitraka Kwatha* w.s.r. to different reduction criteria

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ABSTRACT

Harita has explained seven types of *Kwatha*. Among the seven types of *Kwatha* 1/10th reduction and ½ reduction are said to be having *Deepana* and *Pachana* action respectively. The study is planned to study the concept of *Deepana* and *Pachana Kwatha* as explained by Harita. For this study, a well known *Deepana- Pachana* drug i.e. *Chitraka* is selected and the *Kwatha* is prepared. In the present study, the *Deepana Kwatha* (1/10th reduction), *Pachana Kwatha*(1/2 reduction) are compared with that of the *Kwatha* prepared by the 3/4th reduction in terms of analytical parameters and the findings were analysed.

Key words: *Kwatha,* Decoction*, Chitraka, Plumbago zeylanica, Deepana, Pachana.*

INTRODUCTION

The Five types of *Kalpanas* are explained in our classics and they are called as *Panchavidha Kashaya Kalpana*[1] which are *Swarasa*, *Kashaya*, *Kalka*, *Hima* and *Phanta*. *Kashaya Kalpana*, also called as *Kwatha Kalpana* is the third one among the *Kashaya Kalpana*. It is prepared by boiling the drug in water and reducing it to specific quantity. Different authors have explained different ratio for drug and water and the quantity of reduction also differs according to the purpose used.

As per *Harita*, among the seven types of *Kwatha* 1/10th reduction and ½ reduction are said to be having *Deepana* and *Pachana* action respectively.[2]

Initially, the study was planned by taking *Chitraka* and preparing *Deepana* and *Pachana Kwatha* according to Harita Samhita. But, as *Deepana* and *Pachana* action are expected to be exhibited in both the *Kwatha*, one more *Kwatha* is taken for the study, which does not fall under any of the seven types of *Kwatha*. Thus, in the present study, the *Deepana Kwatha* (1/10th reduction), *Pachana Kwatha* (1/2 reduction) are compared with that of the *Kwatha* prepared by the 3/4th reduction in terms of analytical parameters.

OBJECTIVES

Pharmaceutical and analytical study of *Chitraka Kashaya* prepared by the three different reductions by subjecting to various analytical procedures.

Pharmaceutical Study

Pharmaceutical study includes preparation of the formulation and also the various stages involved in the preparation of the formulation.

Procedure

Three samples of *Chitraka Kwatha* were prepared separately according to its reduction criteria. Before this, *Shodhana* of *Chitraka Moola* was done as per the classical reference. After *Shodhana*, by using

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Submission Date : 15/11/2016 Accepted Date: 16/12/2016

Access this article online

Quick Response Code

Website: www.jaims.in

DOI: 10.21760/jaims.v1i4.6913

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Choornodaka the *Kwatha Churna* of *Chitraka* was prepared and then *Kwatha* was prepared by using that *Yavakuta Churna*.

1. Preparation of *Deepana Kwatha:*

- 50g (1part) *Chitraka Kwatha Churna* was taken in a stainless steel vessel and 800ml water (16 parts) was added to it.
- It was kept on a gas stove and heated, reduced to 1/10th part.
- After the desired quantity is obtained, heating is stopped and *Kwatha* is filtered through cloth.
- This is labelled as *Deepana Kwatha*.

2. Preparation of *Pachana Kwatha*:

- 50g (1 part) *Chitraka Kwatha Churna* was taken in a stainless steel vessel and 800ml water (16 parts) was added to it.
- It was kept on a gas stove and heated, reduced to ½ part.
- After the desired quantity is obtained, heating is stopped and *Kwatha* is filtered through cloth.
- This is labelled as *Pachana Kwatha*.

3. Preparation of drug control:

- 50 g (1 part) *Chitraka Kwatha Churna* was taken in a stainless steel vessel and 800ml water (16 parts) was added to it.
- It was kept on a gas stove and heated, reduced to 3/4thpart.
- After the desired quantity is obtained, heating is stopped and *Kwatha* is filtered through cloth.
- This is labeled as drug control.

