Pharmaceutical Chemistry

Impact of Bhavana Samskara on physico-chemical parameters with special reference to Gandhaka Rasayana prepared by different media and methods

Shuchi Mitra, P. K. Prajapati¹, V. J. Shukla², B. Ravishankar³

Department of Rasa shastra, Govt. Ayurvedic College, Rampur Chauraha, Muzaffarnagar (U.P.), ¹Department of Rasa shastra and Bhaishajya Kalpana, ²Pharmaceutical laboratory, ³Pharmacological laboratory, Institute for Post Graduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar, Gujarat, India.

Abstract

Gandhaka Rasayana is frequently used in the management of different skin disorders (Kushtha). It is a herbo-mineral preparation prepared by Shuddha Gandhaka Bhavit with 11 herbal drugs in a serial manner for eight times each. Therefore, it was used as a model drug and four samples were prepared by adopting different methods and media. The physicochemical parameters were evaluated. The effect of increasing the number of Bhavana (lavage) on particle size of the drug was examined. Similarly, an attempt was made to differentiate the structure (surface anatomy) of the drug with Bhavana and without Bhavana by using a very sophisticated x-ray photo electron spectrometer (XPS) study. Overall, a remarkable difference was observed in the samples with Bhavana and without Bhavana.

Key words: Bhavana, Gandhaka Rasayana, ICP, particle size, XPS

Introduction

“Everything has to undergo a change.” It is the only unchangeable fact and everything else in this universe is in a continuous process of change. The changes happening continuously and naturally in any panchabhautika substance are due to the Agni Mahabhishta present in it. When this transformation is performed in a proper manner, under controlled conditions to get the expected result, it is termed as samskara. In the present days of globalization, all the rational skeptics are engrossed in finding the basic reasons for transformation. Bhavana is also one type of Samskara responsible for transformation, having its utility in almost all pharmaceutical processing.¹

Gandhaka Rasayana is a very well known and commonly used medicament, but different pharmacies prepare it by different procedures according to their ease and feasibility. The main difference is either in the number of Bhavana or in the method of Chaturjata use, as it is a group of four costly drugs (Dalechini, Ela, Tejpatra and Nagkeshara). Because of this, some pharmacies mix the Ghana (water-soluble extract) of these drugs instead of giving Bhavana, some others make kwatha, while some make arka of these drugs for Bhavana. Therefore, here, an attempt has been made to find out the difference between the samples prepared by giving Bhavana or without Bhavana on an analytical ground.

Materials and Methods

The materials used are

| Sample | Media | Bhavana Details |
|--------|-------|-----------------|
| Sample-1 | G.R.K | 88 Bhavana-Chaturjata in the form of Kwatha² |
| Sample-2 | G.R.A | 88 Bhavana-Chaturjata in the form of Arka¹ |
| Sample-3 | G.R.K-I | 11 Bhavana-Chaturjata in the form of Kwatha |
| Sample-4 | G.R.G | No Bhavana-Chaturjata in the form of Ghana |

(K. Kwatha; A. Arka; G. Ghana)

Details of the preparation

Gandhaka Rasayana is a herbo-mineral compound, prepared with suddha Gandhaka and Bhavana by Kwatha of Chaturjata, Triphala, Shunthi and with SwaRasa of Guduchi, Bhiringraja and Adraka (respectively for eight times each, Table 1). For the preparation of Gandhaka Rasayana by different media, two references have been taken; one from Yoga Rattnakara Rasayanadhikara p-501 and the other from A.F.I. Churnadhikara (modified). According to the first reference, in the first sample, Chaturjata Kwatha was used for Bhavana and according to the second reference, in the second sample, Chaturjata Arka was used for Bhavana. In both the samples, 88 Bhavana were given. In the third sample, only 11 Bhavanas were given and in the fourth sample, instead of giving Bhavana, Ghana (dry
extract) was prepared by the hot extraction method[4] taking the bhavana dravya in the same quantity that was incorporated in the 88 Bhavana and only mixed in Siddha Gandhaka. Then, mechanical microfining of this was performed up to 5 min.

All the samples were evaluated for physicochemical properties[1] by using standard methods like loss on drying, ash value, pH, water-soluble extractive, methanol-soluble extractive, acid-soluble ash, carbon disulfide-soluble extractive, specific gravity, particle size distribution, etc.

Organoleptic parameters
The specific characters that are mentioned in our classics for evaluating the qualities of preparation by color, touch, fineness, taste, odor, etc. were noted through Jyamendriya in all the samples. These characters are useful to both, the patient and the physician, for having a primary idea about the quality of different formulations without using chemical tests.

