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A REPRESENTATION OF RASADRAVYAS IN MODERN PERIODIC TABLE ACCORDING TO ELEMENTS PRESENT IN THEM

[1]Dr. Sripal Hirekerur and [2]*Dr. Divya K.

[1]Associate Professor, Indian Institute of Ayurvedic Medicine and Research, Bangalore.

*[2]Associate Professor, SDM Institute of Ayurveda and Hospital, Bangalore.

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***Corresponding Author**
Dr. Divya K.
Associate Professor, SDM Institute of Ayurveda and Hospital, Bangalore.

ABSTRACT

Background: Rasashastra, the Iatrochemistry of Ayurveda has described different drugs of herbal, metal, mineral and animal origin, methods to procure, selection of the drugs with superior qualities, methods of processing and converting them to safe and therapeutically potent medications. These drugs are collectively called as 'Rasadravyas'. They are grouped into various categories based on different criteria. The article aims to place these drugs inthe present day periodic table with certain modifications befitting the classification of dravyas as mentioned in texts of Rasashastra. **Data source**: different classical texts and related articles of Rasashastra, chemistry books and articles related to periodic table were referred. **Results and Conclusion**: the article provides an insight to the reader as to which are the present day elements present in the Rasadravyas, the criteria of grouping them and the fact that so many elements/ compounds were used therapeutically from centuries.

KEYWORDS: These drugs are collectively called as 'Rasadravyas'.

INTRODUCTION

Rasashastra is a unique branch of Ayurveda which deals with different metals/minerals/herbal drugs or the 'Rasadravyas'. The science intended the use of such metals or minerals mainly for two purposes: one for loha siddhi or the alchemy part dealing with conversion of lower metals to higher metals and the other one was deha siddhi means using such drugs for maintaining health and attaining moksha (liberation) while living itself. Later on for many years the utility of these drugs is directed to Chikitsavaada meant to prevention and treatment of diseases.

The rasadravyas are classified in to different groups in different texts of rasashastra. Among all the drugs mentioned Parada or mercury is given prime importance because of its wide utility and it is not included in any group. The other drugs are classified in to categories such as Mahrasas, Uparasas, Sadharana rasas, Dhatu, Upadhatu, Sudha Varga, SikataVarga, MallaVarga, Ratnas, Uparatnas, Vishas and Upavishas. The classification is different in different classical literature so the criteria for classification are also unique.

The periodic table is one of the most important concepts in chemistry continuously evolving over the years. It is a graphic description of the periodic law which states that 'the properties and atomic structures of the chemical elements are a periodic function of their atomic number'.[1] In the present article, an attempt is made to place rasa dravyas in the periodic table according to different elements present in. The objective is to introduce to the scientific world regarding the number of elements that are present in Rasadravyas, different compounds possessing them, the category which they belong to.

MATERIALS AND METHODS

1. Different classical texts and related articles of Rasashastra were reviewed to know the classification of rasadravyas and validate the reason for classification.
2. Modern periodic table reviewed and the idea of placing the elements is presented.
3. An attempt is made to place the elements of rasadravyas in the present day periodic table with different criteria.

Classification Of Rasadravyas And Validate The Reason For Classification.

Table 1: Showing Different Categories Of Rasadravyas According To Different Classical Texts Of Rasashastra.

RSN[2]	RRS[3]	RSS[4]	AP[5]	RT[6]	RSM[7]
Rasa	Rasa	Rasa	Maharasa	Shankhaadi	Rasa
Maharasas	Maharasas	Uparasas	Uparasa	Taalakadi	Loha
Uparasas	Uparasas	Dhatu	Dhatu	Kshara	Malla
Lohas	Sadharanarasa	Ratna	Ratna	Dhatu	Sudha
Pancharatna	Ratna		Uparatna	Upadhatu	Sikata
	Uparatna			Mishrakadhatu	Ratna
	Lohas			Ratna	
				Visha	
				Upavisha	

Scientific background of Classification of Rasa dravya

According to Damodar Joshi[8]: the classification of drugs are based on following criteria.

- Classification of Rasa dravyas is based on the importance of the Utility of the dravyas towards Rasa (Mercury) on preference basis or on the basis of their physical and therapeutic charecteristics. Those which are highly useful with Potentiation, are grouped in Maharasa. Those, which are comparatively little less Useful, are grouped in Uparasa and those, which are still less useful in ordinary way, are grouped in Sadharanarasa.
- Lohas are those which are extracted from the minerals in the form of satwa content and also possess metallic charecters.
- Ratnas are drugs of stony nature and possess very superior qualities like more brightness, more shining, hardness, high cost, few inferior ones in same category are classifies as Uparatnas.
- The herbal drugs having very virulent toxic effects are grouped into Visha and Upavisha.

