A BRIEF HISTORY OF INDIAN ALCHEMY COVERING
PRE-VEDIC TO VEDIC AND AYURVEDIC PERIOD
(CIRCA 400 B.C. - 800 A.D.)

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ABSTRACT

History of Indian alchemy can be traced to pre-Vedic period. The Archaeological excavations at Mohenjodaro and Harappa in the Indus valley have brought to light that, the people in ancient India were possessing chemical knowledge as early as in the pre-historic period. In Vedic period single herbs were prescribed. Minerals and animal substances were also prescribed but no compound preparations were in use. Alchemy in India, was started for the preparation of an elixir of life for imparting immortality and later for the transmutation process for converting base metals into gold. Indian alchemy derived its colour and flavour to a large extent from the Tantric cult. Then, during the iatro-chemical period all the previous accumulated alchemical ideas were put into something more practical and tangible. A number of preparations of mercury and other metals were evolved as helpful accessories in medicine.

Here a brief history of the Indian alchemy is presented which will give an idea about the development of chemical knowledge in India in its multiple aspects.

Introduction:

Alchemy, the forerunner of modern chemistry was very much popular in different periods of history in India, China, Egypt, Greece, Arabia and Western Europe. The Indian alchemy, which is an art as well as a science, owns a very ancient history than imagined until now. Mineral pitch and other drugs found even after thousands of years of oblivion at Mohenjo-daro excavations, reveal that, as early as 2500 years B.C. in pre-Vedic period, the Indus valley people had a knowledge of the mineral drugs of preventive and

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curative value. In Vedic period mostly single herbs were used as medicines. Minerals and animal substances were also prescribed but no compound preparations were in use. Apart from the art of treating diseases, there also existed the art of rejuvenating the aged. Atharvaveda contains two kinds of hymns—one for the cure of diseases and possession by demons of disease, called as ‘Bhaiṣajyāṇि’, and the other, for securing of long life and preservation of health and youth, named as ‘Āyuṣyāṇि’—a term later on, was known as ‘Rasāyana’, the Sanskrit equivalent of alchemy. In Vedic literature the fermented juice of ‘Soma’ plant was considered as ‘Amṛta’ (ambrosia) i.e. the drug of rejuvenation cum-immortality. It can therefore be said that the Rasāyana system of Indian medicine, i.e. the Indian alchemy was founded with the aim of prolonging human life, and later on it became the art of rejuvenation and even of immortality.

Among the two kinds of medicines, as described in Caraka Samhitā, priority is given to ‘Rasāyana’ for promoting the strength, vitality, health, and virility, and then comes next in rank, the medicine proper, for curing diseases (ca. ci 1/13-14). In this way, Indian alchemy was evolved and developed to achieve two objectives, firstly to prepare the elixir of life for attaining immortality and, secondly to transform base metals into higher metals. To achieve these objectives the alchemists developed complicated processes and secret practices involving the metals, minerals and herbs. Later on ‘Rasāyana’ was almost exclusively applied to the employment of mercury and other metals in medicine. So it is believed that in India, more so than in Europe, chemistry has however, been evolved chiefly as a handmaid of medicine, and somewhat later on, as an adjunct of the Tantric cult.

Systematic evolution of Indian alchemy in the form of ‘Rasaṣāstra’ took place since the time of Nāgārjuna, and the mercury, sulphur, mica and other metals and minerals as well as poisons assumed great importance. From the second century onwards, the Indian alchemy progressed more and more into a regular science and reached its peak during the next six centuries which was incorporated in Ayurveda. Thus, ‘Rasaṣāstra’ started as the Indian alchemy, i.e. pharmaceutical chemistry retaining the objective of rejuvenation, and in course of time a number of pharmaceutical prepara-

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tions of mercury, sulphur and other metals and minerals as well as poisons were incorporated in it, for the treatment of various diseases.

The word 'Rasa' as used in the alchemical literature is in general reserved for mercury, though it is equally applicable to a mineral or a metallic salt also. In its fully developed form, the mercury-based alchemy in India, relates to male-female symbolism (Siva and Parvati). 4

Now, the use of mercury both in alchemy and in medicine is well known, which is found only in later literature i.e. the earliest Tantric texts in the 5th or 6th century A.D. Mercury is entirely unknown in earlier literature. It is mentioned only once in Caraka Samhita, once in the Bower Manuscript of 4th century A.D. and twice in Susruta Samhita. But if calcined metals were alchemical preparations, then Indian alchemy is ancient. 5

The history of Indian alchemy can be divided into prevedic or prehistoric, vedic, post-vedic or Ayurvedic, Tantric and iatrochemical periods.

