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''STUDY OF MANDURAVAJRAVATAKA W.S.R. YOGARATNAKARA''

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Abstract :-

Herbal medicines are used globally for their efficacy and safety margins. However, quality control of these drugs is one of the challenges in current scenario. Herbal medicines facing issues including lack of authentication, non-availability, inadequate standardization methodologies and regulatory insufficiency. It is required to overcome these issues related to the standardization of herbal medicines. Similar consideration must be adopted for Herbo mineral preparations which mainly come under the umbrella of Rasa Shastra in Ayurveda. Ayurveda described particulars techniques for quality evaluation of Rasa Dravya's. Additionally modern research suggested organoleptic tests and heavy metal analysis along with sophisticated techniques like High Performance Thin Layer Chromatography (HPTLC) , XRD, XRF etc.

Vataka, vatika, gutika,modaka, pindi, guda and vati are the synonyms of *Vati.* All the terminologies used above are used as synonyms for *vataka* in different parts of classics. Difference may prevail in the shape or size of the above said preparations but the basic method of preparation remains same. No previous study of standardization of *Vataka* is available till now. Hence standardization of *vataka* is necessary in present era.

Out of available *sangraha Yogartnakara* is one of the best creation in *kayachikitsa* subject. All well-known treatment is compiled in this *sangrah*. Diagnosis of diseases in practically well explained other than another *granthas.* Language of this *sangrah* is easy to understand. Thus if whoever study this *grantha* thoroughly then he/she can be a good practitioner. So, we thought it will be interesting and useful to study standardization of *Mandurvajravataka.*[1,2]

Key Word :- Ayurveda, Rasashashtra , Herbo-mineral , Manduravajravataka, Standardization, Yogaratnakara sangraha

Introduction :-

Ayurveda system of medicine was highly appreciated and practiced during the golden era of Indian history. This system of medicines recognizes the importance of metallic micro-nutrients in our body. Deficiency or imbalance of these metallic micro nutrients in body results in the manifestation of diseases. This concept has great relevance in present day situation as our world faces major ecological disturbances and consequently newer

diseases. Ayurveda lays more emphasis on the prevention and treatment of diseases by keeping a balance between diet and life- style of an individual depending upon the environment he or she lives in. the necessity of metallic micro-nutrient for perfect health is subject for intensive study. It has been observed that the metal based formulations are especially effective in prevention and cure of diseases related to the organ where they act.

Rasashashtra is a section of *Ayurveda* which describes the use of metals, gems, minerals and poisons for manufacturing special formulations. These metallic micro-nutrients were freely available in soil and water enriching plant and animal kingdom in previous days but now it has been deprived as our soil and water have badly polluted by raw metals and the by-products of industrialization. The main concept of *Rasashashtra* lies in the transformation of base lower metals into noble higher metals and to use them for strengthening the body tissues and to maintain them as fresh. In this system the metals and the minerals are termed as *Dhatus* and *Updhatus*, because of their specific role in biological systems and whose deficiency may causes many undesired problems in the body.

Earlier the medicines were prepared by the physicians themselves for the patients and they were well experienced and trained in processing medications. It was common in practice to modify the preparations according to need of the patients. Now the drug manufacturing is done in large scale and addition of substituents has become common. As chances of adulteration has become common. It has become mandatory to standardize the *ayurvedic* preparations especially *Rasaaushdhis,* as they are used in *alpamatra* (minute quatities). Harmful effects of metallic medicines in various bodies are well documented as in modern medicine.

In order to have a good co-ordination between the quality of raw materials, in process materials and the final products, it has become essential to develop reliable, specific and sensitive quality control methods using a combination of classical and modern instrumental methods of analysis, standardization is an essential measurement for ensuring the quality control of the herbal drugs.

Rasavagbhata explained that among all the *Aushadi Kalpa Louha*

Kalpa is said to be best one.

