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A comparative SEM- EDX Analysis of *Swayamagni Rasa* by *Dhanyarashi* and *Putapaka* method

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ABSTRACT

Introduction: *Swayamagni Rasa* is the herbo-mineral preparation were in, self generated heat transforms particle size from *Loha Churna* into *Bhasma* form. The present trend of preparation of *Bhasma* is by *Putapaka* method by using cow dung cakes. Here the *Niragni* method of *Loha Marana* was carried out along with the *Putapaka* method to Analyse the Physico-chemical changes, and are been compared with respect to its Pharmaceutical and Analytical parameters. **Methods and Materials:** *Swayamagni Rasa* was prepared according to the reference of *Rasa Chintamani*, other methods adopted were *Shodhana* of *Parada*, *Shodhana* of *Ghandaka*, Preparation of *Dwiguna Kajjali, Samanya Shodhana, Vishesha Shodhana,* Preparation of *Swayamagni Loha Bhasma* by *Dhanyarashi* and *Putapaka* method. Physico-chemical Analysis and Instrumental analysis was done for the samples of *Swayamagni Rasa* by *Dhanyarashi* and *Putapaka* method. **Results:** The Physico-chemical analysis of *Swayamagni Rasa* by *Dhanyarashi* and *Putapaka* method gave significant result. SEM-EDX of *Swayamagni Rasa* by *Dhanyarashi*, *Putapaka* method showed the weight and atomic percentage of elements present and its particle size. **Conclusion:** The samples of *Swayamagni Loha Bhasma* by *Dhanyarashi* Method and one sample of *Putapaka* method passed the *classical Bhasma Pareeksha*, that is *Rekha purnatha,Varithara, Nishchandratwa* and *Unama*. Also, elemental analysis of all these four samples of *Swayamagni Rasa* and sample of *Putapaka* shows reduction in the particle size ranging with in nanometer scale. The *Niragni* method of preparation of *loha Bhasma* pharmaceutically and Analytically showed the equivalent results. Further it can be taken up for Animal, Clinical studies to evaluate the efficacy.

Key words: *Swayamagni Rasa, Marana, Niragni, Loha Bhasma, Puta, Dhanyarashi.*

INTRODUCTION

Ayurveda is the science of life aiming to achieve healthier life Physically, Mentally and Spiritually.[1] Rasashastra is a special branch of Ayurveda where in different Herbs, Mineral and Metals are used in various formulations.

In this science, the drugs from different Mineral and Metallic groups i.e *Maharasa*, *Uparasa* etc. are subjected to different pharmaceutical procedures like *Shodhana*, Marana, *Amritikarana* which converts it from toxic to non-toxic, making it more potent and effective in smaller doses, palatable, quick in action and shorter duration of administration,[2] when compared to herbal formulations. Thus, the evolution of *Rasaushadhis* came into existence and presently it has become the main stream of Ayurvedic system of medicine. *Bhasma* is one such formulation, which should be enlightened from the toxicological point of view. Now-a-days, Identity of these medicines on the basis of modern Analytical techniques has become essential for its recognition and acceptance. Here an

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attempt has been made to apply this theory of *Marana* through the preparation of *Swayamagni Loha Bhasma* by *Dhanyarashi* and *Putapaka* method.

Swayamagmi Rasa[2] is the Herbo-Mineral preparation, were self-generated heat, transforms particle size of *Loha* from *Churna* into *Bhasma*. The present trend of preparation of *Bhasma* is through *Putapaka* method by using cow dung cakes. Here the *Niragni* method of *Loha* Marana is carried out along with the *Putapaka* method, to Analyse the Physico-Chemical changes and are been compared with respect to its pharmaceutical and Analytical parameters. The Physico Chemical evaluation is essential to ascertain the Chemical composition, Elemental analysis and the External morphology of the Metallic Medicines.

Materials and Methods

This involves the following procedures

a) *Samanya Shodana* of *Loha*.[3]

b) *Vishesha shodana* of *Loha*.[4]

c) Preparation of *Dviguna Kajjali*.[5]

d) *Marana* of *Loha* (by 2 methods)

1. Swayamagni Rasa by Dhanyarashi Method.[2]
2. Swayamagni Rasa by Putapaka Method.[6]

Name of the Practical: *Samanya shodana* of *Loha*.

