INTRODUCTION

Kwath (decoction) is the process in which the water-soluble and heat stable constituent of hard and woody crude drugs are extracted out. Kwath (aqueous liquid dosage form) has been used since ancient times by various scholars for preparing Kwath churna (decoction powder) which is the compounded coarse powder intended for use whenever decoction is required [1-15]. The present work is hypothesized to prepare Phaltrikadi kwath with the help of Kwathyadravya (different size) as per the mentioned method and compare on the basis of physicochemical parameters which help for determining the suitable size of Kwathyadravya in the preparation of Kwath kalpa.

METHODS

All the authenticated raw herbs (Figs. 1 and 2) used for the preparation of Phaltrikadi kwath were collected from the Ayurvedic Pharmacy, Gujarat Ayurved University, Jamnagar, Gujarat, India (Table 1).

Method of preparation of Phaltrikadi Kwath

Phaltrikadi kwath was prepared according to the procedure mentioned in the "Sharngadhar samhita" Madhyam khand 2/77 [6]. Total 15 samples of Phaltrikadi kwath were prepared, i.e. 3 samples were coarsely powdered (Fig. 3), 3 were of 0.5 cm (Fig. 4), 3 were of 1 cm (Fig. 5), 3 were of 1.5 cm (Fig. 6), and 3 were of 2 cm (Fig. 7) in particle size.

RESULTS

Total 15 samples of Phaltrikadi kwath were prepared and analyzed to determine the effects of particle size, vessel used, and extraction time on the preparation of Phaltrikadi kwath.

Conclusion:

Kwath (decoction) prepared by particle size 1.5 cm and 2.0 cm may be more therapeutically effective, as it has total solid content more than 6%, it proves that “Involkta” phenomena of Ayurvedic classics.

Keywords: Kwath, Decoction, Particle size, Kwathyadravya, Phaltrikadi kwath.
of Kwath (herbal decoction) is to extract the water-soluble constituent of herbs by boiling. Quantum of heat and duration of heating is prime concern for the preparation of Kwath. This remedy is easy to make, but need careful attention and some more time until one becomes familiar with the process. The yield, the color and the taste can vary from batch to batch, but the general, the final product is in liquid form, which looks somewhat like apple cider or light honey. Soaking of Kwathya dravya (solute) results in the softening of the drug due to diffusion of

![Fig. 1: Raw plant material](image1)

![Fig. 2: Raw plant material (Part used)](image2)

### Table 1: Physicochemical evaluation of raw materials used for Phaltrikadi kwath

| Drug name | Parameter | Foreign matter % w/w | Total ash % w/w | Acid-insoluble Ash % w/w | Alcohol-soluble extractive % w/w | Water-soluble extractive % w/w |
|-----------|-----------|-----------------------|-----------------|--------------------------|---------------------------------|-------------------------------|
| Haritaki  |           | 7                     | 6.22            | 0.77                     | 60.34                           | 68.62                         |
| Bibhitaki |           | 5.38                  | 5.55            | 0.68                     | 40.57                           | 60.52                         |
| Amalaki   |           | 3.27                  | 5.69            | 1.22                     | 57.22                           | 62.5                          |
| Guduchi   |           | 8.99                  | 12.82           | 2.87                     | 38.77                           | 48.32                         |
| Katuki    |           | 12.66                 | 4.32            | 0.87                     | 47.98                           | 58.88                         |
| Chirayata |           | 3.23                  | 5.47            | 0.92                     | 53.48                           | 60.90                         |
| Vasa      |           | 7.38                  | 16.97           | 0.78                     | 50.90                           | 58.92                         |
| Neem chhal|           | Nil                   | 4.91            | 1.32                     | 54.32                           | 61.39                         |