Generally these drugs are classified in to four distinct classes named- Rasa, Dhaatu, Ratna and Visha. This classification does not have a common distinguishing feature. The class of 'Rasa' is predominantly possessing 'Rasaayana' (adaptogenic effect) effect. Dhaatus are grouped together on account of their capacity to provide structural strength to the body. The minerals possessing gem quality are grouped as Ratna, whereas inherently highly poisonous plants are grouped as Visha.[9]

The classification of Rasadravyas are different in different texts books and additions and deletions are done based on individual criteria and has continuously evolved through out.based on different opinions we can draw following inferences.

- Earlier texts have classified minerals into Maharasas, Uparasas and Sadharana rasas based on their importance in Potentiation of Parada, utility in Parada Karmas.
- Lohas are classified separately based on their metallic properties. Yasada is included in the group after 14th century.
- Ratnas and Uparatnas may be classified based on their luster, hardness, higher utility in therapeutics.
- The texts of 20th century such as Rasatarangini and Rasamritam have mostly classified drugs based on their chemical composition. For example: Shankaadi includes calcium compounds, Mallavaraga includes arsenic compounds, Sikata varga has silicates.

Table 2: Rasadravyas classified into different categories along with their chemical composition.

Maharasa	Uparasa	Sadaranarasa	Dhatu	Ratnas	Uparatnas	Sudha varga	Sikatavarga
Krishna Abhraka Biotite (Api) $(H_2k(MgFe)_3Al(SiO_4)_3O_7$	Gandhaka Sulphur S	Kampilla	Swarna Gold Au	Manikya Ruby Al_2O_3	Suryakanta Spinel $MgAl_2O_4$	Khatika Chalk $CaCO_3$	Dugdhapashana Talc $MgSiO_3$
Vaikranta Tourmaline CaF_2	Gairika Haematite Fe_2O_3	Gouripashana Vitrious Arsenic As_2O_3	Rajata Silver Ag	Mukta Pearl $CaCO_3$	Chandrakanta Moon Stone $KAlSi_3O_8$	Godanti Selenite $CaSO_4$ $2H_2O$	Kousheyashma Asbestos $Mg_3Si_2O_5(OH)_4$
Makshika Chalcopyrite $CuFeS_2$	Kasisa Green Vitriol $FeSo_4.7H_2o$	Navasadara Ammonium Chloride NH_4Cl	Tamra Copper Cu	Vidruma Coral $CaCo_3$	Rajavarta Lapis Lazuli Na_4 $(NaS_3$ $Al)Al_2(SiO_4)_3$	Mrigashringa Antler $Ca_3(PO_4)_2$	Badarashma Silicate Of Lime
Vimala Iron Pyrite Fe_2S_3	Kankshi Potash Alum K_2SO_4, $Al_2(SO_4)_3.7H_2o$	Kaparda Cowrie Ca_2CO_3	Loha Iron Fe	Tarkshya Emerald Be_3Al_2 $(Sio_3)_6$	Pairojaka Turquoise $CuAl_6(PO_4)_4(OH)_8.4h_2o$	Shukti Oyster Shell $CaCO_3$	Nagapashana Serpentine $(Mg,Fe,Ni,Al,Zn,Mn)_{23}$ $(Si,Al,Fe)_2O_5(OH)_4$
Shilajatu Black bitumen	Haratala Orpiment As_2S_3	Vanhijara	Naga Lead Pb	Pushparaga Yellow SapphireAl_2O_3	Shatikamani Quartz SiO_2	Shankha Conch $CaCO_3$	
Sasyaka Copper Sulphate $CuSO_4$ $7H_2o$	Manashila Realgar As_2S_2	Girisindura Montroydite Hgo	Vanga Tin Sn	Hiraka Diamond C	Vyomashma Jade Na(Al,Fe) Si_2O_6	Samudraphena Cuttle Bone' $CaCO_3$	
Chapala	Anjana SbS2	Hingula Cinnabar HgS	Yashada Zinc Zn	Neela Blue Sapphire Al_2O_3	Paalanka Onyx SiO_2	Kukkutanda Twak Egg Shell $CaCO_3$	
Rasaka Zinc Ore/Zinc Oxide ZnO	Kankushtha	Mriddarashringa Litharge PbO	Pittala Brass Cu_3zn_2	Gomeda Hessonite $Ca_3al_2(Sio_4)_3$	Rudhira Carnelion Sio_2		
			Kamsya Bronze CuSn	Vaidurya Cats Eye $BeAl_2O_4$	Pootika Peridot $(MgFe)_2SiO_4$		
			Vartaloha White metal		Sugandhika		
					Trinakanta Amber $C_{10}H_{16}O$		
					Akeeka		