Reference: *R.T 15/4-6*

Date of preparation: 10/12/2018

Date of completion: 09/01/2019

Instruments:

- Iron vessel
- Steel vessel
- Spatula
- Cloth
- Gas stove
- Strainer

Ingredients: *Ashuddha Loha* (Iron fillings): 750g

Liquid Media: Q.S

Media

- *Kanji*
- *Takra*
- *Kulattha Kwatha*
- *Gomutra*
- *Tila taila*

Procedure

- *Ashudda Loha* (Iron fillings) was taken in an Iron vessel and was heated in *Teevra Agni*, till it became red hot.
- It was then quenched in specific liquid media placed in a stainless steel vessel.
- After cooling down, *Loha* was taken out from the vessel and again put in the Iron vessel and heated till it becomes red hot. This process was repeated 3 times in each media.
- Temperature of *Loha* during red hot state was noted.
- Weight of the *Loha* was measured repeatedly.
- Time taken for each process was noted.

Observations

Table 1: Tabulation of changes observed during the *Nirvapa* in *Kanji*

SN	*Nirvapa Dravya*	Loss after each *Nirvapa*	Time taken for red hot	Changes in *Loha*	Changes in media
1.	*Kanji*	750g	30min	Took long duration for heating. Colour of *Loha* changed from	The smell of kanji was evident during quenching. Colour of *kanji* changed from white to brown. The temperature of *kanji* was
2.	*Kanji*	748g	30min		

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3.	*Kanji*	745g	28min	brown to black. *Loha* became little brittle.	increased after quenching of Iron fillings into it. *Kanji* became viscid and slimy after *Shodana.*

Table 2: Tabulation of changes observed during the *Nirvapa* in *Takra*

SN	*Nirvapa Dravya*	Loss after each *Nirvapa*	Time taken for red hot	Changes in *Loha*	Changes in media
1.	*Takra*	745g	28 min	*Loha* took comparatively less time to become red hot. Colour of *Loha* turned black. *Loha* turned brittle. Some part of *Loha* turned into coarse powder form. Prominent cracks were observed on the surface of Iron fillings.	Foul smell was felt during quenching. Colour of the media changed from white to greyish. *Takra* came out from the vessel while quenching. *Takra* split into solid and liquid parts during quenching and solid part settled down at the bottom of the vessel.
2.	*Takra*	740g	26min		
3.	*Takra*	738g	24min		

Table 3: Tabulation of changes observed during the *Nirvapa* in *Kulatha Kwatha.*

SN	*Nirvapa Dravya*	Loss after each *Nirvapa*	Time taken for red hot	Changes in *Loha*	Changes in media
1.	*Kulatha kwatha*	738g	20 min	Colour of *Loha* turned from blackish brown to	*Kulatha* smell was appreciated during quenching. Sound and
2.	*Kulatha kwatha*	735g	20min	deep brown. Iron fillings were more brittle. *Loha* turned more into coarse powder form. *Loha* started getting stuck to the ladle. Some powder flew away from the vessel as vapour while quenching.	fumes were more observed during *Nirvapa.* *Kulatha Kwatha* became brown to bluish brown in colour. Its consistency became thicker.
3.	*Kulatha Kwatha*	729g	16min		

Table 4: Tabulation of changes observed during the *Nirvapa- Gomutra*

SN	*Nirvapa Dravya*	Loss after each *Nirvapa*	Time taken for red hot	Changes in *Loha*	Changes in media
1.	*Gomutra*	725g	14min	Iron filings were turned in to *Loha Churna, Churna* turned finer. *Loha* was dark brown in colour *Loha* took considerably less time to become red hot. *Gomutra* smell was appreciated	*Gomutra* colour changed from light yellow to dark brown. Comparatively more Sparkles were observed during quenching. A pungent smell was coming out during quenching. Media took longer time

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				in *Loha*. *Loha* was more brittle	for cooling.