सम्यगौषधकल्पनां लहकल्पः प्रशस्यते ।

तस्मात्सर्वप्रयत्नेन शुध्दं लौहं च मारयेत ॥

(र.र.स. 5/97)

This *Louha Kalpana* is said to be "*sarvarogaharam param*" that it useful in all disorders. And *Mandur*a is said to be *updhatu* of *Louha Dhatu* and according to previous studies it proven that *Mandura* is best in various diseases like *Pandu, Kamala, Halimaka* etc.

Vataka, vatika, gutika,modaka, pindi, guda and vati are the synonyms of *Vati.* All the terminologies used above are used as synonyms for *vataka* in different parts of classics. Difference may prevail in the shape or size of the above said preparations but the basic method of preparation remains same. No previous study of standardization of *Vataka* is available till now. Hence standardization of *vataka* is necessary in present era.[3]

Out of available *sangraha Yogartnakara* is one of the best creations in *kayachikitsa* subject. All well-known treatment is compiled in this *sangrah*. Diagnosis of diseases in practically well explained other than another *granthas.* Language of this *sangrah* is easy to understand. Thus, if whoever study this *grantha* thoroughly then he/she can be a good practitioner.

So, we thought it will be interesting and useful to study standardization of *Mandurvajravataka.*

Material And Method :-

Mandurvajra vataka

पञ्चकोलंसमरिचंदेवदारु फ़लत्रिकम् ।

विड्गमुस्तायुक्ताश्चभागास्त्रिपलसंमिताः ॥

यावन्त्येतानिचुर्णानिमण्डुरंत्रिगुणंततः ।

पक्वाऽष्टगुणितेमुत्रेतध्दनीभूतमुध्दरेत ॥

ततोऽक्षमात्रान्वटकान्पिबेतक्रेणतक्रभुक् ।

पाण्डुरोगंजयेत्तव्दन्मन्दाग्नित्वमरोचकम् ॥

मण्डुखज्रवटकोरोगानीकप्रभेदनः ।

अर्शांसिग्रहर्णीशोफ़मूरुस्तम्भंहलीमकम् ॥

कुमीन्प्लीहानमुदरंगलरोगंचनाशयेत्। (यो.र. पाण्डुरोग)

Material :-

- Ashudhha Madura
- Khalva yantra (mortar and pestle)
- Sharav
- Iron vessel (kadhai)
- Mixer grinder with SS vessel
- Measuring cylinders: of capacity 500mL and 1L
- Glass beaker: Glass beakers (200mL and 500mL)
- Citizen electronic balance
- Cotton cloth: White cotton cloth (10m)
- Cow Dung cakes

Ingredients:

Sr. No	. Ingredients	Proportion
1	Panchakola	3 parts
2	Maricha	3 parts
3	Devdaru	3 parts
4	Triphala	3 parts
5	Vidanga	3 parts
6	Musta	3 parts
7	Shudhha Bhasma Mandura	54 parts
8	Gomutra	432 parts

Method:-

All procedure were carried out in dept. RSBK YMT Ayurvedic Medical College Kharghar, Navi Mumbai.

Step 1 :- Shodhan of Ashudhha Mandura[4]:-

- Raw Mandura was taken on ladle and was heated on gas up to red hot.
- Red hot Mandura poured in Gomutrabhavit Triphala.
- After cooling down Mandura was taken out from the vessel.
- Again taken on ladle, heated and poured.
- These processes were repeated 21 times.
- Every time fresh media was taken.
- Note:- This procedure repeated for 3 batches.

Step 2 :- Preparation of Mandura Bhasma:-

- Shuddha Mandura was taken.
- Kumari Swarasa was prepared.
- Then Mandura Churna was transferred in Khalva Yantra; Kumari swarasa was added to it.
- Above mixture was triturated well till Mandura become fine and made paste like consistency.
- Then chakrika (pellets) of Mandura were prepared and allowed it to dry.
- After proper drying pellets was placed in earthen saucer and Samputikarana was done.
- These Sharav Samputa then subjected to Gajaputa.
- After Putapaka the material was collected and ground.
- Same procedure was repeated till Mandura Bhasma gets prepared.
- Note:- This procedure repeated for 3 batches.