Pre-Vedic Period
(Circa 4000 B.C. – 1500 B.C)

Alchemy in the Indian subcontinent owns a very ancient history, which can be traced to as early as the prevedic or prehistoric period. The pre-Harappan settlements of Baluchistan and the neighbouring areas of Sind are the earliest communities, known so far, belonging to about 4000 B.C. Archaeological evidences show that these people were knowing the art of extracting copper from the ores of copper, working the metal into various articles and pottery making and also colouring the same with two or more colours, so it can be said that these people of prehistoric period laid the foundation of chemistry of metallurgy in Indian subcontinent.

Archaeological excavations have brought to light an another prehistoric settlement in India at Mohen-jodaro in Sind and Harappa in Punjab, known as Indus Valley Civilization or Harappan Culture, flourished at about 2500 B.C. and continued to about 1800 B.C. (According to other authorities this civilization existed between 2600 B.C. and 1700 B.C. which seems to have ended between 1700 B.C. and 1500 B.C.) 6 The pottery vessels, articles of faience, beads, metallic objects etc. found at these sites have revealed the knowledge of chemistry possessed by

these people. They were using various tools and weapons made of copper and bronze. Lead and tin were also used, though tin was always occurred alloyed with copper in the form of bronze. Gold was used for making jewellery and silver was used for jewellery and also for ornamental vessels. They were using a large number of minerals, ores and rocks such as; lapislazuli, turquoise, rock crystal, limestone, soapstone, alabaster, haematite, amethyst, slate, agate, jasper, chalcedony, onyx, bitumen, steatite, sodalite, jade, jollingite, arsenical pyrites etc. Most of these were found in the form of beads pendants etc. Cerrusite and Cinnabar have also been found there which were probably used for plasters, eye-salves and hair-washes. Galena was employed for the preparation of eye-salves and paints. Further, evidence has also been obtained that they were acquainted with the art of dyeing cotton with the red colouring matter of the madder root.

In this way the people of Indus valley were using a variety of minerals for ornamental, cosmetic and medicinal purposes. However, a fact of special significance is that, the metallurgy of iron was unknown to the Harappan metal workers. It is believed that, iron was introduced into India by about 1000-800 B.C. The remarkable achievements of the Harappan people in the field of practical chemical arts of pottery, metal working, use of minerals and the like have been brought to light through the archaeological excavations.

The Indus valley civilization declined most probably around 2000 B.C. due to the attacks of Barbarians from the north-west. As a result of which migration of the Indus valley people started towards the Gangetic plains and the hilly regions to the south-east most probably after 2000 B.C. but before 1500 B.C. During this period which is known as post Harappan period, very little evidence of any intellectual and cultural activities is found till the advent of the Aryans, at about 1700 B.C. However, a large number of pottery, iron, silver and copper implements, containing some percentage of lead and silver articles admixed with some percentage of gold were found belonging to this period, in the Gangetic basin and on the uplands to the south-east, notably at Gungeria, Balaghat (c.p.) in the valleys of the Ganges and the Jamuna and at or about the Ranchi uplands.


Vedic Period
(Circa 1500 B.C. - 600 B.C.)

After the pre-vedic period, starts the next phase of the history of Indian art and culture of a new set of people known to be as the Indo-Aryans, which gives a glimpse of the chemical knowledge possessed by them. The Ṛgveda (1500-1200 B.C. or possibly of an even earlier period), which is the earliest record of the sacred hymns, rituals, thoughts followed by the Aryans and as well as the medicine and alchemy prevalent then, mentions the use of various metals like silver, copper, bronze, and gold. The term ‘ayas’ was generally used for the metals, viz. copper, bronze, or lead, later the word ‘ayas’ was specifically assigned to iron. Gold was used for ornaments and it was believed by the Vedic people that it possessed supernatural powers. They were producing the utilitarian appliances using copper and bronze. They were knowing very well, the methods of fermentation. There is plentiful mention of a number of fermented drinks, such as Soma juice, madhu, and surā. Soma juice, the divine drink of immortality finds an honoured place in Ṛgveda. It was also called amṛta (ambrosia) and the Soma plant was extolled as being divine. The Vedic people had also developed the art of making various types of pottery as well as painting the same with different colours. They were also well aware of art of dyeing with certain natural vegetable colouring matters. Following the Ṛgveda, there are the other three Vedas viz. the Sāṃveda, the Yajurveda, and the Atharvaveda, composed probably during the 1000 B.C. to 100 B.C., Atharvaveda being the latest.