Periodic Table

The first periodic table of Mendeleev was based on Atomic masses. The present periodic table is a 2-dimensional structured table. The elements are placed in table cells, in reading order of ascending *atomic number*. The table is divided into four *blocks*, reflecting the filling of electrons into types of subshell. The table columns are called *groups*, and the rows are called *periods*. New periods begin when a new electron shell starts to fill: elements in the same group have the same number of electrons that can be used for chemistry (except for helium in the noble gas group), so that similar physical and chemical properties recur at regular intervals.

The smallest constituents of all normal matter are known as atoms. Atoms are extremely small, being about one ten-billionth of a meter across; thus their internal structure is governed by quantum mechanics.[10] Atoms consist of a small positively charged nucleus, made of positively charged protons and uncharged neutrons, surrounded by a cloud of negatively charged electrons; the charges cancel out, so atoms are neutral.

Atoms can be subdivided into different types based on the number of protons (and thus also electrons) they have.[11] This is called the atomic number, often symbolised Z[14] (for "Zahl" — German for "number"). Each distinct atomic number therefore corresponds to a class of atom: these classes are called the chemical elements.[12] The chemical elements are what the periodic table classifies and organises. Hydrogen is the element with atomic number 1; helium, atomic number 2; lithium, atomic number 3; and so on. Each of these names can be further abbreviated by a one- or two-letter chemical symbol; those for hydrogen, helium, and lithium are respectively H, He, and Li.[13] Elements are placed in the periodic table by their electron configurations,[14] which exhibit periodic recurrences that explain the trends of properties across the periodic table.[15]

There are 3 main groups in in the Periodic Table; metals, metalloids, and nonmetals. For example, elements to the bottom and far left of the table are the most metallic, and elements on the top right are the least metallic. Metallic character increases with increasing atomic number in a group whereas decreases from left to right in a period. The physical and chemical characters vary periodically with their atomic numbers.[16]

Information in Individual Box(Cell) Of The Present day Periodic Table (Typically it will have element name, symbol, atomic number and atomic mass.