Particle Size distribution
The samples were analyzed for particle size determination in a HORIBA-LA-500 model of Sympatec GmbH instrument, made in Germany, by taking water as the dispersion medium and were measured at the 0.5–875 μm range.

Atomic emission spectroscopy (AES) with Inductively coupled plasma (ICP)
One gram of the sample was dissolved in 5 ml of nitric acid after dry ashing, and this was heated on a hot plate to extract metal. Then, it was filtered and washed using deionized water and the volume was made up to 100 ml in a volumetric flask. The instrument was calibrated with the 10 and 100 ppm multistandards (C. P. A. Ltd., Bulgaria). This test was carried out in a Perkin Elmer ICP optima 3300 RL apparatus (PerkinElmer Instruments, 761 Main Avenue, Norwalk, CT 06859-0010 USA).[4]

X-Ray photo electron spectrometer
An XPS system is used for surface elemental identification and chemical state information of a wide variety of samples from different fields like catalysis, corrosion studies, high-temperature super-conductor films, stoichiometry of thin films of compound semiconductors and elemental absorption behavior of conducting polymers like polyaniline.[21]

### Results

Table 2 shows the organoleptic characters. Table 3 shows the analytical data of the physicochemical parameters of Gandhaka Rasayana prepared by different methods. Table 4 shows the AES–ICP analysis. Figure 1 shows the particle size distribution of all the three samples.

### XPS study
When the surface anatomy of Gandhaka Rasayana was studied, only C, H and O peaks were observed at the surface with sulfur particles in the core. In case of sample 88, Bhavana surface was found to be uniform and even, but in the sample without Bhavana, i.e. the G.R.G. sample, the surface observed was not uniform. Because the penetration power of XPS was only 100A, it was not possible to see the structure of it beyond this range.[10]

### Discussion

Organoleptic tests of all the four samples of Gandhaka Rasayana, i.e. G.R.A., G.R.K., G.R.I. and G.R.G. were performed [Table 1].

There was a slight color and taste variation between sample 3 (11 Bhavana) and the other samples. This sample had a cream color with mild astringent taste, while the others had a dark green color with an astringent taste, indicating a lower concentration of Bhavana dravya in this sample.

All the samples had a specific odor of Adraka and Shunthi, but the G.R.G. sample did not have any specific odor. This may be due to a loss of the volatile aromatic components of Bhavana dravya during the pharmaceutical processing of Ghana formation.

### Physicochemical parameters
A considerable difference was found in the values of some of the physicochemical parameters of Gandhaka Rasayana. Both the water- and the methanol-soluble extractive increased in the G.R.K sample and in the G.R.G sample as compared with the G.R.A and the GRK-I samples, but the G.R.A sample had an increased value of both factors as compared with the GRK-I sample. There was not much variation in the pH, which ranged from 3.84 to 4.65. This reveals that a more concentrated form or more water- and methanol-soluble content may not affect the pH of the samples. Loss on drying in Gandhaka Rasayana GRK-I (5.5%) was more than that of the Gandhaka Rasayana Arka sample (G.R.A) (2.75–3.66%), indicating the presence of more moisture in GRK-I, whereas the Gandhaka Rasayana kwatha and the Ghana sample did not show much of a difference in the L.O.D. ranging between 1.24 and 1.80. The ash value in GRK-I was found to be lower (1.46%) as compared with the three other samples, ranging between 4.55 and 5.90%. The ash value indicates the presence of inorganic contents in the sample. Test for acid-insoluble ash indicates the percentage of insoluble inorganic content or the therapeutic efficacy. It indicates the physiological availability of the drug after passing through the gastric solution. There was not much variation in the acid-insoluble ash, which ranged between 0.25% and 0.395%. This reveals that the method of preparation and media does not affect the physiological availability of the drug, especially in case of Gandhaka Rasayana. The CS.-soluble extractive value was found to be increased in GRK-I (22.27%) in comparison with the G.R.G. sample (12.4–13.0%), but in the G.R.K. and G.R.A. samples, it was found to be between 8.4 and 9.7%. These values show the percentage of free sulfur in the

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**Table 1: Details of herbal drugs used in the preparation of Gandhaka Rasayana**

| Name of the drug | Botanical name | Parts used |
|------------------|----------------|------------|
| Haritaki         | Terminalia chebula | Fruits    |
| Vibhitaki        | Terminalia belerica | Fruits    |
| Aamla            | Emblica officinalis | Fruits    |
| Shunthi          | Zingiber officinalis | Rhizome   |
| Ela              | Elettaria cardamomum | Seed      |
| Twak             | Cinnamomum cassia | Stem bark  |
| Patra            | Cinnamomum tamala | Leaf       |
| Nagakeshar       | Mesua ferra | Flower bud  |
| Guduchi          | Tinospora cordifolia | Stem      |
| Adraka           | Zingiber officinalis | Rhizome   |
| Bhringraja       | Eclipta alba | Whole plant |
Figure 1: Particle size distribution of all the three samples 10, 50, 90 indicate the percentage of particles e.g. 10% particles are below 0.54 µm in G.R.A sample