In the Śukla Yajurveda, six metals viz ayas (gold) hiranyya (silver), loha (copper) Śyāma (iron), sisa (lead) trapu (tin) are mentioned. But in the Atharvaveda, gold has been referred to as harita (yellow), and like that silver as rajata (white), and copper as lohita (red).

At several excavated sites, a number of iron objects dating back to about 600-200 B.C. have been found. Many iron objects have also been found in the iron age burials (megalithic burials) in many parts of peninsular India. The probable date of the advent of iron in South India is regarded somewhere between 1050 B.C. - 950 B.C. It is believed that, by about 1000 B.C. - 800 B.C. the iron smelting operations were in vogue in India and by the fifth or fourth century B.C. the Indian metal workers had attained a high degree of perfection in the techniques of producing iron and steel objects.
The Atharvaveda consists mostly of charms, spells, incantations, magic, sorcery, demonology and witchcraft. It also deals with plants and vegetable products as helpful agents in the treatment of diseases and for the prolongation of life. The juice of Soma plant is referred to as amṛta (ambrosia), gold was regarded as the elixir of life and the lead was looked upon as the dispeller of sorcery. In the Atharvaveda, the hymns for the cure of diseases and possession by demons of disease are known as 'bhaisajyani' while those, which have for their object the securing of long life and health are known as 'āyuśyāni' a term which later on gave place to 'Rasaśaya' the Sanskrit equivalent to alchemy. The alchemical notions, which had gathered round gold, lead, Soma juice and other medicinal plants at the time of the Atharvaveda, are of special interest, thus, Atharvaveda is the earliest repository of information on Ayurveda and alchemy. In the Vedas, medicine and for that chemical knowledge were not free from the influence of magic and religion. So, it is believed that, chemistry in ancient India, was evolved chiefly as a handmaid of medicine and somewhat later on, as an adjunct of the Tāntric cult.

The Post-Vedic or Ayurvedic Period (Circa 600 B.C. – 800 A.D.)

After the Vedic period, in which the knowledge of medicine, as well as alchemy was in chaotic state, starts the post-Vedic period. This was the period of systematic and scientific compilations, so it can be called as Ayurvedic period also. This age pertains to the most flourishing and fruitful period of ancient India, with regard to the accumulation and development of chemical knowledge, which was then, closely associated with Ayurveda, which is considered as a subsidiary branch of Atharvaveda.

The medicine and chemistry, during the post-Vedic period were dominated by the abstract theories of the Upani-ads and the systems of philosophies developed during this period. There are many works composed during this period, containing valuable information on various chemical practices most notable among them being the Caraka Samhitā, Susruta Samhitā and Āstāṅgahṛdaya. Progress in the knowledge of chemical compounds and of their preparation, clearly seen in the Caraka and Susruta Samhitās. These classics have given due importance to the compositions used for increasing virility and longevity. For this purpose a number of compositions are mentioned in these works. Essentially the 'Rasāyanas' are herbal, although sometimes references, however are made to the use of metals along with other substances of vegetable origin as components of certain elixirs.


Upto the period of the Caraka and Suśruta Samhitās, substances from the vegetable, animal and mineral kingdoms were utilized. But, in the case of inorganic remedies, the choice, was limited to the few locally available metals and mineral, the synthesis of new inorganic compounds being still unknown. Inspite of the wide range of available varieties, in many conditions, more than one drug, sometimes of different groups or sometimes in combination with animal and mineral matters were required. Even in the earliest texts, elaborate directions for extracting the active constituents of organic substances and homogenizing them is found. Thus, developed the remarkable and elaborate processes met within the Samhitās. There is little evidence of synthetic preparations of either inorganic or organic compounds.

The extant Caraka and Suśruta Samhitās represent not only the chemical and therapeutical knowledge of the time of their final redaction, but they are also repositories of informations accumulated on the subject during the earlier periods dating back to the Vedic age.