Table 5: Tabulation of changes observed during the *Nirvapa-TilaTaila*

SN	***Nirvapa Dravya***	**Loss after each *Nirvapa***	**Time taken for red hot**	**Changes in *Loha***	**Changes in media**
1.	*Tilataila*	719g	10 min	Colour of *Loha* was completely black. Metallic lustre of *Loha* was lost. *Loha* got fire while heating. Cracks were seen on the surface of *Loha*. Brittleness was increased. *Loha* turned completely into coarse powder form. It took 10 minutes to get completely red hot.	Colour of oil turned light brown in colour. Oil became viscid after *Shodana*. A pungent smell and black fumes was observed after quenching.
2.	*Tilataila*	744g	13min		
3.	*Tilataila*	742g	16min		

Precaution

- *Loha* had to be heated in *Teevra Agni*, in order to become red hot.
- The red hot state had to be perceived accurately.
- It was poured carefully into each media to prevent loss.
- *Loha* was allowed to cool down after quenching.
- After quenching, collection of *Loha* was done carefully.

Results

- Total Quantity - 750g.
- Loss - 180g.
- Quantity after *Shodana* - 600g.

Name of the Practical: *Vishesha Shodana* of *Loha*

Reference: *Rasamritam*

Date of Preparation: 01/02/2019

Date of Completion: 15/02/2019

Instruments

- Iron vessel
- Steel vessel
- Spatula
- Cloth
- Gas stove
- Strainer

Ingredients

- *Shoditha Loha Churna* : *600* gm
- *Triphala Kashaya* : 14 liters

Procedure

- Same as *Samanya Shodana* of *Loha* (*Nirvapa* in *Triphala Kashaya* 7 times)

OBSERVATIONS

Table 6: Tabulation of changes observed during the *Nirvapa- Tripahala Kwatha*

SN	***Nirvapa* Dravya**	**Loss after each *Nirvapa***	**Time taken for red hot**	**Changes in *Loha***	**Changes in media**
1.	*Triphala*	600g	17m	A reddish texture was observed	Colour of decoction turned
2.	*Triphala*	593	15m		

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3.	*Triphala*	587	12m	over *Loha* during red hot state. A crackly sound came out while heating till it became red hot. Small particles of *Loha* got attached to the Iron pan. Powder of *Loha* was formed as vapour while quenching. Colour of *Loha* turned blacker.	blackish brown. *Kashaya* started to boil during quenching. *Kashaya* overflowed from the vessel.
4.	*Triphala*	574g	10m		
5.	*Triphala*	560g	10m		
6.	*Triphala*	542g	8m		
7.	*Triphala*	536g	7m		

Precautions

Similar to *Samanya Shodana* of *Loha*.

Results

Total Quantity - 600g.

Loss - 64g.

Quantity after Vishesha *Shodana* - 536g.

Name of Practical : *Dwiguna Kajjali* preparation

Reference : R.T 6/107

Date of preparation : 03/5/2018

Date of completion : 10/11/2018

Duration : 140 days

Instruments

- *Khalva Yantra*
- Weighing Balance
- Spoon

Ingredients

- *Shuddha Parada* : 250gm
- *Shuddha Gandhaka* : 500gm

Procedure

- *Shodita Parada* and *Shodita Gandhaka* were taken in equal quantity.
- It was then triturated in a *Khalva Yantra*.
- The mixture of *Shuddha Parada* and *Shuddha Gandhaka* turned greyish.
- During the process of trituration, few drops of water was sprinkled over the powder for preventing it from spilling.
- Trituration was continued till the powder became greyish black in colour.
- To this mixture, again 250g of *Gandhaka* was added and Mardhana was continued till the mixture became fine.
- The test for *Sushlakshnata, Rekapurnata, Nischandratva, Varitaratwa* of *Kajjali* was analysed and stored.

OBSERVATIONS

- The mixture was easy to triturate as it was in Course powder form.
- The *Parada* and *Gandhaka* got mixed up completely.
- *Parada* globules disappeared.
- Gradually colour change from greyish to jet black was observed.
- The *Kajjali* was becoming fine and softer
- *Kajjali* fulfilled the *Nischandratva*, *Rekhapurnata*,*Varitara* tests.
- *Kajjali* formed was very fine, smooth & lustreless.