Step 3 :- Preparation of Churna of herbal drugs

- All Herbal ingredients are freshly collected and dried in shade separately.
- All Herbal ingredients were taken into khalva yantra and turned into fine powder form.
- All Herbal ingredients are sieved separately from 120 no. sieve.
- All Herbal ingredients powder is preserved in air tight container.

Step 4:- Preparation of manduravjravataka[5]

- The above constituents i.e., Panchakola, Maricha, Devdaru, Triphala, Vidanga, Musta powder was taken in same proportion.
- Mandura Bhasma was taken in triple proportion than above mixture.
- The above constituents were mixed together in Gomutra.
- All mixture was heated in water-bath till the consistency became as for preparation of Vataka and Vataka was prepared and dried in sun light, then preserved in air tight glass container.
- Note: This procedure repeated for 3 batches.

OBSERVATIONS AND RESULTS:-

- **Physicochemical analysis of raw herbal drugs-**

Drug name	LOD %	Ash value %	Acid insoluble ash %	Alcohol soluble extractive	Water soluble extractive	pH
Pippali	20.1	37.35	32.71	24.32	33.04	6.35
Pippali mula	11.97	6.86	0.079	10.96	17.36	6.26

Chitraka	8.57	1.8	0.1	6.56	6	4.86
Musta	9.43	18.97	14.77	10.8	12.8	6.41
Vidanga	10.45	14.78	0.399	10.72	10.48	4.96
Devdaru	9.49	0.00	0.049	14.72	2.16	7.4
Shunthi	11.61	5.586	0.748	6.8	15.52	4.45
Maricha	11.22	4.937	0.548	7.92	86.96	6.44
Haritaki	11.697	2.8	0.1	40.32	44.88	3.34
Amalaki	13.049	4.7	0.4	40.4	54.56	2.91
Bibhitaki	11.455	5.588	0.74	37.84	48	4.19

- **TLC (Thin layer chromatography)of Pippali**

Colour Band under Long UV-365 nm	**R_F value**
Light blue	0.092
Blue	0.38
Light blue	0.52
blue	0.77

TLC of Vidanga :

Colour Band under Long UV-365 nm	**R_F value**
Brown	0.69
Pink	0.92

TLC of Maricha

Colour Band under Long UV-365 nm	R_F value
Blue	0.11
Blue	0.43
Light blue	0.69

TLC of Bibhitaki :

Colour Band under Long UV-365 nm	R_F value
Light blue	0.14
Blue	0.49
Greenish blue	0.89

TLC of Haritaki :

Colour Band under Long UV-365 nm	R_F value
Light blue	0.14
Greenish yellow	0.35
Light blue	0.51
Light blue	0.92