The treatise of medicine, next to the Caraka and Suśruta, containing some chemical informations worthy of note is Aṣṭāṅgahṛdaya, which may however be represented as an epitome of the Caraka and the Suśruta with some gleanings from the works of Bhela and Hārita, bringing the subject up to date.¹⁴

From the second century A.D. onwards, an increasing interest in 'Rasakriyā' (Pharmaceutical chemistry) is found. During the following six centuries this study developed into a regular science which was incorporated into Ayurveda. Upto about 1000 A.D. the 'Rasayanas' as existing were in 'Caraka's' age, mercurial drugs and alchemy as the art of gold making were not yet popular. In Arthaśāstra, among different kinds of gold, artificial gold made from other metals by chemical process using mercury is mentioned. The use of mercury both in alchemy and in medicine is found in India only in later literature, i.e. in the fifth or sixth century A.D. in the earliest Tāntric cult. In the medicinal works mercury is mentioned only once in Caraka Samhitā, once in Bower Manuscript (4th century A.D.) and twice in Suśruta Samhitā.

Later mercurials as drugs of rejuvenation were specifically called 'The Pasāyanas' whereas the previous herbo-mineral preparations, or calcined metals renamed 'Bhasmas' (burnt). So, Sir P C. Ray rightly remarked that, 'Later on Rasāyana' was almost exclusively applied to the employment of mercury and other metals in medicine and at present it also means alchemy.¹⁵

Caraka Samhītā

It is believed by the authorities on the subject that, there must have been a wide gap of about one thousand years or more between the age of Atharvaveda and that of the Caraka. During this period many medical works might have been composed reflecting the spirit and progress of the particular age. Such as the significant works existed at the time of the Caraka itself were the works of Agniveśa, Bhela, Jatikaraṇa, Pārāśara, Hārīta and Kṣārapāni. Caraka re-drafted and remodelled the Agniveśa Samhītā, to which later on the last forty-one chapters were added by Dṛñhabala, a Kashmiri physician, who flourished either in the 8th or 9th century A.D.

The chemical informations found in the Caraka Saṃhitā, particularly with reference to metals and metallic preparations, are of less advanced character than those in the Kauṭilya’s Arthaśāstra, composed somewhere between 321-296 B.C. According to Caraka, each of the gross Bhūtas (mahābhūtas) is a peculiar ultra-chemical compound of five original subtle Bhūtas. In this sense, every substance is penta-Bhautic, but for purpose of chemical analysis and synthesis i.e. considered with reference to the Mahābhūtas. All substances in their chemical constitution belong to one or other of the following classes: mono-Bhautic, bi-Bhautic, tri-Bhautic, tetra-Bhautic, and penta-Bhautic. Compounds of different Bhūtas, again may combine to form more complex substances and these in their turn higher compounds still, and so on in progressive transformation as is more specially the case with organic substances and products.

Sweet, sour, salt, pungent, bitter and astringent are regarded as the six fold catalogue of tastes. Objects are classified again into three groups viz. animal products, vegetable products and products of mineral origin. The animal products used as drugs are, honey, milk and its products, bile, fat, marrow, blood, flesh, faeces, urine, skin, semen, bones, tendons, horns, nails, hoofs, hair, bristles and the bright pigment called (Gorocana). The products mentioned appertaining to the earth for use as drugs are six

metals and their calcis viz. gold, silver, copper, lead, tin and iron, sand, lime, red arsenic, yellow arsenic, gems, salt, red chalk and antimony.

The five varieties of salts as described in the Caraka Samihita are: sauvarcala (nitre), saindhava (rock salt), viśa (black salt), audbhida (vegetable salt) and sāmudra (sea salt).

A number of minerals viz. sulphate of copper, sulphate of iron, realgar, orpiment and sulphur have been prescribed in combination with vegetable drugs for external application in ringworm, eczema and leprosy etc.

Preparation of ksāra (alkali) has also been described, i.e. the ash of Butea frondosa is lixiviated with four or six times its weight of water and strained (through linen) 21 times, which obviously gives rise to a solution of potash carbonate.

For a powder (Navāyaśa powder) iron powder (bhasma) is mentioned as one of the ingredients.

For a pill, iron compound (manḍūra vaṭaka) rust of iron and pyrites have been mentioned for use as ingredients.

In a powder (pitaka cūrṇa) useful in the diseases of mouth and throat realgar, yāvak-ara, orpiment, rock-salt are given.

For a collyrum calcis of conch-shell, coral, lapis, lazuli, iron, copper, the bones of the pelican, sulphide of antimony have been described as ingredients. At another place crust of hen’s eggs, sulphate of iron, iron powder and samudraphena are given among the ingredients of a vartī. For a powder of pearl compound, pearl, sulphur, powder of iron, copper and silver are given as ingredients. The metals are always used after subjecting to a particular process, called ‘killing of metals’.

