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A CRITICAL REVIEW OF THESIS WORKS DONE ON RASAKARPURA

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A CRITICAL REVIEW OF THESIS WORKS DONE ON RASAKARPURA***Corresponding Author****Mehta N. J.**

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QR Code IJAAM**ABSTRACT:**

Rasakarpura is a mercurial preparation in the field of ayurved. It is a *Nirganga* (without using sulphur as an ingredient) type of *kupipakva* (sublime) metallic preparation. There are different 53 methods for the preparation of *Rasakarpura*. Different opinions about mercuric chloride, mercurous chloride or mixture of both as chemical composition of final product are available in classical books of ayurved. Various types of research works on *Rasakarpura* were also carried out in many institutes of ayurved. Therefore here an attempt was made to compile those MD (Ayu) and PhD works so that some conclusions are drawn to identify the *Rasakarpura* and its chemical composition.

Key Words: *Rasakarpura*, Mercuric chloride, Mercurous chloride, *Rasashastra*

INTRODUCTION

To promote the ayurved many institute are working in the India and also in some other countries of world. One of the efforts to promote the ayurved is research of drugs. Previously physicians were made medicines for their own use on the base of the need of patients and availability of the ingredients. So that many drugs are having many methods of preparation and therefore chemical composition of the final product is found different opinions. Now a day due to advance technology it is possible to identify the structure of the some products in certain level. One of such drug is *Rasakarpura*. Different type of research works regarding preparation method, analytical, toxicological and clinical were carried out in various institute of ayurved. So here an attempt was made to compile those works and due to this effort, may be some conclusion will be drawn on the composition of *Rasakarpura*, which is the main controversial part.

MATERIAL AND METHOD

Total fifty three (53) methods for the preparation of *Rasakarpura* are available in classics of ayurved.^[1] Various post graduation and doctorate level research works are done to develop Standard Manufacturing Process (SMP) for *Rasakarpura*. In some of these works it was prepared by different methods and analyses of those samples were carried out by the scholar. Some works were also extended for toxicity study and clinical study. Total twelve (12) M.D. (Ayu) and Ph.D. works are found

on *Rasakarpura* from the various institute of ayurved. Those works are concisely presented as below.

Patel A. S. et al^[2] has worked on the problem of "*Rasakarpura Nirmana*" in which various classical references were utilized for the preparation of *Rasakarpura*. But the study indicates the failure of many procedures.

H. Yeri Swami et al^[3] has prepared *Rasakarpura* for 28 times. In which 21 were performed according to reference of *Rasa Tarangini*, 2 were prepared by method of commentator Pandit Haridatta Sastry of *Rasa Tarangini* book (by changing the ratio of *Parada* and *Gandhakamla*-sulphuric acid i.e. 1: 0.5) and remaining 5 were performed by following different references. There was no final product by using method of *Rasachintamani* due to failure of practical. Other samples were analyzed for the chemical structure of final product. They found that *Rasakarpura* prepared by *Rasa Ratnakar* method is 96.08% mercurous chloride and 05.02% is mercuric chloride. Sample of *Rasakarpura* prepared by *Ayurved Prakash* method is having 83.95% of mercurous chloride and 09.63% of mercuric chloride. *Rasakarpura* prepared by *Rasa Tarangini* method is 99.79% w/w mercuric chloride. Sample prepared by using modify method of *Rasa Tarangini* by Haridatta Sastry (half amount of sulphuric acid than mercury) is mercurous chloride 92.66% w/w.

Rao P. G. et al^[4] also worked on *Rasakarpura* as his post graduation research work. In this work *Rasakarpura* was prepared by using *Rasa Tarangini* method. But details of the work can not be found by author of this article.

Rao P. G. et al^[5] has prepared *Rasakarpura* in four sets. In 1st set *Parada* 1 part, concentrated H_2SO_4 1.5 part and *Saindhava Lavana* equal to intermediary product was used. In 2nd set, mercury (1 part), *Kasisa* (2 part) and *Saindhava Lavana* (2 part) were used. In 3rd and 4th set, *Tuttha* and *Sphatika* were used instead of *Kasisa* in addition to *Parada* and *Saindhava Lavana*. He reported that 300 – 320°C temperature for 6 – 6½ hours are sufficient in EMF to sublime the product. On analysis of samples he found that *Rasakarpura* Sample I as mercuric chloride, Sample II as mercurous chloride and Sample III and IV as mixture of mercuric chloride and mercurous chloride.