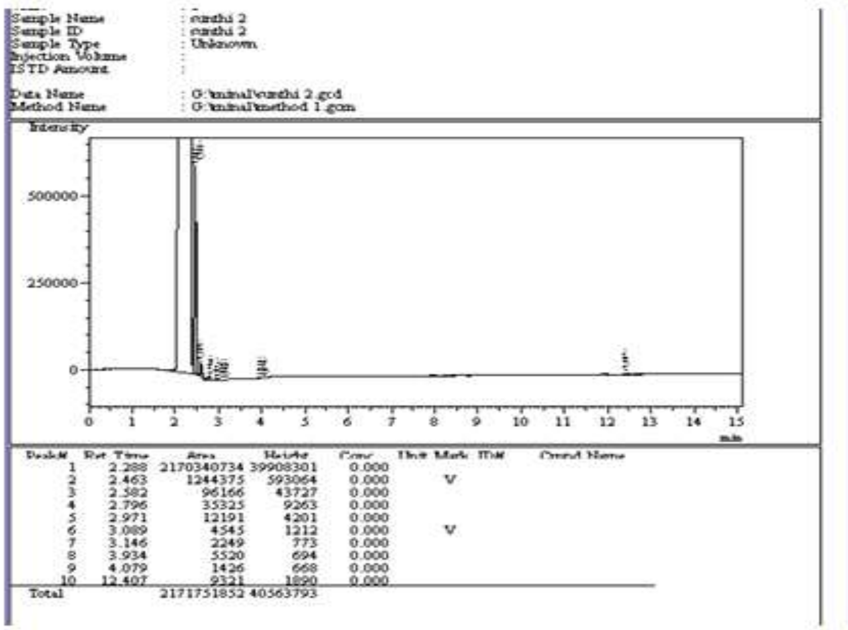
TLC of Chavya :

Colour Band under Long UV-365 nm	Rf value
Dark green	0.23
Dark green	0.35
Black	0.62

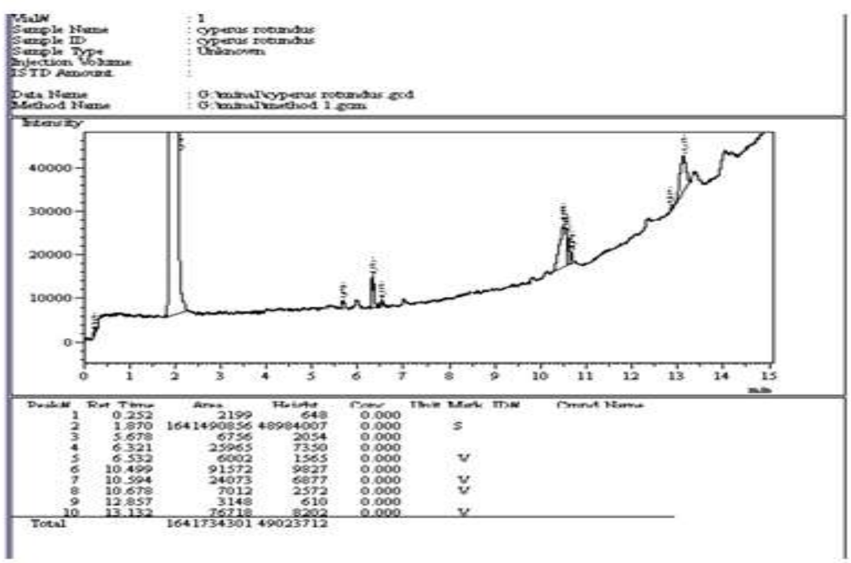
TLC of Amalaki :

Colour Band under Long UV-365 nm	Rf value
Green	0.046
Green	0.2
Light green	0.42

GLC (Gas Liquid chromatography) of Shunti:



GLC of Musta :



Results of final weight after 21 Nirvapa:-

Batch	**A**	**B**	**C**
Initial weight (gm)	**300**	**300**	**300**
Final weight (gm)	**285**	**295**	**280**

XRF of Raw Mandura before Shodhan procedure :-

Element	**Mass%**	**Intensity (cps/µA)**
Aluminium (Al)	1.042	0.065
Silicon (Si)	0.712	0.094
Phosphorus (P)	0.010	0.003
Sulphur (S)	0.026	0.015
Potassium (K)	0.201	0.115
Calcium (Ca)	0.146	0.108
Titanium (Ti)	0.153	0.683
Vanadium (V)	0.015	0.097
Chromium (Cr)	0.137	1.152
Manganese (Mn)	0.433	2.640
Iron(Fe)	66.247	390.017
Nikel (Ni)	0.053	0.170
Copper (cu)	0.069	0.270
Oxygen (O)	30.756	-