Precautions

- To prepare *Kajjali, Gandhaka* should always be taken in fine powder form.

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- Trituration should be done slowly and carefully to prevent the loss.
- Few drops of water should be sprinkled over *Kajjali* to prevent spillage during trituration.
- *Khalva* should be kept covered when the process is not in progress.

Results

- No. of days taken : 140days
- Total time taken for preparation of *Kajjali* : 82hrs
- Weight of *Kajjali* obtained : 695gm
- Total wt. loss : 55gm.

Marana of *Loha*

Name of the Practical : *Swayamagi Rasa by Dhanyarashi Method*

Reference : *Rasa.chinthamani* 9/25

Date of Preparation : 11/03/2019

Date of Completion : 05/04/2019

Instruments

- Copper vessel
- Spatula
- Cloth
- *Khalva yantra*
- *Dhanyarashi*
- Thread

Ingredients

Dviguna Kajjali - 20g

Samanya vishesha shodhita Loha Churna - 20g

Bhavana Dravya - Kumari Swarasa (Q.S)

Prakshepaka

Triphala

Trikatu

Jatipahala

Ela and *Lavanga* = all ingredients equals to 10g

Procedure

- The *Dviguna Kajjal*i was taken and added with *Shuddha Tikshna Loha Churna* in a clean *Khalva Yantra*.
- The ingredients are given *Bhavana* with quantity sufficient *Kumari Swarasa*.
- The *Mardana* is continued and the mixture is rolled it into 2 *Golakas*.
- The *Golakas* were wrapped using *Eranda Patra* and tied with the thread.
- The tied *Golakas* are kept in copper vessel and closed with *Eranda Patra*.
- This copper vessel was kept under sunlight for 6hrs.
- The copper vessel was shifted into *Dhanyarashi*, and kept for 8 days.
- The 9th day, the Copper vessel was taken out of *Dhanyarashi* and weighed.
- The *Golaka* was powdered in *Khalva yantra* and seived with the seiver.
- The fine *Churnas* of *Prakshepaka* were added and stored.

OBSERVATIONS

Table 7: Tabulation of changes observed in *Swayamagni Loha Bhasma*

SN	Parameters		Observations	
1.	Colour		Blakish colour	
2.	Touch		Very Soft and fine	
3.	Weight after *Bhavana*,		60g (2 *Golaka*)	
			1st	2nd
4.	Weight after taking off from *Dhanyarashi*		21g	22g
5.	Temperature when kept	Morning (10am)	34°C	36°C

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	for 6hrs under sunlight	Afternoon (2pm)	44.3°C	43°C
		Evening (5pm)	36°C	35.3°C

- After keeping in sunlight, the leaves of *Eranda* were dried completely.
- After removing from *Dhanyarashi*, the *Eranda* smell was appreciated.
- During powdering of *Golaka*, the *Eranda* smell was more felt.
- After the addition of *Prakshepaka*, the smell of *Prakshepaka* was also appreciated.
- The temperature of *Tamra paatra* was 42^0C degree while taking it out of *Dhanya Rashi.*
- The powder obtained was very soft and black is colour.
- The *Rekhapurna, Varithara* and *Unama* test was also passed.

Precautions

- The wrapping of *Eranda Patra* to be done properly and tightly or else mixing of *Dhanyarashi* with *Golaka* might take place.
- The *Golaka* with *Tamra Paatra* should be kept in the hot sun to serve the purpose.
- The mixing of *Prakshepaka* should be done properly.