Mehta N. J. et al^[6] developed Standard Operating Procedure of *Rasakarpura* and *Rasakarpura Drava* as per the reference of *Rasa Tarangini* 6/65-71 & 6/103-105. In the pharmacological study acute and chronic toxicity of *Rasakarpura* and Dermal toxicity of *Rasakarpura Drava* with using standard drug i.e. chemically prepared Mercuric chloride was carried out. Result shows *Rasakarpura* is less toxic in comparison to chemically prepared mercuric chloride. In analytical study of *Rasakarpura*, mercuric chloride 97.98% along with Sodium, Magnesium and Calcium as trace element were found. In clinical study patients were cured by 0.1% of *Rasakarpura Drava* and *Gandhaka Malahara*.

Suvarna et al^[7] also prepared *Rasakarpura* by using *Rasa Tarangini* method. An analytical report reveals that it is completely soluble in water and alcohol, and slightly in chloroform. As the particle size of *Rasakarpura* was found 11.48µm, so it is quickly absorption. The percentage of *Parada* obtained is 70.08% and chloride is 19.4% in the *Rasakarpura*. N.P.S. Test indicates it may be mercuric chloride.

Sarode Sandeep et al^[8] concluded that *Rasakarpura* prepared as per *Rasa Tarangini* method was better than it that prepared by using equal quantity of *Parada* and *Romaka Lavana*. They used *Sharava* in *Lavana Yantra* for *Paka* (indirect heating pattern).

Shetti Shraddha et al^[9] prepared *Rasakarpura* by using *Rasa Tarangini* method. An analytical report reveals that *Rasakarpura* has density of 5.43 g/cm³

and an acidity of 3.2 and crystal structure orthogonal. For elemental analysis SEM and EDTX proved to be useful, which had showed mercury as the main element followed by chlorine. Other trace element like Na, O, C, S etc were also determined. AAS that worked on the principal of cold vapour technique failed to detect mercury in *Rasakarpura* as the level above the detectable limits. However, Mg was detected by AAS in *Rasakarpura*. XRD showed mercuric chloride $HgCl_2$ as the major crystallite phase for *Rasakarpura*.

Reddy Sekhar et al^[10] prepared *Rasakarpura* by using 5 different methods and after that they were analyzed by using different parameters. *Rasakarpura* – 1 was prepared by *Rasa Tarangini* method. *Rasakarpura* – 2 was prepared by heating *Suddha Parada*-18 parts, *Gandhakamla*-10 parts, *Saindhava Lavana*-10 parts by adopting special *Kupi* which was made by using waste glass pieces in *Bhatti* as used in Traditional method. *Rasakarpura* – 3, 4 and 5 were prepared by using reference of *Rasamrita*, *Paradasamhita* and *Yoga Tarangini*. Total mercury was found to be 67.28%, 45.97%, 69.85%, 69.85% and 72.82% in *Rasakarpura* – 1, 2, 3, 4 and 5 respectively. Particle size for *Rasakarpura* – 1, 2, 3, 4 and 5 material which passed through the sieve no 44 (355µ) were 56.45%, 96.37%, 51.54%, 73.94% and 90.50% respectively. By XRD analysis, *Rasakarpura* - 1 was identified as Mercury chloride, with orthorhombic crystal structure, having Primitive Lattice and *Rasakarpura* – 2, 3, 4 and 5 were identified as Calomel, with Tetragonal crystal structure, having Body centered lattice respectively.

Mehta N. J. et al^[11] developed S.O.P. for the preparation *Rasakarpura Drava* and *Rasakarpura Malahara* (gel). Sophisticated analyses were carried out by TG-DTA-DSC method to find out the sublimation point of *Rasakarpura* (prepared as *Rasa Tarangini* method). Report suggests that it is started at 282.06°C and completely sublimed at 282.88°C temperature.