For use of iron, gold and silver as rasāyana drugs, a process has been described i.e. their thin sheets are to be made red hot and plunged into one of the decoctions of the myrobalans, cow’s urine, the solution of the salts, the solution of the alkali (Potash Carbonate) at a time and to be powdered."

Caraka mentions vegetable as well as animal oils. The viscous (oily) substances are classified under four groups, butters, oils, fats and marrows.

Nine sources of spirituous liquor or fermented drinks have been mentioned in the Caraka Sārāhītā which are cereals, fruits, roots, wood, flowers, stems (stalks), leaves, barks of plants and sugar from various sugar-yielding canes. From these the preparation of 84 different kinds of āsava (wine) have been described. The nine main classes of liquors from the above nine sources, are called - dhānāsava, phalāsava, mūlāsava, sārāsava, puspāsava, patrāsava, kandāsava, tvagāsava and sārkārasava respectively.

Finally, it can be said, that, the post-vedic period was started with Caraka, who is to Ayurveda what Hippocrates is to that of Greek medicine. Caraka a practising physician, is also the first to codify medicine in India, representing rather a more or less final development of the subject. Sir P.C. Ray is inclined to place (p xv) him in the pre-Buddhist era, a much earlier period that does Sylvain Levi, the French orientalist who makes him the court physician of the Indo-Scythian king, Kaniska, who reigned in the 2nd century A.D. (Circa 150 A.D.). However, there is general agreement in placing him in c. 100 A.D. ³

Caraka defined 'Rasāyana' as—therapeutics are of two kinds: the one which promotes the strength and vitality of the healthy, the other which cures diseases. Whatever promotes longevity, memory intelligence, health and virility etc. is called Rasāyana. Here priority is assigned to Rasāyana which represents drugs of rejuvenation, and the medicine proper curing diseases has been put next in rank. Nothing corresponding can be found in any other system of medicine, certainly not in the codex of Hippocrates.

The foremost among the Rasāyanas, in Caraka Sārāhitā comes 'Cyavana prāsa' which was conceived and tried upon himself by the sage Cyavana, who by its use though grown very old became young once again. It is celebrated as the highest Rasāyana. Caraka gives a long receipt of Cyavana’s preparation with all ingredients as herbal (cikitsāsthāna, adhyāya 1(1); 66,69).

Another vitalizer given in the Caraka Sārāhitā is called 'Brahmarasaṇā' containing Emblic myrobalans and iron (cikitsāsthāna, adhyāya 1 (1) 58 and (3; 3). This declaration of its contents pinpoints a herbometallic preparation. In this way another preparation 'Lauhādi-rasāyana' (iron vitalizer) is given (cikitsāsthāna adhyāya 1 (30; 15–23).

22. History of Chemistry in Ancient and Medieval India, P. Ray (1956)
Indian Chemical Society, Calcutta, p.no. 62-63.
After pure herbal preparations as vitalizers, next comes herbo-metallic, usually called 'calcined metals' and then thirdly there is mention of śilājatūrasāyana (mineral pitch vitalizer) in Caraka Samhitā, which is by its make-up a herbo-mineral preparation (cikitsāsthāna, adhyāya, 1(3), 48-65).

The all herbal and herbo-mineral rasāyanas here, are the natural products, whereas herbo-metallic rasāyanas were not found in nature, and thus alchemy made it its concern to make them, and in this way, the alchemy was started as pharmaceutical chemistry, retaining the objectives of rejuvenation. So, it can be said that, Caraka's rasāyana when extended to metals becomes alchemy. Rasāyana treats an infirm old patient, while alchemy ricketly metal first and through it the same old patient. Thus, the chief objectives of the two were to acquire the power of transmuting base metals into gold and to prepare an elixir, which could impart immortality to human beings.14