Result

Total quantity taken:40g

Total quantity obtained:37

Loss:3g

Name of the Practical : *Swayamagi Rasa* by *Putapaka* Method

Date of Preparation: 21/02/2019

Date of Completion: 12/04/2019

Instruments

- *Sharava* 2 in no
- Spoon
- *Khalva Yantra*
- Plate
- Gloves
- Muffle Furnace
- *Vastra*
- Multani mitti

Ingredients

Table 8: Tabulation of Ingredients and Quantity of *Swayamagni Rasa-Putapaka*

Ingredients	*Dwiguna Kajjali* - 75g
	Samanya Vishesha Shodhita Loha Churna - 75
Bhavana dravya	*Kumari Swarasa* - q.s
Prakshepaka	*Triphala, Trikatu, Jatipahala, Ela, Lavanga* = all ingredients equals to 25g

Procedure

- The *Dwiguna Kajjali* was taken and added with *Shuddha Tikshna Loha Churna* in a clean *Khalva Yantra.*
- The ingredients were given *Bhavana* with quantity sufficient of *Kumari Swarasa*.
- The *Mardana* is continued and made into *Chakrika*.
- The *Chakrikas* were dried and placed in *Sharava* and 7 layers of *Sandhibandhana* was done.
- The *Gaja Puta* was given initially by classical method, and later the procedure was continued in muffle furnace.
- The temperature was noted simultaneously.
- *Sharava* was left for self cooling.
- The next day, the *Sharavas* were taken out and the sample was weighed.
- The procedure was repeated till the *Rekhapurnata, Nischadratva* and *Varitara Laxanas* obtained.

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- The final product was powdered, seived and added with *Prakshepaka*, then stored.

OBSERVATIONS

Table 9: Tabulation of changes during *Putapaka*

No. of *Putas*	Media *(Kumari Swarasa)* ml	Weight of *Chakrika* (g)	Initial weight (g)	Final weight (g)	Loss (g)
1.	118	172	150	136	14
2.	118	156	136	133	3
3.	114	153	133	131	2
4.	116	153	131	130	1
5.	113	151	130	122	8
6.	116	137	122	120	2
7.	112	142	120	119	2
8.	109	136	119	117	2
9.	97	133	117	109	8
10.	95	125	109	104	5
11.	92	120	104	102	2
12.	92	123	102	99	3
13.	87	121	99	97	2
14.	84	118	97	96	1
15.	84	115	96	94	2
16.	80	111	94	88	6
17.	80	103	88	82	6

- After successive *Puta*, the colour of *Loha* changed drastically.
- There was drastic change in the consistency of the material after each *Puta*.
- While giving *Bhavana*, self-generated heat was noticed.
- The *Bhavana* given for longer duration, the material seemed to be more fine and soft after *Puta*.
- After each *Puta* in the end stages, the material started becoming *Rekhapurna* and there seemed to be more wastage while preparing *Chakrikas*.
- All *Bhasma Lakshanas* were observed by the end of 17th *Puta*.

Table 10: Tabulation of changes before and after *Putapaka*

No.of *Puta*	Before *Puta* with *Bhavana Dravya*	After *Puta* without *Bhavana* dravya
1.	*Loha Churna* was blackish in colour	Pellets – blackish in colour
2.	Mixture was rough to touch After *Bhavana, Chakrikas* were easy to prepare	Pellets - *Colur* of *Loha Churna* turned to blackish brown
3.	Heat generation during trituration was observed Rough to touch	Pellets – were blackish brown in colour
4.	Reduction in roughness *Chakrika* could made easily made. After *Bhavana*, mixture started getting lighter	Pellets – light brownish in colour
5.	Reduction in roughness Chakrika could made easily made. After *Bhavana*, mixture	Pellets – light brownish in colour Pellets were dried early.