Observation

Aromatic smell was emitted from all the 3 samples during boiling.

Precautions to be taken

- All the utensils and cloth used should be clean and dry.
- During the preparation, mouth of the vessel should not be closed.
- Temperature of the mixture should be maintained between 80^{0}C to 90^{0}C.
- After the desired quantity is obtained, it is immediately filtered through the cloth.

Analytical Study

Analytical study provides the objective parameters to fix up the standards for quality of raw drugs, process adopted in the manufacture as well as the finished products. To establish assessment of quality control, analytical study of *Chitraka Kwatha Churna* and *Chitraka Kwatha* prepared by 1/10th reduction, ½ reduction and 3/4th reduction was carried out.

A. Organoleptic characters

a. Colour
b. Taste
c. Odour
d. Appearance

B. Physio-chemical assay

a. pH
b. Refractive index
c. Loss on drying
d. Specific gravity
e. Viscocity
f. Ash value
g. Acid insoluble ash
h. Water soluble ash
i. Percentage of total solid contents

C. Chromatographical study

a. HPTLC

Physico-chemical assay

Determination of pH:[3]

Preparation of buffer solutions

One tablet of pH 4, 7 and 9.2 was dissolved in 100 ml of distilled water.

Determination of pH 1 ml of sample was taken and made upto 10 ml with distilled water, stirred well and filtered. The filtrate was used for the experiment. Instrument was switched on. 30 minutes time was given for warming pH meter. The pH 4 solution was first introduced and the pH adjusted by using the knob to 4.02 for room temperature 30°C. The pH 7

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solution was introduced and the pH meter adjusted to 7 by using the knob. The pH 9.2 solution was introduced and the pH reading was checked without adjusting the knob. Then the sample solution was introduced and reading was noted. The test was repeated four times and the average reading were taken as result.

Refractive index[4]

A drop of water was placed on the prism and the drive knob was adjusted in such a way that the boundary line intersects the separatrix exactly at the centre. The reading was noted. Distilled water has a refractive index of 1.3325 at 25˚C. The difference between the reading and 1.3325 gives the error of the instrument. If the reading is less than 1.3325, the error is minus (-) then the correction is plus (+) if the reading is more, the error is plus (+) and the correction is minus (-). Refractive index of kwatha is determined using 1 drop of the sample. The correction if any should be applied to the measured reading to get the accurate refractive index. Refractive index of the test samples were measured at 28˚C.

Specific gravity[5]

A specific gravity bottle was cleaned by shaking with acetone and then with ether. The bottle was dried and the weight was noted. The sample solution was cooled to room temperature. The specific gravity bottle was carefully filled with the test liquid, the stopper was inserted and the surplus liquid was removed. The weight was noted. The procedure was repeated using distilled water in place of sample solution.

Viscosity[6]

The given sample is filled in a U tube viscometer in accordance with the expected viscosity of the liquid so that the fluid level stands within 0.2 mm of the filling mark of the viscometer when the capillary is vertical and the specified temperature is attained by the test liquid. The liquid is sucked or blown to the specified height of the viscometer and the time taken for the sample to pass the two marks is measured. Viscosity is measured using the formula;

$$\eta 1 = \frac{\rho 1 t 1 \times \eta 2}{\rho 2 t 2}$$

η_1– Visosity of sample

η_2 - Visocity of water

t_1 and t_2-time taken for the sample and water to pass the meniscus

ρ_1 and ρ_2 – Density of sample and water.

Total Ash[7]

2g of powdered sample was incinerated in a tarred platinum crucible at temperature not exceeding 450˚C until carbon free ash is obtained. Percentage of ash was calculated with reference to weight of the sample.