1. Shuddha Sulphur (Water)
2. Sample - 1
3. Shuddha Sulphur (Alcohol)
4. Sample - 3
5. Sample - 4
6. Sample - 2 (with 88 Bhavana)
7. Sample - 4 (Without Bhavana)

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samples. In GRK-I, it is higher because the concentration of Bhavana dravya is less in comparison with the other samples. In the G.R.G. sample, the concentration of free sulfur was found to be 2–3% increased when compared with the G.R.K. and G.R.A. samples. The reason for this may be that the G.R.K. and G.R.A. samples were levigated 88 times with kwatha/SwaRasa/arka of different bhavana dravya. Thus, there may be some possibility of compound formation with free sulfur, and this possibility is only 2–3% as sulfur is water-insoluble [Table 2].

**Particle size distribution**

Ninety percent of the particles are below 41.45 µm in size in G.R.A. Ninety percent of the particles are below 26.92 µm in size in G.R.K [Table 5].
Ninety percent of the particles are below 40.81 µm in size in GRK-I.

 Ninety percent of the particles are below 93.65 µm in size in G.R.G.

 The above data indicate that the G.R.A. and G.R.K. groups are more microfined although the particle size distribution is quite varying in spite of the same number of Bhavana.

 AES–ICP
 Given a general observation, the elements like Cu, V, Cr, Mn, Pb, Co, Zn, Ni, As, Se, Sr, Mo, Ag, Cd, Sb, Ba and Hg are expressed in mg/kg concentration [Table 4].

 From all the suppositions for transitions in the content of the Gandhaka Rasayana prepared using different media and methods, it is clear that an absence or presence of a particular element in prior stage and its changed concentration in the final stages or from the original suddha Gandhaka to the final Gandhaka Rasayana through all the intermediate steps (lavigation) is only by virtue of a direct addition or subtraction of the amount of that trace element present in the Bhavana dravya. It may be actually in the form of some conversion or addition–subtraction phenomenon. These changes may be occurring as such on much subtler levels.

 XPS
 When the surface anatomy of Gandhaka Rasayana was studied, only C, H and O peaks were observed at the surface having sulfur particle in the core. In case of sample 88, the Bhavana surface was found to be uniform and even, but in the sample without Bhavana, i.e. the G.R.G. sample, the surface observed was not uniform. As the penetration power of the XPS analyzer was only 100A, it was not possible to see the structure of beyond this range. Therefore, by this study, it can be proved that Gandhaka Rasayana is a herbo-mineral compound having sulfur particle in the core and overlapping of Bhavana dravya on it, or it may be that our acharya used sulfur as a vehicle for uniform distribution of the extracts of herbal drugs having Rasayana or other similar properties.[9]

 Conclusion
 An analytical study of a more reduced size of particles was found in the samples prepared by giving 88 Bhavana in comparison of the sample prepared by mixing Ghana of Bhavana dravya and the sample that was given 11 Bhavana. Also, the sample 2 (88 Bhavana) had uniform overlapping of the Bhavana dravya. Thus, Bhavana is an important and mandatory process during drug possessing, affecting the physicochemical and biological properties of a dosage form.

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 हिन्दी सारांश
 विभिन्न माध्यम एवं विधिओं से निर्मित गंधक रसायन के भातिक रासायनिक गुणों पर भावना संस्कार का प्रभाव
 शुचि मित्र प्रदीप प्रजापति शी.जे. शुक्ला शी. रविकांकर
 गंधक रसायन का प्रयोग मुख्यतःयवकणक विकारों- कुह रोग में किया जाता है | यह एक वानरसाधक एवं मुक्त खनिज का योगी है | इसका निर्माण शुद्ध गन्धम में 91 द्रव्यों की भावना देकर किया जाता है | इस प्रकार यह एक मॉडल रोग का प्रकार है | इसके निर्माण में चार प्रकार के द्रव्यों का प्रयोग किया गया तथा इसके विभिन्न भालीक एवं रासायनिक परीक्षण किए गए | एक प्राप्त होने के बारे में इसकी सत्यी संसर्ग का अध्ययन एकत्रित में किया गया जिसमें एक संपत्ति भिन्न भावना के निर्माण किया तथा दोनों में महत्वपूर्ण अन्तर पाया गया।