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	started getting lighter	
6.	Reduction in roughness *Chakrika* could made easily made. After *Bhavana*, mixture started getting lighter	Pellets – colour changed to light maroon *Rekhapurnata* (+)
7.	*Churna* was becoming Softer *Chakrika* could made easily made. After *Bhavana*, mixture started getting lighter	Pellets – light maroon in colour *Rekhapurnata* (+)
8.	*Churna* was becoming Softer *Chakrika* could made easily made. After Bhavana, mixture started getting lighter	Pellets –light maroon in colour *Rekhapurnata* (++)
9.	*Churna* was becoming Softer *Loha Churna* was very sticky so that it was very difficult to make *Chakrikas*. After *Bhavana*, mixture started getting lighter Quantity of *Bhavana* dravya reduced	Pellets – externally and internally brownish colour was observed. *Rekhapurnata* (+++) *Varitara* – little part of *Loha Churna* was started floating
10.	*Churna* was becoming Softer *Loha Churna* was very sticky so that it was very difficult to make *Chakrikas*. After *Bhavana*, mixture started getting lighter Quantity of *Bhavana* dravya reduced Duration of giving *Bhavana* reduced	Pellets –brownish colour was observed through out. *Rekhapurnata* (+++) *Varitara* – little part of *Loha Churna* was started floating
11.	*Churna* was becoming Softer *Loha Churna* was very sticky so that it was very difficult to make *Chakrikas*. After *Bhavana*, mixture started getting lighter Quantity of *Bhavana* dravya reduced Duration of giving *Bhavana* reduced	Pellets –the colour started getting darker. *Rekhapurnata* (+++) *Varitara* – around 30% of *Loha Churna* was floating
12.	*Loha Churna* was very sticky such that it was very difficult to make *Chakrikas*. Quantity of *Bhavana Dravya* reduced Duration of giving *Bhavana* reduced	Pellets –the colour started getting darker. *Rekhapurnata* (+++) *Varitara* – around 50% of *Loha Churna* was floating
13.	*Churna* was becoming Softer *Loha Churna* was very sticky so that it was very difficult to make *Chakrikas*. After *Bhavana*, mixture started getting lighter Quantity of *Bhavana* dravya reduced Duration of giving *Bhavana* reduced	Pellets –the colour started getting darker and a purple tinge was observed. *Rekhapurnata* (+++) *Varitara* – around 70% of *Loha Churna* was floating
14.	As *Chakrikas* were difficult to prepare, *Churna* was placed in *Sharava* and subjected to *Puta*. Loss was more as *Churna* was stickier. Mixture was fine and soft	Pellets –purple tinge was more observed. *Rekhapurnata* (+++) *Varitara* – around 70% of *Loha Churna* was floating
15.	As *Chakrikas* were difficult to prepare, *Churna* was placed in *sharava* and subjected to *Puta*. Loss was more as *Churna* was stickier.	Pellets –completely dark brown and purplish colour *Rekhapurnata* (+++) *Varitara* –maximum particles of *Loha Churna*

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	Mixture was very fine and soft	was floating
16.	As *Chakrikas* were difficult to prepare, *Churna* was placed in sharava and subjected to *Puta*. Loss was more as *Churna* was stickier. Mixture was very fine and soft	Pellets –completely dark brown and purplish colour *Rekhapurnata* (+++) *Varitara* – complete *varitara* was observed.
17.	Colour and softness remained the same.	Pellets –completely dark brown and purplish colour *Rekhapurnata* (+++) *Varitara* – complete *varitara* was observed.

Precautions

- *Shuddha Loha* and *Kajjali* has to be triturated well with *Kumari Swarasa*, so that it get mixed homogenously.
- Hence, once *Rekhapurnata* was observed, *Chakrikas* weren't made to avoid wastage.

Results

- Total Quantity -150g
- Loss-82g
- Quantity after *Shodana*- 68g

RESULTS

Physico-chemical analysis report

Table 11: Physico-chemical analysis report of *Swayamagni Rasa - Dhanyarashi Method*

SN	Parameters	Sample-SD
1.	Solubility	1.2%
2.	Ash Value	96.8%
3.	Acid insoluble Ash	88.7%
4.	Water insoluble Ash	86.4%
5.	Bulk Density	1.164gm/ml
6.	Loss on Drying @105°C	1.90%
7.	pH	4.2

Table 12: Physico chemical analysis report of *Putapaka* Method

SN	Parameters	Sample-SP
1.	Solubility	1.2%
2.	Ash Value	98.8%
3.	Acid insoluble Ash	89.3%
4.	Water insoluble Ash	87.2%
5.	Bulk Density	1.178gm/ml
6.	Loss on Drying @105°C	1.20%
7.	Ph	3.9