Water Soluble Ash[8]

To the crucible containing total ash, 25ml of distilled water was added. The insoluble matter was collected in a Gooch crucible, or on a ash less filter paper, washed with hot water, and ignited for 15 min. at a temperature not exceeding 450^0C. The weight of the insoluble matter was subtracted from the weight of ash; the difference in weight represents the water soluble ash. The percentage of water soluble ash was calculated with reference to the air dried drug.

Acid insoluble Ash [9]

To the crucible containing total ash, 25ml of dilute HCl was added. The insoluble matter was collected on ash-less filter paper (Whatmann 41) and washed with hot water until the filtrate is neutral. The filter paper containing the insoluble matter was transferred to the original crucible, dried on a hot plate and ignited to constant weight. The residue is allowed to cool in suitable desiccator for 30 min and weighed without delay. The content of acid insoluble ash was calculated with reference to the air dried drug.

Total solids[10]

50 ml of liquid sample was transferred in a pre-weighed evaporating dish, which has been dried to a constant weight and evaporated to dryness on a water bath, then dried at 105˚ C for 3hr. After cooling the dish containing the residue in a desiccator for 30 min, it was weighed immediately.

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Loss on drying[11]

10 g of sample was placed in a pre-weighed evaporating dish. It was dried at 105°C or 5 hours in hot air oven and weighed. The drying was continued until difference between two successive weights was not more than 0.01 after cooling in desiccator. Percentage of moisture was calculated with reference to weight of the sample.

Chromatographical assay

HPTLC [12]

Sample preparation: 10ml of sample was mixed with 10 ml of water and was extracted with 20 ml of butanol. 10 µl of the butanol extract was applied on a pre-coated silica gel F254 on aluminium plates to a band width of 7 mm using Linomat 5 TLC applicator. The plate was developed in Butanol : Acetic Acid : Water (4: 1: 1). The developed plates were visualized in UV 254, 366 and white light 540nm after derivatisation with vanillin-sulphuric acid and scanned under UV 254, 366 and 540. R_f colour of the spots and densitometric scan were recorded.

Results of the Analytical Study:

Table 1: Organoleptic characters

Parameter	*CK* prepared by 1/10th reduction	*CK* prepared by ½ reduction	*CK* prepared by 3/4th reduction
Colour	Dark brownish yellow	Light brownish yellow	Light brownish yellow
Taste	*Katu*, *Tikta*	*Tikta*, *Katu*	*Tikta*, *Katu*
Odour	Aromatic	Aromatic	Aromatic
Appearance	Brown coloured thin fluid	Brown coloured thin fluid	Brown coloured thin fluid
CK : *Chitraka Kwatha*			

Table 2: Standardization parameters of *Chitraka Kwatha Churna*

Parameters	Results n= 3 % w/w;
	Chitraka Kwatha Churna
Total Ash	6.6271
Acid Insoluble Ash	0.4990
Water Soluble Ash	2.8856

Table 3: Results of standardization parameters of *Chitraka Kwatha.*

Parameters	Results n= 3 %w/w		
	½ reduction	3/4 reduction	1/10 reduction
Total Solids	2.102	2.075	5.555
Loss on drying	97.898	97.925	94.445
pH	4.23	4.29	4.37
Specific Gravity	1.0074	1.0122	1.0219
Viscosity	1.0964	1.1159	1.4228
Refractive Index	1.33583	1.33583	1.34283

DISCUSSION

Pharmaceutical Study

Practical No. 1

The *Churnodaka* was prepared as per the reference of Rasatarangini.[13]

Observations

The colour of the *Churnodaka* was seen pale white in colour. It may be because the *Sudha Churna* was white in colour. It was also observed that the *Churnodaka* was acrid it taste. It may be because of the alkalinity of Sudha *Churna*.

Precautions taken

Only the supernatant water was collected without disturbing the solution else the sediment *Sudhachurna* will get mixed with the water. As *Sudhachurna* is *Kshareeya*, stainless steel vessel should not be used to avoid corroding.

