Pharmaceutico – Analytical Study of Chitraka Kwatha w.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 Swarasas, 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
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:
   - 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 3/4th part.
   - 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°C to 90°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
   - Colour
   - Taste
   - Odour
   - Appearance

B. Physio-chemical assay
   - pH
   - Refractive index
   - Loss on drying
   - Specific gravity
   - Viscosity
   - Ash value
   - Acid insoluble ash
   - Water soluble ash
   - Percentage of total solid contents

C. Chromatographical study
   - 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 up to 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
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

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

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

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;

\[ \eta_1 = \frac{\rho_1 t_1 \times \eta_2}{\rho_2 t_2} \]

\( \eta_1 \) - Viscosity of sample
\( \eta_2 \) - Viscosity of water
\( t_1 \) and \( t_2 \) - time taken for the sample and water to pass the meniscus
\( \rho_1 \) and \( \rho_2 \) - Density of sample and water.

Total Ash

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

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˚C. 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

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

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.
Loss on drying

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

Sample preparation: 10 ml 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. Rf colour of the spots and densitometric scan were recorded.

Results of the Analytical Study:

Table 1: Organoleptic characters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CK prepared by 1/10th reduction</th>
<th>CK prepared by ½ reduction</th>
<th>CK prepared by 3/4th reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Dark brownish yellow</td>
<td>Light brownish yellow</td>
<td>Light brownish yellow</td>
</tr>
<tr>
<td>Taste</td>
<td>Katu, Tikta</td>
<td>Tikta, Katu</td>
<td>Tikta, Katu</td>
</tr>
<tr>
<td>Odour</td>
<td>Aromatic</td>
<td>Aromatic</td>
<td>Aromatic</td>
</tr>
<tr>
<td>Appearance</td>
<td>Brown coloured thin fluid</td>
<td>Brown coloured thin fluid</td>
<td>Brown coloured thin fluid</td>
</tr>
</tbody>
</table>

CK : Chitraka Kwatha

Table 2: Standardization parameters of Chitraka Kwatha Churna

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Results n= 3 %w/w;</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Total Ash</th>
<th>Acid Insoluble Ash</th>
<th>Water Soluble Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Ash</td>
<td>6.6271</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acid Insoluble Ash</td>
<td>0.4990</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Soluble Ash</td>
<td>2.8856</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Results of standardization parameters of Chitraka Kwatha.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Results n= 3 %w/w;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
<td>½ reduction</td>
</tr>
<tr>
<td>Total Solids</td>
<td>2.102</td>
</tr>
<tr>
<td>Loss on drying</td>
<td>97.898</td>
</tr>
<tr>
<td>pH</td>
<td>4.23</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.0074</td>
</tr>
<tr>
<td>Viscosity</td>
<td>1.0964</td>
</tr>
<tr>
<td>Refractive Index</td>
<td>1.33583</td>
</tr>
</tbody>
</table>

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.
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 1/10th 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 1/10th 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°C to 90°C. 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 1/10th, 3/4th 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.
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 ⅜ reduction is found to be more acidic when compared to the kwatha prepared by 1/10 th 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 ⅜ 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 ⅜ reduction and 3/4 th reduction and the value was slightly increased for the kwatha prepared by 1/10 th reduction. It indicates that the 1/10 th 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 1/10 th 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, 1/10 th 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 1/10th the reduction. (Table 3)

Viscosity

Among the three samples, 1/10 th 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)
HPTLC

Table 4: Densitometric scan at 254 nm

<table>
<thead>
<tr>
<th>CK 1/2</th>
<th>CK 3/4</th>
<th>CK 1/10</th>
<th>Chitraka Kwatha Churna</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.10 (0.55%)</td>
</tr>
<tr>
<td>0.39 (9.00%)</td>
<td>0.39 (9.08%)</td>
<td>0.39 (11.16%)</td>
<td>0.40 (7.97%)</td>
</tr>
<tr>
<td>0.54 (2.62%)</td>
<td>0.53 (2.02%)</td>
<td>0.52 (4.05%)</td>
<td>0.52 (1.60%)</td>
</tr>
<tr>
<td>0.57 (3.57%)</td>
<td>0.58 (4.07%)</td>
<td>0.58 (5.75%)</td>
<td>0.58 (4.82%)</td>
</tr>
<tr>
<td>0.74 (15.95%)</td>
<td>0.74 (16.07%)</td>
<td>0.74 (18.66%)</td>
<td>0.75 (16.22%)</td>
</tr>
<tr>
<td>0.85 (68.87%)</td>
<td>0.85 (68.76%)</td>
<td>0.85 (59.03%)</td>
<td>0.85 (55.48%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.98 (0.79%)</td>
<td>0.97 (3.84%)</td>
</tr>
<tr>
<td>CK : Chitraka Kwatha</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The sample *Chitraka Kwatha Churna* has shown the peaks at R_f values as shown in table 4. Compared with this, the sample CK 1/10 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 3/4 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 1/10 reduction, may be the ½ and 3/4 reduction were not sufficient to extract the maximum amount of constituents from the drug. (Table 4)

Table 5: Densitometric scan at 366 nm

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

The sample *Chitraka Kwatha Churna* has shown peaks at R_f values as shown in table 5. On observation, the sample 3/4 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 1/10 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

<table>
<thead>
<tr>
<th>CK 1/2</th>
<th>CK 3/4</th>
<th>CK 1/10</th>
<th>Chitraka Kwatha Churna</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.40 (23.80%)</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 6: Densitometric scan at 540 nm
The drug Chitraka has shown peaks at Rf 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 Rf 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 Rf 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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