### Table 2: Showing the facts during preparation of Phaltrikadi kwath

| Sample number | Kwath dravya particle size | Vessel used | Temperature range (°C) | Time taken in Paka (min) | Initial volume of water (ml) | Volume of decoction (finished product) (ml) |
|---------------|---------------------------|-------------|------------------------|--------------------------|------------------------------|--------------------------------------------|
| 1             | Coarse powder (pass 60*)  | Stainless steel | 23–90                | 330                      | 41.00                        | 512                         |
| 2             |                          | Stainless steel | 23–90                | 330                      | 41.00                        | 500                         |
| 3             |                          | Mritika patra  | 20–80                 | 330                      | 41.00                        | 515                         |
| 4             | 0.5 cm                    | Stainless steel | 24–85                | 330                      | 41.00                        | 510                         |
| 5             |                          | Stainless steel | 24–89                | 330                      | 41.00                        | 505                         |
| 6             |                          | Mritika patra  | 19–79                 | 330                      | 41.00                        | 518                         |
| 7             | 1.0 cm                    | Stainless steel | 24–85                | 360                      | 41.00                        | 515                         |
| 8             |                          | Stainless steel | 24–88                | 360                      | 41.00                        | 520                         |
| 9             |                          | Mritika patra  | 22–85                 | 360                      | 41.00                        | 500                         |
| 10            | 1.5 cm                    | Stainless steel | 23–81                | 330                      | 41.00                        | 520                         |
| 11            |                          | Stainless steel | 23–90                | 330                      | 41.00                        | 509                         |
| 12            | Mritika patra            | 20–81        |                        | 360                      | 41.00                        | 522                         |
| 13            | 2.0 cm                    | Stainless steel | 22–84                | 330                      | 41.00                        | 500                         |
| 14            |                          | Stainless steel | 22–86                | 330                      | 41.00                        | 510                         |
| 15            | Mritika patra            | 19–80        |                        | 330                      | 41.00                        | 520                         |
liquid into the Kwathya dravya (solute) because of the osmosis. Due to the presence of hydroxyl group, the Kwathya dravya (solute) swells which result in the increased diffusion pressure inside the cells, which ultimately leads to the bursting of the cell wall. This process is enhanced by the vigorous boiling and agitation during the Kwath nirmana (preparation of decoction). The water diffuses into the Kwathya dravya (solute), dissolves the water-soluble constituents and discharges it to the liquid media due to collapsement of boundary layer which results in the transfer of water-soluble principles into the solvent (water). The continuous heating and agitation during the Kwath nirmana enhance the extraction process by weakening the bounds, thereby separating the hydrophobic substances from hydrophilic substances.

Fig. 3: Raw plant material (Coarsely powdered)

Fig. 4: Raw plant material (Particle size 0.5 cm)

Fig. 5: Raw plant material (Particle size 1 cm)

Fig. 6: Raw plant material (Particle size 1.5 cm)
Fig. 7: Raw plant material (Particle size 2 cm)

Fig. 8: Vessel used for the preparation of Phaltrikadi kwath

### Table 3: Physicochemical evaluation of Phaltrikadi kwath churna

| S. No | Parameter                                      | Observation (%) |
|-------|------------------------------------------------|-----------------|
| 1     | Foreign matter                                 | Nil             |
| 2     | Loss on drying (at 110°C)                      | 11.9 w/w        |
| 3     | Total ash (at 450°C)                           | 5.32 w/w        |
| 4     | Acid-insoluble ash                             | 0.73 w/w        |
| 5     | Hexane-soluble extractive value                | 1.592 w/w       |
| 6     | Benzene soluble extractive value               | 3.784 w/w       |
| 7     | Chloroform-soluble extractive value            | 5.904 w/w       |
| 8     | Alcohol-soluble extractive value               | 20.46 w/w       |
| 9     | Water-soluble extractive value                 | 26.00 w/w       |
| 10    | Qualitative chemical test for alkaloid         | Present         |
| 11    | Qualitative chemical test for tannin           | Present         |
| 12    | Quantitative estimation of alkaloid content    | 0.917 w/w       |
| 13    | Quantitative estimation of tannin content      | 0.90 w/w        |