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Quantity of loss

About 16.66% loss was observed. This may be because it was difficult to remove the supernatant water completely as water was getting mixed with the *Sudha Churna*.

Practical No. 2

Shodhana of *Rakta Chitraka* was performed as per the reference in Rasatarangini.[14]

Rakta Chitraka Mula was collected in fresh form and washed to remove the external impurities. As *Rakta Chitraka Mula* was considered *Tikshna*, *Shodhana* procedure is mentioned in *Rasatarangini*. For the *Shodhana*, *Churnodaka* was prepared (practical no.1) and the roots of *Chitraka* were kept in *Churnodaka* after cutting it into small pieces. As the duration of immersion in *Churnodaka* is not mentioned, it was removed after 24 hours, washed and dried.

Observations

It was observed that the colour of *Churnodaka* changed to cherry red colour. This may be because of some chemical constituents of the drug. Slight burning sensation was observed in hands while performing the *Shodhana* which may be due to the *Tikshnata* of the drug.

Precautions taken

Gloves were worn during the *Shodhana* process to avoid the burning sensation in hands.

Quantity of loss

It was observed that the weight of the *Chitraka* was decreased considerably after the drying (43.75%). This may be because, fresh roots contain moisture which will be lost after the drying process.

Practical no. 3

The dried roots of *Chitraka* were pulverised and made into coarse powder.

Observation

The *Kwatha Churna* was brownish-yellow in colour and with aromatic smell. This may be because of the chemical constituents of the drug.

Precautions taken

The drug should be dried completely else it will stick inside the pulveriser and the desired size reduction may not be obtained.

Quantity of loss

1.69% loss was observed after the powdering. This may be because of the loss of the powder from the gap between the outlet of the pulveriser and the collecting bag.

Practical no. 4

The three samples of *Chitraka Kwatha* were prepared by three different reductions. As there was no specific reference about the preparation of *Kwatha*, the general method was followed as per the reference of Sharangadhara *Samhita*.[15]

The filtrate was packed separately and was used for the purpose of analytical and experimental study.

Observation

During the boiling of *Kwatha*, strong aromatic odour was observed and the *Kwatha* stained cloth light yellow colour. The staining may be because of the constituents of the drug.

The Kwatha prepared by $1/10^{th}$ reduction was more viscous and darker in colour than the other two samples. This may be due to the more time given for the extraction for $1/10^{th}$ reduction.

Precautions taken

a. For the preparation of each *Kwatha*, a separate stainless steel vessel was used of 4 litre capacity.

b. This mixture is boiled on mandagni, the temperature was maintained between 80^0C to 90^0C. This was done for proper extraction of the drug to prevent the charring of the drug due to high temperature.

c. Continuous stirring was done to prevent the formation of scum on the upper layer of the liquid which slows down the rate of evaporation.

d. After it attains $1/10^{th}$, $3/4^{th}$ and ½ reduction, the mixture was filtered separately through a clean white cotton cloth. This was done to obtain the clear liquid, free form the particles of the drug.

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Analytical study

Total ash

The ash value helps to determine the amount of inorganic substances present in the sample. The total ash usually consists of carbonates, phosphates, silicates and silica which include both physiological ash and non-physiological ash. Physiological ash is derived from the plant tissue itself and physiological ash is the residue of the adhering material to the plant e.g. sand and soil.

Total ash value is important in identification and standardization of the drug or the prepared product. A high ash value is indicative of the presence of inorganic matter again which may indicate the contamination, substitution, adulteration of the drug or the prepared product. The total ash value of *Chitraka Kwatha Churna* was found to be 6.6271. (Table 2)

Acid insoluble Ash

The presence of acid insoluble ash indicates mainly the presence of silica. In the sample the acid insoluble ash was 0.4990. (Table 2)

Water soluble Ash

The water soluble ash of the sample was found to be 2.8856. (Table 2)