XRF of Raw Mandura After Shodhan procedure :-

Element	**Mass %**			**Intensity** (cps/µA)		
	A batch	**B**	**C**	**A**	**B**	**C**
Aluminium (Al)	5.782	5.653	6.303	0.3284	0.2707	0.3951
Silicon (Si)	7.905	6.683	8.063	1.8691	1.3382	2.0841
Phosphorus (P)	-	-	-	-	-	-
Sulphur (S)	1.065	1.482	1.415	0.9937	1.1922	1.4367
Potassium (K)	4.280	5.289	4.764	4.5504	4.7772	5.4626
Calcium (Ca)	3.170	2.827	3.043	4.5697	3.3804	4.6812
Titanium (Ti)	0.502	0.583	0.512	3.5406	3.2111	3.8614
Vanadium (V)	-	-	--	-	-	-
Chromium (Cr)	0.130	0.138	-	1.6061	1.4335	-
Manganese (Mn)	0.286	0.290	0.277	3.9489	3.3516	4.1594
Iron(Fe)	41.171	42.025	39.394	512.7308	437.1376	538.9868
Nikel (Ni)	-	-	-	-	-	-
Copper (cu)	0.080	0.062	0.100	0.9367	0.6108	1.3187
Oxygen (O)	35.631	O35.008	35.911	-	-	-

Specific observations during Marana Process :-

Puta	Observation		
	Batach A	**B**	**C**
1st	Colour of pallets became Greyish Black after puta. Cracks on sharava.	Intact sharava. All pallets was also as it is in brown colour.	Colour of pallets became Greyish Black after puta.
2nd	Some pellets were broken. Cracks were seen on pellets.	Colour of pallets became Greyish Black after puta.	Cracks on Sharava. Some pellets were broken. Cracks were seen on pellets.
3rd	Same as above	Same as above	Same as above
4th	Pellets became harder than earlier puta.	Pellets became harder than earlier puta	Pellets became harder than earlier Puta
5th	The Mandura become soft and fine powder of Mandura obtained. Metallic shinning was not seen on the surface of pellets	The Mandura become soft and fine powder of Mandura obtained. Metallic shinning was not seen on the surface of pellets	The Mandura become soft and fine powder of Mandura obtained. Metallic shinning was not seen on the surface of pellets
6th	Pellets became very fragile. Colour of Mandura became dark violet.	Same as above	Pellets became very fragile. Colour of Mandura became dark violet.
7th	Some pellets were broken. Pellets Became very fragile. Colour of Mandura Bhasma became brown.	Pellets became very fragile. Colour of Mandura became dark voilet.	Some pellets were broken. Pellets Became very fragile. Colour of Mandura Bhasma became brown.
8th	Same as above	Same as above	Same as above
9th	Same as above	Same as above	Same as above
10th	Mandura Bhasma became Raktavarnasadrushya (dark red) colour.	Mandura Bhasma became Raktavarnasadrushya (dark red) colour.	Mandura Bhasma became Raktavarnasadrushya (dark red) colour.

The Results of wt. loss during after Marana process:-

	Batch A	**Batch B**	**Batch C**
Initial wt. (gm)	250 gm	250gm	250gm
Final wt (gm)	232gm	235gm	230gm
Total loss	18 gm	15 gm	20gm
Percentage Loss	7.2%	6%	8%