SEM-EDX analysis report

Table 13: SEM-EDX of *Swayamagni Rasa* by *Dhanyarashi* method

Element	Weight %	Atomic %
C L	0.41	1.24
O K	20.14	33.79
Mg K	1.03	1.24
Al K	0.00	0.00
Si K	1.09	1.18
S K	3.69	5.36
Mn K	0.02	0.02
Fe K	70.92	56.05
Zn K	0.00	0.00

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As L	0.00	0.00
Ag L	0.00	0.00
Cd L	0.00	0.00
Hg M	2.70	1.12

- In elemental analysis of *Swayamagni Rasa* by *Dhanyarashi* method there was presence of Sulphur and Mercury.
- Mercury weight % is 2.76 and atomic % is 1.12.
- Sulphur weight % is 3.69 and atomic % is 5.36.
- Iron weight % is 70.92 and atomic % is 56.05.
- Oxygen weight % 20.14 and atomic % is 33.79.
- Carbon weight % 0.41 and atomic % is 1.24%.
- The particles present in the preparation were clearly distinctive.
- The particle size were clearly analysed and were in the range of 411.2 to 432.6 nm at a magnification of 10.00 K X.
- The particle size were clearly analysed and were in the range of 173.3nm to 294.8nm at a magnification of 20.00 K X.
- The particle size were clearly analysed and were in the range of 215.7 nm to 244.1nm at a magnification of 30.00 K X.

Table 14: SEM-EDX of *Swayamagni Rasa* by *Putapaka* method.

Element	Weight %	Atomic %
C L	0.00	0.00
O K	26.23	38.78
Mg K	1.24	1.96
Al K	0.00	0.00
Si K	1.08	1.45
Mn K	0.02	0.02
Fe K	71.43	57.79
Zn K	0.00	0.00
As L	0.00	0.00
Ag L	0.00	0.00
Cd L	0.00	0.00
Hg M	0.00	0.00

- In elemental analysis of *Swayamagni Rasa* by *Putapaka* method there was presence of Sulphur and Mercury.
- Iron weight % is 71.43 and atomic % is 57.79.
- There is no presence of heavy metals in the prepared sample of *Swayamagni* Rasa by *Putapaka* method.
- The particles present in the preparation were clearly distinctive.
- The particle size were clearly analysed and were in the range of 380.9 to 528.2nm at a magnification of 10.00 K X.
- The particle size were clearly analysed and were in the range of 249.5nm to 273.7 at a magnification of 20.00 K X.
- The particle size were clearly analysed and were in the range of 324.6nm to 333.3nm at a magnification of 30.00 K X.

SWAYAMAGNI RASA - DHANYARASHI

Bhavana with Kumari

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Golaka kept in Tamrapatra

Golaka from Dhanyarashi

Cut Surface of the Golaka

Varitara Pariksha

Unama Pariksha

SWAYAMAGNI RASA - PUTAPAKA

Kumari Swarasa

Mardana

Chakrika

Gaja Puta for Loha

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After first puta

Mardana after 8th Puta

Chakrika for 10th Puta

Product after 12th Puta

Loha Bhasma

Ingredients of Swayamagni Rasa by Dhanyarashi and Putapaka

DISCUSSION

Discussion on Physico- chemical Analysis Report of *Swayamagni Rasa by Dhanyarashi* and *Putpaka* method. (Table No. 11,12)

Solubility

The Solubility of both the samples are same that is 1.2%

Probable reason: The solubility is the property of substance which states how fast a material can dissolve, the smaller the particle is, the faster is it dissolves. 1.2% shows that both the samples are equally and easily soluble.(https://en.m.wikipedia.org)

Ash value

The ash value of *Dhanyarashi* and *Putapaka* method is 38.6 and 38.2 respectively.

Ash value is useful in determining authenticity and purity of sample and also these values are important qualitative standards. On incineration, crude drugs normally leave an ash usually consisting of

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carbonates, phosphates and silicates of sodium, potassium, calcium and magnesium. Higher Ash value indicates low quality products.