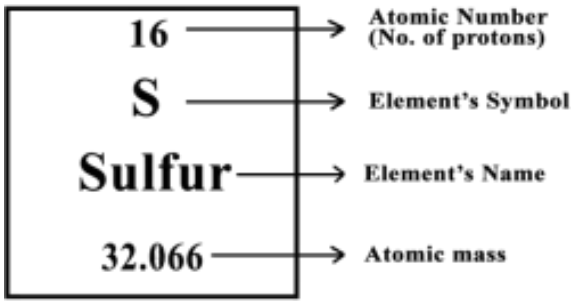
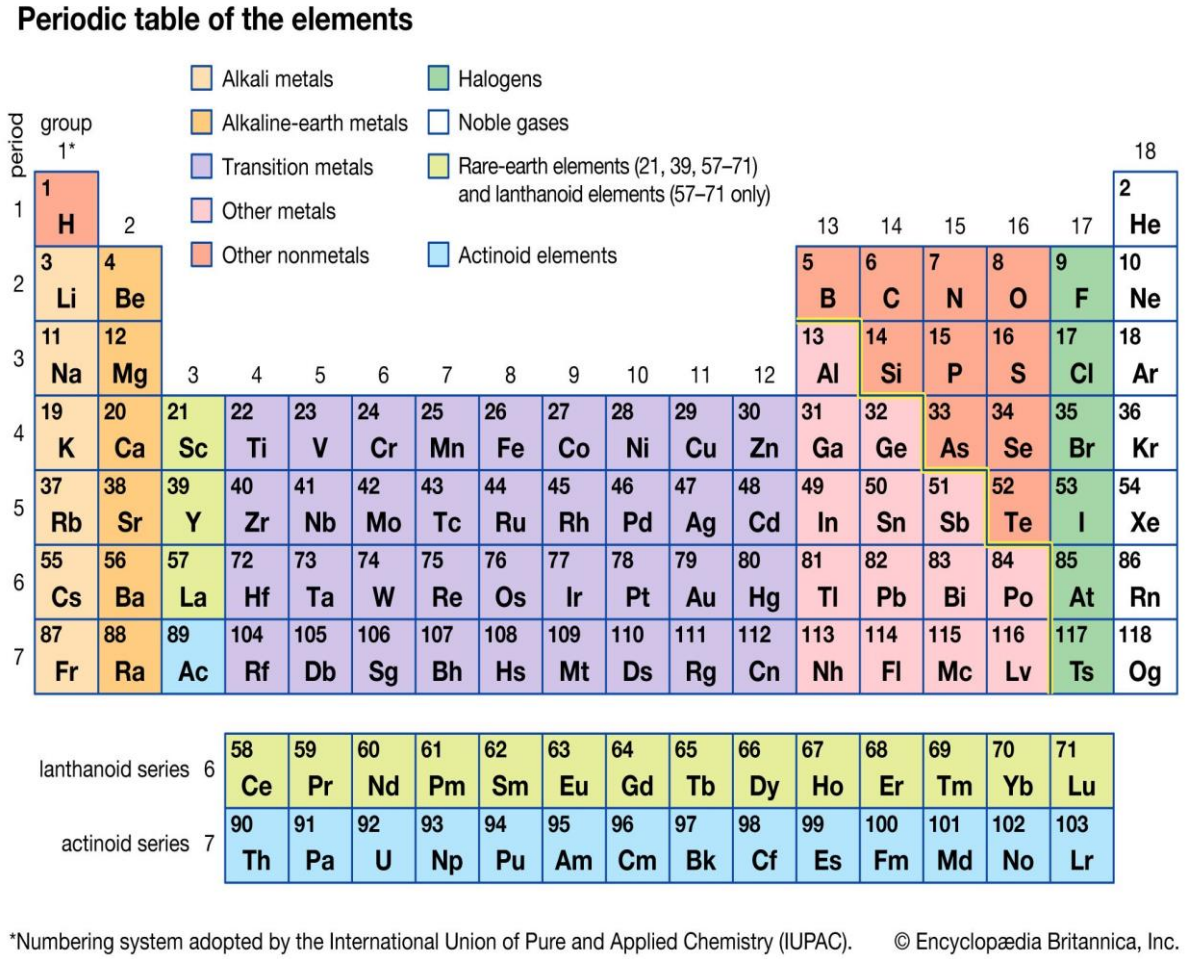
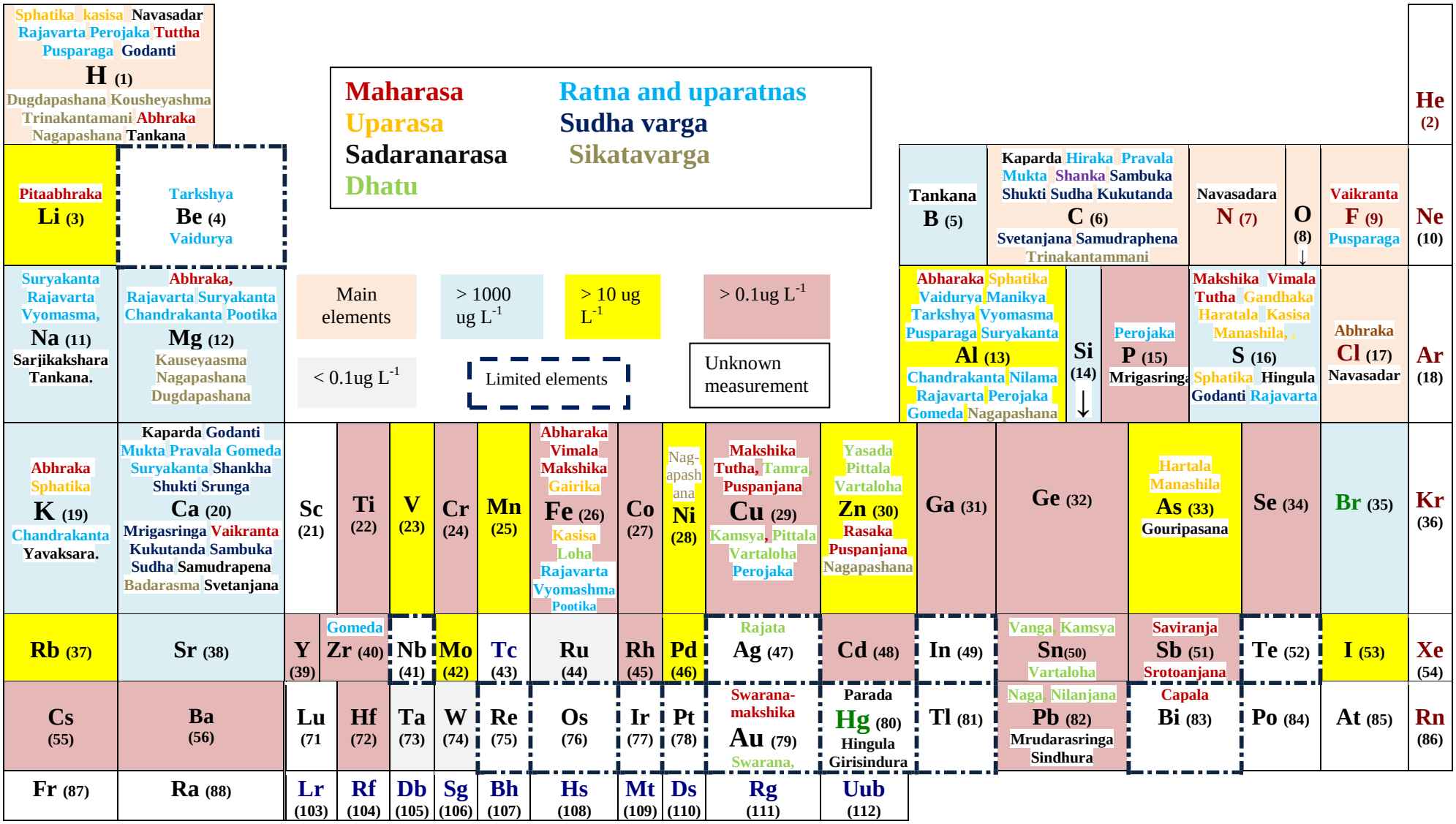