Suśruta Samhitā

As regards the age of Suśruta Samhitā, its style comparing to Caraka indicates a somewhat later date of its composition. The extant Suśruta Samhitā is generally believed to be a comparatively modern recession by a celebrated Buddhist 'Nāgārjuna' who is said to have added the Uttaratantra or the supplement. The age of Suśruta has been the subject of animated controversy for a long time past. According to Dr. Hoernle, it must have been copied within the period from about 400 A.D. to 500 A.D. Suśruta Samhitā also like Caraka Samhitā is a repository of the chemical and therapeutical informations accumulated from the Vedic age to the date of its final recasting.15 Though the original Suśruta Samhitā was composed somewhat later than the Caraka Samhitā, there cannot be a great interval between these two.16 Thus, it can be said that, the date of the finally redacted text may be put somewhere between 3rd & 4th century A.D. as the commonly accepted date and the original Suśruta Samhitā probably existed during the last few centuries before the Christian era.17

According to Suśruta, alkalies are of two kinds viz. for external application for escharotic use is given

like other alkalies by straining alkaline solutions. They are made of three strengths, namely weak, moderate and strong.

Neutralization of the alkali by an acid is also given in Suśruta Samhitā.

Distinction has also been made between the alkalies, yavakṣāra (factitious carbonate of potash) and Sarjikṣāra (trona or natron). Borax too has been mentioned under alkali.

Thirty seven classes of vegetable are mentioned, which chiefly constitute the Materia-Medica. In one sloka six metals, namely, tin, lead, copper, silver, kr̥naloha (iron) and gold, and their calces are also recommended for use as drugs. Lead and tin are described as vermifuge - a property also accepted by the later itro-chemists.

Six types of salts are mentioned viz. saindhava (rock-salt) sāmudra (sea-salt), viḍa, sauvarcala (nitre), romaka and audbhida.

Among the minerals, sulphate of copper, sulphate of iron, alum-earth, red-ochre, orpiment and realgar etc. are prescribed for external application. Process of roasting of iron and other metals has been given to make them fit for internal administration. By this method, metals are converted into their respective oxides, or oxychlorides as the case may be. Thus, Suśruta describes a practical method, though crude and imperfect, for the preparation of metallic salts. The much reputed ‘potable gold’ in the shape of the chloride of the metal was probably obtained in this way.

In Suśruta Samhitā, the origin of bitumen is much the same as in the Caraka Samhitā and the Bower Manuscript. The only difference being that, according to Suśruta, bitumen is related to six instead of four metals (gold, copper, silver and iron).

Two varieties of iron pyrites of the lustre of gold and silver respectively are mentioned (containing copper and free from copper respectively).

The poisons are classified as animal, vegetable, and mineral respectively. Phenaśmax Bhasma (white arsenic) and orpiment have been recognized as mineral poisons.

A large variety of liquors prepared from the juice of fruits like grapes and raisins, from date-palm juices, from rice-paste and barley, from sugarcane juices, treacle and honey, as well as from flowers and bark of trees are also described in Suśruta Samhitā.

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The mercury was not well known in Suśruta’s time, as it is used at one or two places only in Suśruta Saṁhitā that too as an ingredient of a cosmetic preparation for the treatment of Vyaṅga, etc.\(^\text{30}\)

In this way, long before the 5th century, probably as early as the 1st century A.D. the prevailing school of medicine and surgery, the Caraka and Suśruta respectively had founded and elaborated theory of inorganic and organic compounds. The knowledge of chemical compounds and of their preparation continued to make progress in both of these schools. A study of treatises of the Caraka and the Suśruta, makes it clear that, the materia medica of Ayurveda is extensive, and utilizes substances from the animal, vegetable and mineral kingdoms and the drugs included had each been selected after careful clinical experiments and long experience. The specific properties like taste, assimilability, potency, physiological actions are described in almost all cases. A statistical break-up of the materia medica in the Caraka Saṁhitā shows 341 plant substances, 177 drugs of animal origin and 64 mineral substances, metals etc. The corresponding numbers for the Suśruta Saṁhitā are 395, 57 and 64 respectively. The drugs of animal origin are found less and less in the later works. But in case of inorganic drugs, the choice was limited to the few locally available metals and minerals. Process for the dissolution of finely divided iron, gold, silver, gems, minerals etc, in vegetable acids for medicinal preparations are found in some passages. After the age of Caraka and Suśruta, a steadily increasing complement of inorganic substances among Ayurvedic medicines is found. Most of the incoming materials differed from the readily available and naturally occurring inorganic drugs mentioned in the earlier works, as these drugs were synthetic substances or minerals and ores transformed by chemical processes or metallurgical treatment. The beginning of this trend is seen in the work of Vāgbhaṭa.\(^\text{31}\)