Standardization parameters for *Chitraka Kwatha*

pH

All the samples are weakly acidic in nature. The *kwatha* prepared by ½ reduction is found to be more acidic when compared to the kwatha prepared by 1/10th reduction. In the stomach, drugs that are weak acidic in nature, will be present in their non-ionic form. Since non-ionic species diffuse more readily through cell membranes, weak acids will have a higher absorption in the stomach which has acidic pH. However, the reverse is true in the basic environment of the intestines- weak bases will diffuse more readily since they will be non-ionic. It can be assumed that the kwatha prepared by ½ reduction gets absorbed in stomach more readily than the other two samples. (Table 3)

Refractive Index

Refractive index of a substance is a dimensionless number that describes how light or any other radiation, propagates through that medium. Refractive index was found to be same for the kwatha prepared by ½ reduction and 3/4th reduction and the value was slightly increased for the kwatha prepared by 1/10th reduction. It indicates that the 1/10th reduction sample was denser. (Table 3)

Specific Gravity

The specific gravity of a liquid is the weight of a given volume of the liquid (unless otherwise specified) compared with the weight of an equal volume of water at the same temperature, all kinds of weighing being taken in air. Among the three samples of kwatha, the Chitraka kwatha prepared by 1/10th reduction has more specific gravity than the other two samples. This may be because the sample has more amounts of water soluble constituents. (Table 3)

Total solids

The total soluble content determines the amount of active constituents in a given sample of drug. Among the three samples of kwatha, 1/10th reduction sample has solid contents which is more than double of the other two samples. This may be due to the sample was boiled for more time than the other two samples and by this, more number of solids might have been extracted into the water. (Table 3)

Loss on drying

Loss on drying of a drug or a formulation indicates the presence of moisture content. Lowest moisture content was observed in the kwatha prepared by 1/10the reduction. (Table 3)

Viscosity

Among the three samples, 1/10th reduction sample was found to be more viscous. This may be because it was more concentrated. As the reduction of the sample was more, there is chance that the more amounts of active principles were extracted into the water making it more concentrated. (Table 3)

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HPTLC

Table 4: Densitometric scan at 254 nm

CK 1/2	CK 3/4	CK 1/10	*Chitraka Kwatha Churna*
-	-	0.10 (0.55%)	-
-	-	-	0.23 (1.47%)
0.39 (9.00%)	0.39 (9.08%)	0.39 (11.16%)	0.40 (7.97%)
0.54 (2.62%)	0.53 (2.02%)	0.52 (4.05%)	0.52 (1.60%)
0.57 (3.57%)	0.58 (4.07%)	0.58 (5.75%)	0.58 (4.82%)
-	-	-	0.70 (8.61%)
0.74 (15.95%)	0.74 (16.07%)	0.74 (18.66%)	0.75 (16.22%)
0.85 (68.87%)	0.85 (68.76%)	0.85 (59.03%)	0.85 (55.48%)
-	-	0.98 (0.79%)	0.97 (3.84%)
CK : *Chitraka Kwatha*			

The sample *Chitraka Kwatha Churna* has shown the peaks at R_f value as shown in table 4. Compared with this, the sample CK 1/10th reduction has similar peaks but it showed different peak at R_f value 0.10 which was absent in Chitraka kwatha churna. It may be because by the boiling with water, the constituent of the drug has altered. Also, there was no peak at R_f value 0.70, which may be due to the constituent drug present in chitraka kwatha churna was water insoluble or undergone thermal decomposition while boiling.