Naik M. S. et al^[12] compiled various preparation techniques of *Rasakarpura*. The large scale manufacture of *Rasakarpura* is seen only in Kondapalli. The process is carried out at a distance place outside the village to avoid toxicity of fumes that arise during the preparation for local public. In the process, a wide porcelain vessel is taken and 17 kg of mercury is placed in it. 10 liters of Sulphuric acid (H_2SO_4) is gently added to mercury with great care. It is kept on hearth to provide heat. Medium type of heat is given, the mercury starts bubbling after 30 minute and white colored fumes start to originate from this mixture, the

mixture is stirred with an iron ladle continuously, the fumes intensify further with a stink of burning corps. After one hour when the mixture becomes like a white paste, the stirring is also intensified. Gradually it becomes powder at the end of one and half hours. The fumes ceases completely when the mixture is converted into white powder. Then the contents are transferred into an iron bowel. No change is found in the weight of mercury. The outcome of this process is made into fine powder and mixed with Saindhava and carefully kept inside the mud smeared thin glass bottles which are readily prepared in the factory itself. Each bottle is filled with the 120 gm of the compound and sealed with black mud paste. After seal is dried, three such sets are kept amidst pebbles 1 cm. size in an earthen plate. This set is arranged on hearth and severe heat is given with firewood for 2 hours, to process the whole quantity of the compound it required 225 glass bottles which are kept on 75 hearths. After intense heating for 2 hours, the sets are left for cooling down. After almost 24 hours when the set is cool down by itself, the bottles are carefully taken out the external mud cover is scraped with great care, the bottle is broken and the *Rasakarpura* formed as a glittering white layer is collected and preserved. The *Rasakarpura* appears like camphor flakes.

Vinay T. C. et al^[13] was prepared *Rasakarpura* by using *Rasa Tarangini* reference. In analytical part of this study, XRD reveals presence of $HgCl_2$ as main constituents along with other trace elements like Ca, Na, Pb, Ar, Zn, Mg, Fe. LD50 value was found to be 55 mg/kg with a confidence limit of 35.02 to 155 mg/kg.

DISCUSSION

Today a problem has arisen before the present scholar that what is the scientific identity to be placed before the scientific world for the chemical composition of *Rasakarpura*, because the physical properties of *Rasakarpura* are seen to be somewhat identical with mercuric chloride, mercurous chloride or even combination of the both. There is difference of opinion in the chemical identity of *Rasakarpura* as available in *Rasashastra* book.

Vaidya Vasudeva Mulashankar Dwivedi^[14], Pandit Girija Dayalu Sukla^[15], Dr Siddhinandana Mishra^[16], Pandit Visvanath Dwivedi^[17] are the authorities who have quoted *Rasakarpura* as mercuric chloride.

Vamana Ganesh Desai^[18], Nadakarni^[19], Dr Prabhakar Chatarji^[20] are the names of the authors

who opine *Rasakarpura* as mercurous chloride or calomel.

Dr Himasagar Chandra Murti^[21] and Shri Hari Prapannaji^[22] opine corrosive sublimate as *savvira* or *dachikana*. Swami Hari Sharanananda also claimed *Dalchikana* as the product of mercury with double part of sulphuric acid.^[23]

By the above all references we can say that the authors differ in their opinion regarding *Rasakarpura*.

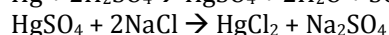
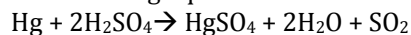
Amongst the 53 references so far we have collected, only 3 references have indicated the use of *Gandhakamla* in the preparation of *Rasakarpura*. The proportion of *Parada* and *Gandhakamla* in references of *Rasa Tarangini*^[24], *Rasa Yog Sagar*^[25] and *Siddha Prayog Sangrah*^[26] is found 1:1.5, 1:1 and 1:0.6 respectively.

As we can see, mercuric chloride is called per chloride of mercury or Hydragirum per chloride or corrosive sublimate and its formula is $HgCl_2$. Mercurous chloride is called sub chloride of mercury or calomel and its formula is $HgCl$ or Hg_2Cl_2 .

Mercuric chloride and mercurous chloride differ in their formula, chemical reaction as well as action. Mercuric chloride is completely soluble in water and mercurous chloride is insoluble in water. Mercuric chloride is antiseptic and antibacterial whereas mercurous chloride is laxative.