Aṣṭaṅga Hṛdaya

Next to the Caraka Saṁhitā and Suśruta Saṁhitā in importance, is the Aṣṭaṅga Hṛdaya (lit. heart or the kernel of the eight limbs or divisions of the Ayurveda). The author of this work is Vāgbhaṭa, who was a Buddhist by religion and a medical authority of his time. He is comparable with Galen in Greek medicine.\(^\text{32}\) He lived


\(^{32}\) Indian Alchemy or Rasayana, S. Mahdihassan, (1979), Vikas Publishing House Pvt. Ltd, New Delhi, p.nos. 50 & 52.
most probably in the 1st half of 7th century A.D.\textsuperscript{33}

Aśṭāṅga Hṛdaya is an epitome of the Caraka Samhitā and the Suśruta Samhitā with some gleanings from the works of Bhela and Hārīta. Mineral and natural salts chiefly figure in the prescriptions along with vegetable drugs. Mention of mercury is made incidentally, but in such a perfunctory manner that, it would not be safe to conclude about the knowledge of its compounds. There are however, some metallic preparations recommended in it, which would presuppose an advanced knowledge of chemical processes.

In Aśṭāṅga Hṛdaya minerals like sulphate of copper, red ochre, realgar, orpiment, sulphate of iron etc. are recommended in a recipe for external application for genital sores.

A number of preparations of gold, silver, copper, iron, tin and lead have been given in it. At one place there is direction for roasting in a closed crucible (andhamū-ā or a crucible with the lid on) a mixture of 64 parts of stibium (Srotoujana), which is evidently stibnite or the native sulphide of antimony and one part each of copper, iron, silver and gold.

In another case, direction has been given to roast in a closed crucible mixture of 30 parts of lead, 5 parts of sulphur, 2 parts of copper and orpiment each, 1 part of tin and 3 parts of stibium.

With regard to the preparation of alkali and caustic alkali, Vāgbhaṭa has borrowed this almost word for word from the Suśruta.

For use of mercury, direction has been given at one place (Uttarasthāna, chap XIII) to take equal parts of mercury and lead and to make them up into a collyrium with their equal weight of stibium and camphor.\textsuperscript{34}

Thus it can be said that, there must have existed in the very beginning herbalism, promising immortality. Then came a herbo-mineral preparation to produce an enhanced effect. Then, mercurials as drugs of immortality were used and in this way alchemy came into existence. The herbal and herbo-metallic rasāyana and mercurial alchemy all became identical with regard to 'Rasāyana' i.e. alchemy.\textsuperscript{35}

\textsuperscript{33} Ayurveda Ka Vaijnanika Itihasa, 2nd Edn, P.V. Sharma, (1981).
Chaukamba Orientalia, Varanasi, p.no. 127.
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सारांश

पूर्वबेंदिक बैंडिक तथा अयुर्बेंदिक कालों
भारतीय रासायनिक विज्ञान का संक्षिप्त इतिहास

— मोमिन अली

भारतीय रासायनिक विज्ञान के इतिहास से संबंधित चिन्हों का पूर्वबेंदिक काल से पता लगाया जा सकता है। सिद्धांत में हृदय-था तथा मोहनजोधर की पुरातात्विक खुदाईयों से यह तथ्य प्रकाश में आया है कि प्राचीन भारत में रासायनिक-विज्ञान की जानकारी का इतिहास इतना अधिक प्राचीन है कि इसका संबंध पूर्व ऐतिहासिक काल से चला आ रहा है। बैंडिक काल में एकाकी द्रव्यों का चिकित्सा में प्रयोग होता था खनिज एवं जंगल द्रव्यों का भी प्रयोग होता था, किंतु भोजन द्रव्यों के विभिन्न योगों के प्रयोग का प्रचलन नहीं था। भारत में रासायनिक विज्ञान का प्रारंभ दर्षित औषधि एवं अभ्यास तथा अन्य कोंट्रो की द्रव्यों को स्वर्ण-धातु में परिवर्तन का उपयोग होता था। तात्पर्य मज़े के ब्राह्मण के पश्चात् भारतीय रासायनिक विज्ञान की उसके प्रभाव से बढ़त प्रगति हुई। तदु-पश्चात् रसायनशास्त्र के काल में पूर्व संचित रासायनिक विचारों को उद्योगी व्यावसायिक एवं वास्तविक रूप में प्रस्तुत किया गया तथा पारद व बन्य धातुओं के चिकित्सो-योगों कुछ योगों को विकसित किया गया।