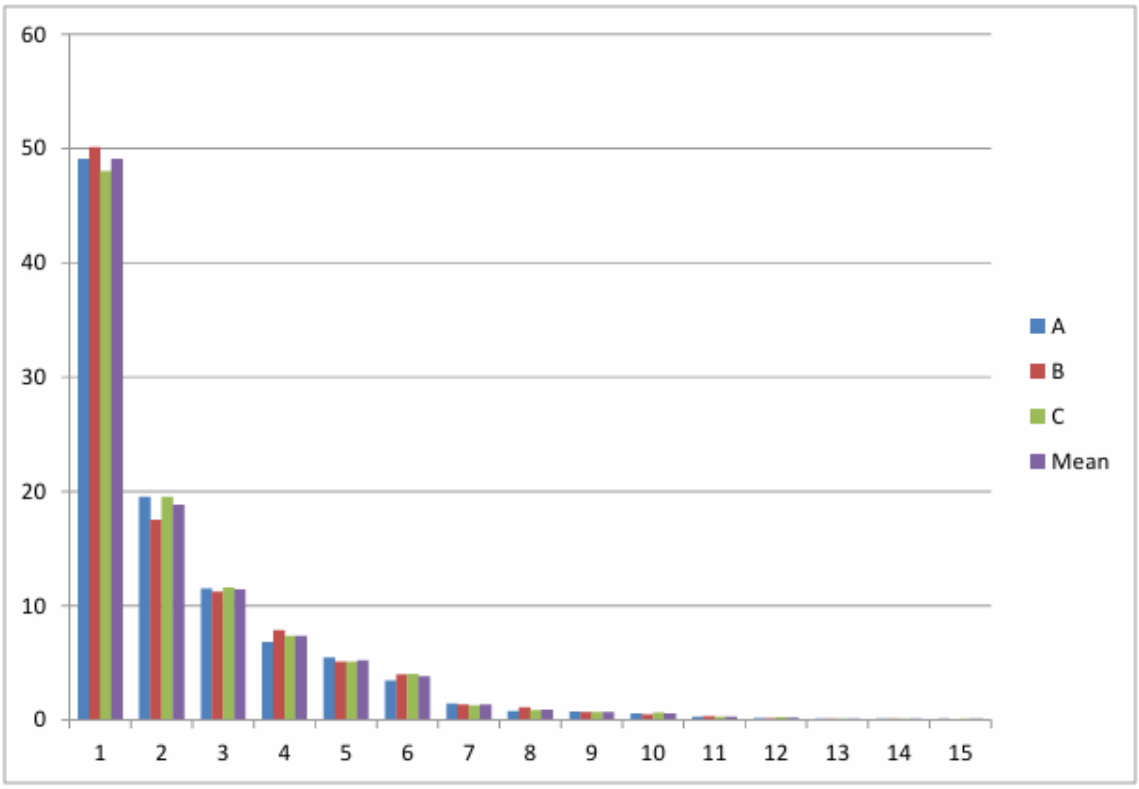
XRF of Mandura bhasma:-

Component	Mass %		
	Batch A	**Batch B**	**Batch C**
Fe_2O_3	52.8	51.7	52.8
SiO_2	22.5	20.8	21.9
Al_2O_3	12.9	13.0	12.5
CaO	4.92	4.93	4.86
MgO	3.05	3.42	3.13
K_2O	1.73	3.39	2.39
TiO_2	0.739	1.25	0.724
P_2O_5	0.654	0.717	0.724
MnO	0.302	0.295	0.307
SO_3	0.164	0.202	0.256
Cr_2O_3	0.125	0.135	0.198
ZnO	0.122	0.102	0.133
CuO	0.0940	0.0698	0.122

XRF of Manduravajravataka:-

Component	Mass %			Mean	SD	RSD
	A	B	C			
Fe_2O_3	49.1	50.1	48.0	49.067	0.858	0.017
SiO_2	19.5	17.5	19.5	18.833	0.943	0.05
Al_2O_3	11.5	11.2	11.6	11.433	0.17	0.015
K_2O	6.80	7.84	7.37	7.337	0.425	0.058
CaO	5.46	5.06	5.10	5.207	0.18	0.035
MgO	3.45	3.97	4.01	3.81	0.255	0.067
Cl	1.44	1.33	1.28	1.35	0.067	0.05
P_2O_5	0.775	1.10	0.825	0.9	0.143	0.159
TiO_2	0.731	0.699	0.685	0.705	0.019	0.027
SO_3	0.533	0.480	0.660	0.558	0.076	0.135
MnO	0.295	0.301	0.282	0.293	0.008	0.027
ZnO	0.142	0.146	0.235	0.174	0.043	0.246
Cr_2O_3	0.125	0.135	0.132	0.131	0.004	0.032
Co_2O_3	0.123	0.114	0.122	0.12	0.004	0.034
CuO	0.103	0.07214	0.115	0.097	0.018	0.187