Peak at R_f value 0.23, 0.70 and 0.97 were absent in Chitraka kwatha prepared by 3/4th reduction and ½ reduction, which may be because drug Chitraka kwatha churna has the constituent which is insoluble in water or thermo-labile. When compared with the kwatha of 1/10th reduction, may be the ½ and 3/4th reduction were not sufficient to extract the maximum amount of constituents from the drug. (Table 4)

Table 5: Densitometric scan at 366 nm

CK 1/2	CK 3/4	CK 1/10	*Chitraka Kwatha Churna*
0.10 (4.43%)	0.10 (3.26%)	-	-
0.18 (6.12%)	0.18 (4.69%)	-	0.17 (3.27%)
0.36 (25.13%)	0.36 (19.48%)	0.35 (13.10%)	0.35 (35.19%)
0.40 (4.28%)	-	-	-
-	0.64 (8.18%)	-	0.66 (7.74%)
-	-	0.68 (14.09%)	-
0.74 (43.70%)	0.75 (44.40%)	-	0.75 (25.31%)
0.79 (11.52%)	0.79 (13.28%)	-	0.80 (14.69%)
0.90 (4.82%)	0.90 (6.71%)	0.90 (8.23%)	0.92 (13.79%)
CK : *Chitraka Kwatha*			

The sample *Chitraka Kwatha Churna* has shown peaks at R_f values as shown in table 5. On observation, the sample 3/4th reduction has shown additional peaks at R_f values 0.10 and CK ½ reduction has shown peaks at R_f values 0.11 and 0.40. Also, it is observed that peaks were absent in R_f values 0.66 in samples CK ½ reduction and at R_f values 0.17, 0.66, 0.75 and 0.80 in the sample CK 1/10th reduction. The probable reason may be quoted as at these reductions, the constituents of Chitraka were not extracted into the media at 254 nm. (Table 5)

Table 6: Densitometric scan at 540 nm

CK 1/2	CK 3/4	CK 1/10	*Chitraka Kwatha Churna*
-	-	0.40 (23.80%)	-

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-	0.72 (100.00%)	0.72 (76.20%)	0.70 (75.39%)
-	-	-	0.97 (24.61%)
CK : *Chitraka Kwatha*			

The drug *Chitraka* has shown peaks at R_f value 0.70 and 0.97. These peaks were absent in the sample CK ½ reduction. Also, the peaks were absent in the samples CK 3/4th reduction and CK 1/10th reduction at R_f value 0.97. The probable reason may be quoted as at these reductions, the constituents of *Chitraka* were not extracted into the media at 540 nm. There is the presence of an extra peak at R_f value 0.40 in CK 1/10th reduction. It may be because at this reduction, some additional constituents might have formed by modification of an existing compound of *Chitraka* to another compound. (Table 6)

CONCLUSION

Chitraka is considered as the *Agrya Dravya* (superior drug) for *Deepana* and *Pachana* by Acharya Charaka. *Deepana* dravyas mainly exhibit dominance of *Tikshna Guna* and by the effect of same only they will increase the *Tikshna Guna* of *Agni* and *Pachana Dravyas* exhibit *Ushna Guna* in predominance by which, they may help to do *Pachana Karma*. The difference between *Deepana* and *Pachana* is may be because of the amount of variation in *Agneya Guna*. The *Chitraka Kwatha* prepared by 1/10th reduction was more viscous and darker in colour than the other two samples. The characteristic aromatic odor of *Chitraka* was present in all the three samples of *Chitraka Kwatha*. In physico-chemical assay of the three samples of *Kwatha*, the *Kwatha* which is prepared by ½ reductions was found to be more acidic. Refractive index, specific gravity, viscosity and total solids were increased in all the groups, the percentage of total solids was significantly increased in the group where *Kwatha* is prepared by 1/10th reduction. It indicates the high concentration of 1/10th reduction group. In HPTLC, more peaks were seen in 1/10th reduction, indicating the presence of more active constituents than the other two *Kwatha* samples.

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How to cite this article: Ashok Kumar B.N., Sudheendra Honwad, B. Ravishankar, Sneha Pai, Shiv Om Dixit. Pharmaceutico – Analytical Study of *Chitraka Kwatha* w.s.r. to different reduction criteria. J Ayurveda Integr Med Sci 2016;4:27-35.
http://dx.doi.org/10.21760/jaims.v1i4.6913

Source of Support: Nil, **Conflict of Interest:** None declared.

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