Probable Reason: Both the samples show almost similar values as both the final products contain Carbon, silica and also manganese in trace quantity, which are inorganic. By these values it is evident that both samples are authentic and pure.

Acid insoluble ash

The Acid insoluble ash of *Dhanyarashi* and *Putapaka* method is 32.6and 32.4 respectively.

Acid insoluble ash value helps in determining the contamination of product by earthy matter i.e sand mud etc.

Probable reason: The presence of inorganic matter like silica and carbon might have left behind without forming ash. By these values it is evident that both samples are genuine.

Water insoluble ash

The Water insoluble ash of *Dhanyarashi* and *Putapaka* method is 26.6 and 26.2 respectively.

Probable reason- The insoluble content are very less in both the samples, By which it is evident that both the samples are easily soluble in water. This may be because of light weight of the *Bhasmas*.

Bulk density

The Bulk density of *Dhanyarashi* and *Putapaka* method is 1.17gm/ml and 1.18gm/ml respectively.

Probable reason: the bulk density is the one which shows how compact the molecules are with each other in a given sample. The samples show significant values which means they are compact with good inter molecular bonding,

Loss on drying

The Loss on drying of *Dhanyarashi* and *Putapaka* method is 1.40% and 1.20% respectively.

Probable reason: this is mainly done to estimate the moisture content of the sample. Presence of more moisture indicates towards lesser shelf life and increased risk of microbial contamination. The samples show lesser moisture content which means they have good shelf and this may be because there are no hygroscopic substance in both the samples and no herbal drugs are added.

pH

The pH of *Dhanyarashi* and *Putapaka* method is 8.2 and 7.9 respectively.

Probable Reason: Both the samples are Basic in nature which means both are alkaline and easily soluble in water. This may be because the oxides formed in the formulations are alkaline.

Discussion on SEM-EDX Analysis report - *Dhanyarashi* method (Table No. 13)

Magnisium was found in the sample this may be because *Kumari* also has trace elements in it and by *Bhavana* procedure Mg might have incorporated.

The Carbon, Silicon, Manganese are found in trace quantity which might have formed into its oxides and may have its specific role in the body.

The presence of oxygen in the sample indicates that the final product might be in the oxide form.

The Iron might have oxidised in the presence of the atmospheric oxygen and formed into an oxide of iron.

Discussion on : SEM-EDX Analysis report - *Putapaka* method (Table No. 14)

The absence of Hg and Sulphur is indicative of its role as catalyst as explained in the classics.

The Magnesium, Silica and Manganese were present in very trace quantity which may be beneficial to the body.

The Iron along with the Presence of Oxygen might have converted in to iron oxides of iron.

Table 15: SEM-EDX Analysis report - Puta method

SN	Samples number	Resolution size	Particle size
1.	*Swayamagni Rasa* by *Dhanyarashi* method	10.00K	432.6nm 411.2nm

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		20.00K	294.8nm 173.3 nm
		30.00K	215.7nm 244.1nm
2.	*Swayamagni Rasa* by *Putapaka* method	10.00K	528.2nm 380.9 nm
		20.00K	249.5 nm 273.7 nm
		30.00K	324.6 nm 333.3 nm

- The SEM-EDX values fall under the category of fine Nano-Particles, which ranges between 100nm to 2,500nm (ref wikipedia)
- Particle size of *Bhasmas* could be analysed.
- Particle size of *Bhasmas* were in the range of nanometres, and were analysed under 10.00K, 20.00K, 30.00K resolutions respectively.

CONCLUSION

The *Swayamagni Rasa* by *Dhanyarashi* method and *Putapaka* method passed the classical *Bhasma Pariksha* that is, *Rekha Purnatha*, *Varithara*, *Nishchandratwa* and *Unama*. Also, elemental analysis of *Swayamagni Loha Bhasma* and sample of *Putapaka* shows reduction in the particle size ranging with in nanometre scale. This *Niragni* Method of *Loha Bhasma* can be Prepared and Analysed by Pharmaceutical Industries with the adoptive changes by making it feasible for the current trend. The *Niragni* method of preparation of *Loha Bhasma*, Pharmaceutically and analytically showed the equivalent Results.

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