Table 3: Present day Periodic table.



RASADRAVYAS PLACED IN PERIODIC TABLE ACCORDING TO ELEMENTS PRESENT IN THEM

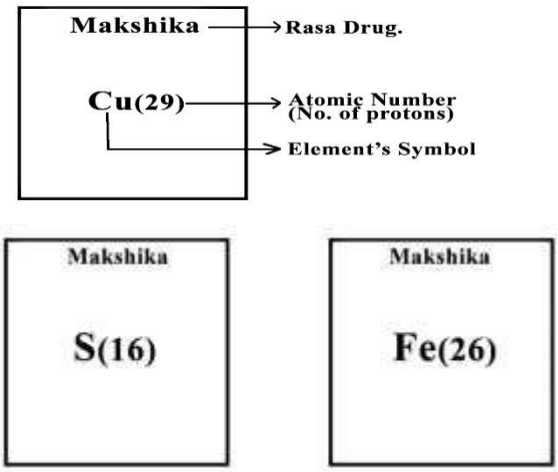


O													
Tutha	Sphatika	Girisindura	Manikya	Tarkshya	Gomeda	Chandrakanta	Perojaka	Rudhura	Shukti	Sudha	Mrigashringa	Dugdapashana
Abhraka	Gairika	Mrudarasringa	Mukta	Pusparaga	Vaidurya	Rajavarta	Sphatikamani	Pootika	Godanti	Kukutanda	Nagapashana	Trinakantammani
Kasisa	Gouripashana	Kaparda	Pravala	Nilama	Suryakanta	Vyomasma	Paalanka	Shanka	Sambuka	Samudraphena	Badarasma	Tankana

Si						
Abharaka	Pusparaga	Chandrakanta	Vyomasma	Pootika	Nagapashana
Sphatika	Gomeda	Rajavarta	Paalanka	Dugdapashana	Badarasma
Tarkshya	Suryakanta	Sphatikamani	Rudhura	Kauseyaasma	

According To Elements Present In Them

First the chemical composition of the drug mentioned in the Rasashastra is identified. For example: Makshika(Copper pyrite), the chemical formula is Cu2S Fe2S3. Therefore Makshika is compound of 3 elements that is Cu, S, Fe. Now Makshika will be placed in the box of its elements Copper, Sulfur and Iron.