*SD= standard Deviation RSD = Relative standard Deviation



ANALYTICAL TESTS ON MORDERN PARAMETERES :-

LOD % Mean , Standard deviation and relative standard deviation of Mandura bhasma

A	B	C	Mean	SD	RSD
1.648	1.847	1.246	1.58	0.25	0.158

LOD % Mean , Standard deviation and relative standard deviation of Manduravajravataka:

A	B	C	Mean	SD	RSD
6.936	10.552	4.425	7.304	2.515	0.344

Ash value % Mean , Standard deviation and relative standard deviation of Mandura bhasma:

A	B	C	Mean	SD	RSD
99.95	99.75	99.65	99.783	0.125	0.001

Ash value % Mean, Standard deviation and relative standard deviation of manduravajravataka:

A	B	C	Mean	SD	RSD
69.215	63.31	72.482	68.336	3.796	0.056

Water soluble ash value % Mean , Standard deviation and relative standard deviation of Mandura bhasma:

A	B	C	Mean	SD	RSD
0.647	0.299	1.29	0.745	0.411	0.551

Water soluble ash value% Mean , Standard deviation and relative standard deviation of manduravajravataka :-

A	B	C	Mean	SD	RSD
4.197	3.688	4.336	4.074	0.279	0.068

Acid insoluble ash value % Mean , Standard deviation and relative standard deviation of Mandura bhasma :

A	B	C	Mean	SD	RSD
99.3	98.75	98.35	98.8	0.389	0.004

Acid insoluble ash value % Mean , Standard deviation and relative standard deviation of Manduravajravataka :

A	B	C	Mean	SD	RSD
65.685	62.643	71.293	66.54	3.583	0.054

The Results of pH – Manduravajravataka:-

Batch	By Strip method	By electrode method
Batch A	8	7.26
Batch B	8	7.58
Batch C	8	7.66

Alcohol soluble extractive % Mean , Standard deviation and relative standard deviation of **Manduravajravataka:-**

A	B	C	Mean	SD	RSD
12.32	29.84	13.68	18.613	7.958	0.428

Water soluble extractive % Mean , Standard deviation and relative standard deviation of **Manduravajravataka:**

A	B	C	Mean	SD	RSD
18.88	15.44	17.36	17.227	1.408	0.082

Organoleptic test :

Test	Raw Mandura	Mandura bhasma	Manduravajravataka
Colour	Black	Brown	Brown
Odour	Metallic	Odourless	Teste Gomutra Gandhi

Teste	Metallic	Testless	Bitter
Touch	Rough	Smooth	Smooth

DISCUSSION:-

Vataka kalpana is one of the useful kalpana mentioned in Rasashashtra. But till date no specific study has been done on standardization of any vataka, hence present study enlightens the Vataka Kalpana, so that Manduravajravataka was prepared. In this study Manduravajravataka prepared by specific Marana procedures of Mandura Bhasma which are mentioned in Rasamruta. The current study was aimed to develop standard manufacturing process of a herbomineral formulation in form of Vataka. In this chapter, the observations and results obtained during the study has been discussed with scientific reasoning.[6,7,8]

This study was done under following headings: -

PHARMACEUTICAL STUDY:

1. Collection of Raw Drugs
2. Shodhana of Mandura

Changes during Shodhana process (Nirvapana) After heating, immediate cooling in liquid media leads to decrease in tension and increase in compression force,and also gomutra contains high amount of kshara to which additional kshara was added and Mandura were dipped in the Gomutra kwathith triphala kwath. Repetition in heating and cooling cause ‘s disruption in compression tension equilibrium leads to increased brittleness, reduction in hardness and finally reduction in the particle size. During red hot state some metals react with atmospheric oxygen and compounds are formed on the surface. During red hot state of the metals and minerals volatile chemical impurities like Nikel are removed completely. Iron when heated to red hot, reacts with atmospheric oxygen or steam to form ferroso-ferric oxide $(Fe_3O_4)_3$, copper furnishes in moist air and converted to basic copper sulphate, which on red hot state is completely decomposed to cupric oxide (black oxide of copper).

Marana of Mandura:-

Heating during Putapaka causes linear expansion of both the metal and the compound but the expansion of metal and compound are different. And this difference in the linear expansion leads to separation of the compound from the metal, causing exposure of the metallic part which facilitates further change. Repetition of this process leads to reduction in particle size and fineness of the particles. After Marana, the metals generally convert to their compound form, which are biologically favourable to the body.

Manduravajravataka Nirman:[9.10]-

Manduravajravataka Nirman was done according to reference of Yogaratnakara by taking 5 gm each of the herbal material and mandura Bhasma was taken in quantity of 90 gm. These procedures were subjected in gomutra 720ml and reduced until it became vataka consistency by water bath method to avoid overheating. This mixture was cooled then approx. 10 gm vataka was prepared and dried in shade then preserved in airtight container. All this procedure repeated for other 2 batches also.

Analytical Study :-

Classical analytical parameters

Mandura Bhasma was raktavarna (reddishblack) in colour. Manduravajravataka was tikta, katu, kashaya rasa, has specific (Gomura Gandhi) odour.

Modern Analytical Parameters:-

1. Loss on drying
2. pH Estimation
3. Uniformity of weight
4. Tablet Hardness test
5. Friability test for tablets
6. Tablet Disintegration Time
7. Ash value
8. Acid insoluble ash
9. Water soluble ash
10. Water soluble extractive
11. Alcohol soluble extractive
12. TLC (Thin layer chromatography)
13. XRF
14. ICP- AES Qualitative Analysis Report

CONCLUSION: -

Manduravajravataka from Yogaratnakara, _Pandurog adhikar', was selected as study formulation amongst 2 available references.

1. Authenticated ingredients like panchkola, triphala, musta, vidanga, devdaru enhance the standard of the formulation.

2. Gomutra bhavit triphala kwath prepared as per the classical reference, was obtained of desired quality and was fulfilling the standards.

3. From the results of analytical and classical testing, it was clearly observed that after purification, level of toxic elements like Nikel and vanadium in Mandura were totally absent and Chromium and copper were significantly decreased by the process of shodhana, hence improving the quality and potency of the drug.

4. By the process of marana as per the references of Rasamruta the Mandura bhasma was obtained after 10 gajputa of desired standard. The procedure proves convenient, time and money saving and attaining optimum standard.

5. Fresh Kumari swarasa used for bhavana ultimately increases the potency of the drug.

6. Mandura bhasma , other mentioned herbal drugs and gomutra were mixed together in specific ratio and reduced till the consistency required to make Vataka.

7. After following the procedure mentioned in Yogaratnakara pandurog adhikara, Manduravajravataka is obtained with desired standards.

8. Manduravajravataka is Kashay, katu, tikta rasatmak, ushna viryatmak and of madhur vipaka.

9. In XRF calcium and iron elements was increased in mandura bhasma and also increased in final product.

10. Granthakara might have mentioned the Vataka formulation to maintain the specific dose of the same.

11. According to this study standard formulation 'Manduravajravataka' can be prepared and it can be used in Vataka form to meet the view of Granthakara regarding the specific dose, yet there is a scope for further study to prove this specific dose.

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