

Chemical Practices in Ancient India

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ABSTRACT

There has been a very ancient tradition of chemical practices in India. Chemical activities had been common to ancient Indians and a part of their day to day life from prehistoric time. Earliest chemical practices started with the paleolithic period, intimately associated with medicine purpose, metallurgical operations and technical art. The Ancient Indians had excellent metallurgical skill. Metals like gold, silver, iron, tin, lead and mercury were used in various forms in ancient Indian society by the 5th century B.C. Indian iron and steel objects earned the admiration of the people in the other part of the then known world. Apart from the high level metallurgical skill, ancient Indians made great strides in respect of the use of alkalis, acids and salts, preparations of glass, cosmetics and perfumes, pyrotechnics and many chemical arts and crafts. Evidently India was the standard bearer in the ancient world in chemical practices.

Key Words : Ancient India, prehistoric, archaeological excavations, glazed articles, metallurgy, smelting

INTRODUCTION

Chemical is any substance consisting of matter. This includes any liquid, solid or gas. In simple words, everything is a chemical because everything is made of matter. A chemical is any pure substance or any mixture. Chemicals appear naturally and can be made.

We find a very ancient tradition of chemical practices in India. Chemical practices in ancient India intimately associated with medicine purpose, metallurgical operation and technical art. The history of chemical practices started from the paleolithic, protohistoric period and the earliest textual record of chemical practices is mentioned in Rigveda. Fortunately so many evidences and source materials are available for the study of chemical knowledge and practices in ancient India.

Objectives of the study:

The main aim of this study is to illuminate the facts regarding vast chemical knowledge of ancient Indians. The other objectives along with this aim are:

- To highlight the facts regarding chemical knowledge and practices in day to day life of

ancient India.

- To illuminate a wide variety of chemical practices in ancient India including the high level metallurgical skill in the then known world.

METHODOLOGY

This paper is informative as well as descriptive in nature based on primary and secondary literary data sources including the evidences found in the archaeological excavations. The central probe concentrated in this paper is vast chemical knowledge and wide variety of chemical practices in ancient India from the prehistoric period to the whole historic period.

Beginning of Chemical Practices in India (Prehistoric Period) :

Earliest period of chemical practices started with the prehistoric time of man's life, when they live a life of savage. We find the evidences of chemical practices in the paleolithic period where they started the rock painting in hills region.¹ They learned about minerals and used natural colours from the products like turmeric, madder

etc. for their painting. In this way they shaped their painting with the help of chemical science.

People of Indus Valley Civilization had very extensive chemical knowledge. Harappan civilization was the earliest society which has developed a labored and elaborate urban system. They were skilled in employing a wide variety of chemical practices such as production of backed bricks, glazed pottery, painted pots, glass vessels, seals, jewellery, earthen wares terracotta etc.

Pottery could be regarded as the earliest chemical process in which materials were mixed, moulded and fixed to achieve desirable qualities. Different areas were known to make pottery as far back as 4000 BCE. Most were basically made for utilitarian purposes with the use of potter's spinning wheel. It is now known that craftsman of the Harappa Civilization had an intimate knowledge of the processing and properties of the naturally occurring minerals and were well practised in the art of pottery making and metal working.² E. Mackey believed that the glazed pottery found at Mahenjodaro was probably the earliest specimen of this type of pottery.³ It is an interesting fact that the practise of glazing pottery appeared in Mesopotamia about 1500 years later than in the Harappan Civilization.⁴

Gypsum cement had been used in the construction of a well in Mhenjodaro. It contained sand, clay, traces of calcium carbonate and lime.⁵

The people of Indus Valley civilization used a number of minerals for different type of useful products such as medicinal preparations, plasters, hair washes etc. Faience – a sort of proto-glass was quite popular in Harappan society and was used for ornaments. No glass objects except for faience and glazed articles were found in that time.⁶

Harappan people also smelted and forged various objects from lead, copper, silver and gold; and also used tin and arsenic to improve the hardness of copper for making artefacts.

Harappan metalsmiths knew the technique of making beads, soldering, sheet-making, rivetting, coiling and 'cire-perdue' casting (wax metal-casting process).

There was then a flourishing trade in metals and metallic ores between India and neighbouring countries like Persia and Mesopotamia.⁷

Later excavations have unearthed specimens of iron implements.⁸ Iron ore and items made from it have been found in eight bronze age Harappan sites, some as far back as 2600 BCE or earlier. This may have been a

natural development from smelting copper and then using it for the making of iron utensils.⁹

Chemical Practice in Historic Period:

In ancient texts amazing information is available on chemical knowledge and chemical practices. In the ancient text 'Ras Ratna Samuchchay' of Vaagbhata, 10 chemicals – Maharas, Upras, Samanya Ras, Ratna, Dhatu, Vish, Kshar, Ami, Lavan and Lohbhasmi has been mentioned as the main chemicals. There is a description of chemical laboratory also in the 7th chapter of Rasratna Samuchchay. 32 instruments were used in this laboratory.

Nagarjuna has explained in his texts (Ras Ratnakar, Arogya Manjari, Yoga Saar) the methods of purifying and medicinal use for good health of mercury in detail. He has given the method of preparing a mixture of various metals, purification of mercury and other metals, purification of maharas and converting various metals into gold or silver.