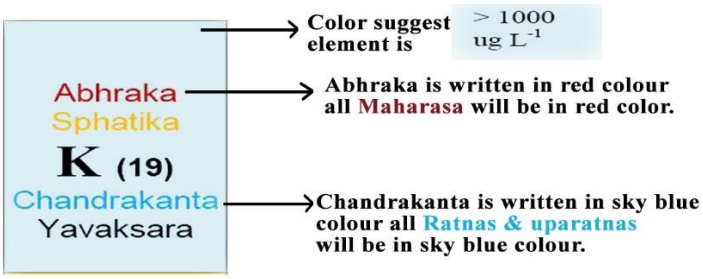
2) Based On Similar Elements

Another drug which contain one of the above mentioned elements is placed next or below to it. For example: Tamra(Copper).

3) Quantity Of Micro Elements Present In The Human Body.

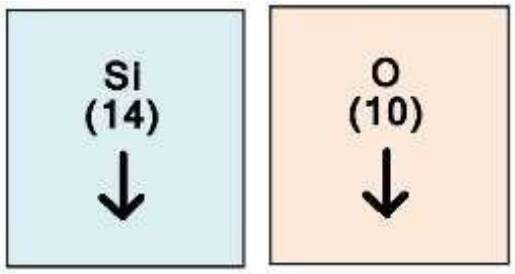
The individual cell is filled with different colors according to its presence in the body using color code. For example the H, C, O, N, F, & Cl which are considered as main elements are filled with same color. The cells are having color based on their quantity present in the body that is all main elements have same color code, then the elements which are below 1000 ug per litre have same color code and so on as shown in the table.

Then different groups of drugs like Maharasa, Uparasa, Sadaranarasa and so on will be written indifferentcolors.



4) Replacement Of Lanthanoids & Actinoids With Compounds Of Silica And Oxygen

Lanthanoids & actinoids are placed in separate panels at the bottom of the periodic table. These are replaced with rasadravyas which contain silica and oxygen. As more number of drugs are present in the cell a separate panel is made for them. In the table a 'down arrow' is put indicating that the details are presented below.



At the end of the table we have the following panels.

O	Tutha	Sphatika	Girisindura	Manikya	Tarkshya	Gomeda	Chandrakanta	Perojaka	Rudhura	Shukti	Sudha	Mrigashringa	Dugdapashana
	Abhraka	Gairika	Mrudarasringa	Mukta	Pusparaga	Vaidurya	Rajavarta	Sphatikamani	Pootika	Godanti	Kukutanda	Nagapashana	Trinakantammani
	Kasisa	Gouripashana	Kaparda	Pravala	Nilama	Suryakanta	Vyomasma	Paalanka	Shanka	Sambuka	Samudraphena	Badarasma	Tankana

Si	Abharaka	Pusparaga	Chandrakanta	Vyomasma	Pootika	Nagapashana
	Sphatika	Gomeda	Rajavarta	Paalanka	Dugdapashana	Badarasma
	Tarkshya	Suryakanta	Sphatikamani	Rudhura	Kauseyaasma	

DISCUSSION

The periodic table has evolved over the years with multiple theories put forth for classification of elements. The present day periodic table, the elements are arranged based on the atomic number. It is based on the principle that physical and chemical properties of elements are periodic function of their atomic numbers.

The science of Rasashastra uses different metals/minerals called 'Rasadravyas' for therapeutic purpose. These drugs are classified in ancient texts of Rasashastra based on

different criteria such as those useful in Parada karma, chemical composition and so on. In this article an attempt is made to place the rasadravyas in the modern periodic table. So it introduces to the scientific world that there are these many elements used in Rasashastra as medicine in individual/compound forms.

It is done in such a way that if one looks into the table, he will get to know that how many compounds of different elements are used in Rasashastra. For example in a cell of element Potassium (K), compounds containing Potassium are placed such as Abhraka, Sphatika, Chandrakantha, Yavakshara.

The table gives an insight to the reader about the quantity of particular element present in the body. For example: a cell showing Iron, the background color of cell indicates its amount present in the body.

The color of rasadravya in the cell indicates the category it belongs to. For example: in the cell of Iron, there are Abhraka, Makshika belong to group of Maharasas, Loha belong to Dhatu Varga and so on.

This kind of division and presentation of Rasadravyas in periodic table answers.

- What are the elements present in the Rasadravya?
- Which are the elements present in the body.?
- Which are the elements present and not present in the body being used by the rasashastra as medicine?

CONCLUSION

The study is only an initial attempt to place the rasadravyas in periodic table. The subject requires further more ideas as to how better they can be placed. The present day available periodic table has evolved over the time to the form we see it now. Similarly additions or deletions to this can be done based on other scientific ideas.

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