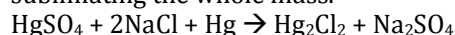
According to modern chemistry mercuric chloride can be prepared by heating mercury with excess of concentrated sulphuric acid and then subliming the product with salt.^[27]

The process of chemical reaction can be shown in the following equation.



Mercurous chloride can be prepared by heating excess quantity of mercury with less volume of concentrated sulphuric acid and then subliming the product with salt.

Mercurous chloride can also be prepared by grinding mercuric sulphate thoroughly with common salt and metallic mercury and subliming the whole mass.^[28]



By the above equations it is evident that the total proportions of mercury and sulphates will determine the product as mercurous and mercuric chloride.

It has been observed in other references of the preparation of *Rasakarpura* that in its ingredients, sulphate form like *Sphatika* [$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot H_2O$], *Kasisa* ($FeSO_4 \cdot 7H_2O$), *Tuttha* ($CuSO_4 \cdot 7H_2O$) etc are used. It is known that the compound like ferrous sulphate release sulphuric acid when heated.

$$2FeSO_4 \cdot 7H_2O \rightarrow Fe_2O_3 + H_2SO_4 + SO_2 + 6H_2O$$

In almost all references either *Sphatika* or *Kasisa* are taken in 1 part or even less than that of mercury. So we can very well grasp the idea behind this proportion that excess of metallic mercury is made to react with less quantity of sulphuric acid leading to mercurous chloride or calomel.

This is supported by experiments, in which *Kasisa* or *Sphatika* are used, have led to mercurous chloride. Similarly the practical done according to *Rasa Tarangini* by using concentrated sulphuric acid with the one and half proportionate of mercury has given out mercuric chloride.

Shri Haridutta Sastri, the commentator of *Rasa Tarangini* has recommended the half proportion of sulphuric acid instead of one and half proportion as mentioned in text.^[29]

The experiment by conducted H. Yeriswamy et al with half part of concentrated sulphuric acid to 1 part of mercury produced mercurous chloride.

In Andhra Pradesh it is considered to be a common remedy for Arthritis, *Shwasa*, *Kasa* and *Sootikopadravas* (post-partum complications). In Kondapalli near Vijayawada, *Rasakarpura* is being prepared in large scales by many families and supplied throughout Andhra Pradesh and exported all over India. They also follow formula and ingredients mentioned in *Rasa Tarangini* with slight modification in the proportion of the ingredients and techniques. A good quality and high yield is obtained by this technique, so all south Indian ayurvedic pharmacies using this type of manufacturing for *Rasakarpura*. Even today some families totally thrive on the traditional manufacturing of *Rasakarpura*. This method was used and analysed by Niak M.S. in his thesis.

Rao P. G. et al, Mehta N. J. et al-MD thesis, Suvarna et al, Shetti Shraddha et al, Reddy Sekhar et al, Mehta N. J. et al-PhD thesis, Vinay T. C. et al analysed that *Rasakarpura* prepared by *Rasa Tarangini* method is mercuric chloride. In these works also analysed that *Rasakarpura* prepared by other method than *Rasa Tarangini* is mercurous

chloride and in some methods it is found mixture of mercuric and mercurous chloride.

Sarode Sandeep et al and Mehta N. J. et al also concluded that *Rasakarpura* preparation method of *Rasa Tarangini* is easier and convenient.

Mehta N. J. et al, Shetti Shraddha et al and Vinay T. C. et al conclude that in *Rasakarpura* there are also some other elements as trace elements.

By the above facts it is clear now that the preparation according to the reference of *Rasa Tarangini* will lead to mercuric chloride which is in fact *Dalchikana* or *Savvira* as claimed by Swami Hari Sarananandaji. The preparation done without concentrated by using other sulphate materials lead to mercurous chloride which is the *Rasakarpura* before the period of *Rasa Tarangini*.

So it is important to select reference for preparation of *Rasakarpura* according to the use of *Rasakarpura*.

CONCLUSION:

Rasakarpura is chloride salts of mercury along with trace elements. If proportion of *Gandhaka* (direct or indirect) is less than *Parada* than there may be chance to find mixture of mercuric and mercurous chloride, while the proportion of *Gandhaka* is more than *Parada* than there may be found mainly mercuric chloride in final product.

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