### Table 4: Physicochemical evaluation of prepared Phaltrikadi kwath

| Particle size | Batches | Sp. Gr. at Room temperature°C | pH | Refractive index | Foreign matter | Litmus paper test | Ash value | Acid-insoluble Ash | Total Solid Content | Temperature°C |
|---------------|---------|-------------------------------|----|-----------------|----------------|-------------------|-----------|-------------------|--------------------|---------------|
| Coarse        | I       | 1.0189                        | 3.47| 1.4240          | Nil            | Acidic            | 0.15      | 0.0172            | 5.101              | 23            | 90          |
|               | II      | 1.0248                        | 3.67| 1.4240          | Nil            | Acidic            | 0.68      | 0.0172            | 5.542              | 23            | 90          |
|               | III     | 1.0166                        | 3.89| 1.4240          | Nil            | Acidic            | 0.25      | 0.0452            | 3.923              | 20            | 80          |
| 0.5 cm        | I       | 1.0367                        | 3.30| 1.4310          | Nil            | Acidic            | 0.21      | 0.0188            | 5.781              | 24            | 85          |
|               | II      | 1.0254                        | 3.31| 1.4310          | Nil            | Acidic            | 0.53      | 0.0288            | 5.131              | 24            | 89          |
|               | III     | 1.0206                        | 3.47| 1.4310          | Nil            | Acidic            | 0.13      | 0.0248            | 4.368              | 19            | 80          |
| 1.0 cm        | I       | 1.0266                        | 3.37| 1.4320          | Nil            | Acidic            | 0.08      | 0.0272            | 5.116              | 24            | 88          |
|               | II      | 1.0292                        | 3.39| 1.4320          | Nil            | Acidic            | 0.14      | 0.0292            | 5.471              | 24            | 88          |
|               | III     | 1.2478                        | 3.85| 1.4320          | Nil            | Acidic            | 0.13      | 0.0460            | 4.421              | 22            | 85          |
| 1.5 cm        | I       | 1.0296                        | 3.40| 1.4330          | Nil            | Acidic            | 0.20      | 0.0304            | 6.546              | 23            | 81          |
|               | II      | 1.0323                        | 3.44| 1.4330          | Nil            | Acidic            | 0.24      | 0.0316            | 6.540              | 23            | 90          |
|               | III     | 1.0275                        | 3.61| 1.4330          | Nil            | Acidic            | 0.22      | 0.0400            | 6.543              | 20            | 81          |
| 2.0 cm        | I       | 1.0325                        | 3.75| 1.4340          | Nil            | Acidic            | 0.40      | 0.0236            | 6.541              | 22            | 84          |
|               | II      | 1.0336                        | 3.70| 1.4340          | Nil            | Acidic            | 0.57      | 0.0220            | 6.815              | 22            | 91          |
|               | III     | 1.0222                        | 3.85| 1.4340          | Nil            | Acidic            | 0.12      | 0.0252            | 4.414              | 19            | 80          |
In the present study, when using device gas stove has been taken. Due to the fast urbanization, it may be quite difficult to use these methods to prepare the drug in a large scale. Nowadays, to cope up with the increasing demands of Ayurvedic preparations it has become quite common to use steam jacketed vessels in place of gas stove. These facilitate to prepare a standard and quality product. Adoption of modern technology in the preparation of Ayurvedic formulation is the need of present era. It is permissible and good if we do not change the basic principle mentioned in the Ayurvedic classics. Quantum of heat, quantity of water, and duration of heating is a time concern for Kwath nirmana. The purpose is to drive the water-soluble therapeutically active principles from the source drug. During preparation of Kwath, quantum of heat (temperature) was the most important factor for consideration because it may decompose the water-soluble extract which is sensitive toward too much heat, so during the preparation of Kwath mridu agni was maintain throughout the process for each sample, in medium range (not exceed 80°C–90°C) stirring was done in between the Kwath preparation to get the uniform temperature and concentration throughout the solvent and also to protect the burning of drug. Filtration of Kwath was done to remove the exhausted material from Kwath, for this cotton cloth (double folded) is used to separate the exhausted material for obtaining the clear solution of Kwath. Nowadays, due to increasing demand for Ayurvedic products, there is a transfer of traditions to technology. Nowadays, instead of Mritika patra and steel vessel, steam jacketed vessels are used for the manufacturing of Kwath.

There is no much difference of specific gravity of decoction prepared using substance of different particle size was observed it is ranged between 1.0166 and 1.0336. PH of all prepared Kwath samples was in between 3.30 and 3.89 that means all are acidic in nature which was also confirmed by litmus paper test. Total ash of all prepared samples was observed in between 0.08% and 0.68%. Acid-insoluble ash of sample is also varying from 0.0172% to 0.046%. Refractive index of all sample varying 1.4240–1.4340, but there is a remarkable difference in total solid content, it is from 3.923% to 6.815%.

CONCLUSION

After reviewing all analytical data, it can be concluded that decoction prepared in Mritika patra had shown higher total ash, acid-insoluble ash, and lesser total solid content in comparison to those samples which were prepared in steel pan. Decoction prepared by particle size 1.5 cm and 2.0 cm may be more therapeutically effective, as it has total solid content more than 6%. It proves that “Yavakuta” phenomena of Ayurvedic classics.

ACKNOWLEDGMENT

The authors are thankful to the Institute of Ayurvedic Pharmaceutical Sciences, Gujarat Ayurveda University, Jamnagar, Gujarat, for providing necessary arrangement with infrastructure to complete the research work.

AUTHORS CONTRIBUTIONS

Dileep Singh Baghel : Principal investigator, performed preparation and analysis on all samples, interpreted data, write manuscript and acted as corresponding author. Dr. Anand Kumar Chaudhary : Guide, supervised development of work, helped in data interpretation, manuscript evaluation and editing.

CONFLICTS OF INTERESTS

None Declared.