The people of ancient India had the considerable knowledge of medicine. In ancient India Rasshastries used to extract juices from various plants and trees for their medicinal properties. In the field of medicine, Ayurveda is the most significant contribution of ancient India. In Atharvaveda, hymns refer to the topics of Ayurveda.¹⁰ 'Charaka Samhita' and 'Susruta Samhita' were the two celebrated Ayurvedic treatises on medicine and surgery. Copper, silver, lead and iron are mentioned for use as drugs in Charak Samhita.¹¹

There are some 44 ancient texts that describes the process of Indian metallurgy. Before 18th century B.C. humanity was aware of only 7 metals – gold, silver, copper, iron, tin, lead and mercury. All these seven metals were mentioned in India's ancient scriptures including Rigveda, Yajurveda and Atharvaveda. These materials were used in society. Kautilya's Arthashastra is a treasure of knowledge discussing about the mines, metals, precious articles like gems, rubys, pearls etc.

The advent of iron technology in India is of great significance. Indian iron and steel objects earned the admiration of the people in other parts of the then known world by the 5th century B.C. The Greek historian Herodotus in 5th century B.C. indicates that the Indians in the Persian army used arrows tipped with iron. Ktesius (5th century B.C.) speaks of two swords of Indian steel presented to him in the Persian court. It is in record that the gift which Alexander the great received from Indian king Porus was of 30 pounds of steel.¹² Later the Indian

iron and steel became very famous in Rome for fashioning them into fancy cutleries and armours.¹³

Ancient Indians were far better than European experts in several technologies such as smelting, casting, calcination, steaming, fixation and fermentation. It is worth mentioning that the secret of manufacturing of Damascus steel was adopted by the Arabs from Persians and Persians from India.¹⁴

Apart from iron and steel, ancient Indians made long steps in using copper, silver, zinc, lead, tin and gold.

India was one of the first countries to mine gold. Greek visitors like Megasthenese had mentioned in their records. Much of the gold used in the Persian empire in the 5th century B.C. came from India. A typical naturally occurring gold powder, mentioned in the Mahabharata (2.52.2-4) was known as Pipilika Gold.

Indians also knew the techniques for isolation, distillation and use of zinc. Indian metalsmiths were the first in the then known world to achieve success in developing the method of extraction of zinc from its ores.

Silver was also of importance in Ancient India. The archaeological finds of silver artifacts have helped to clarify the antiquity of the Vedic culture. Artisans of that time were not only skilled in kshepana (setting), Guna (properties) but also making solid or hollow articles of gold and silver.

Another metal expertly used by ancient Indians was copper. People had made fine copper axes by cutting the copper in molds. Bronze was also known in India from 3000 B.C.E. Bronze items were made through the lost wax system. The copper alloy of brass was also used. Copper was also used as a material for making instruments and vessels for medicinal purposes.

The historic monuments like 'Iron Pillar' at Delhi and the 'Copper Statue of the Buddha' found at Sultanganj in Bihar and now in Birmingham Museum in England, bear vigorous evidence to the metallurgical skill in the classical age of India.

In iron pillar, the specific gravity of the metal is over 7.6 and the pillar weighs more than six tons. It is made of wrought or malleable iron (99.72%) and is still without any sign of rust on it even though it is about 1500 years old.¹⁵ V. Ball says about it : "It is not many years since the production of such a pillar would be an impossibility in the largest foundries of the world, and even now there are comparatively few places where a similar mass of metals could be turned out."¹⁶

Buddha's huge copper statue, probably belonging

to the 5th century A.D. has been cast in two layers, the outer layer by wax metal-casting process (cire perdue) and the inner layer in segments on a mould composed of sand, clay, charcoal and paddy husk using iron bands for holding the segments together.¹⁷

Diamond and many other precious jewels were used in Vedic period. This science was not only to recognize the value of gems but also for their use in Jyotish and counteracting of negative influence of planets. There is a lot of this kind of information in Garuna and Agni Purana.

Apart from the high level metallurgical skill there are so many evidences of chemical practices in historic period in various chemical arts and crafts such as dyeing, tanning of leather, production of glass, pottery, jewellery, cosmetics, perfumes, soap, ink alcoholic liquors, paper making and preparations of saltpetre and gun powder etc.

Rigveda mentioned tanning of leather and dyeing of cotton. Usually they used plants and their products like madder, turmeric as dyeing materials. Other dyeing materials used by them were oripment and some insects.

In ancient India, glass was used to make beads, bangles and laboratory ware. I have mentioned that no glass objects were found at the sites of Indus Valley civilization, except for some glazed and faience articles. A number of such glass objects were found at Maski in south India (1000 – 900 B.C.), Hastinapur and Taxila (1000 – 200 B.C.). Ancient texts like Ramayana, Brahatsamhita, Arthashastra and Sukranitisara inform us about the use of glass and suggest us that ancient Indians had achieved high degree of perfection in glass making. Pliny referred to the glass of India as being superior to all others in his writing. 'Central Glass and Ceramics Research Institute – Kolkata' tested the glass of that time and found it to be of soda lime with a high percentage of alumina.¹⁸

Sanskrit literature, like 'Brahatsamhita' referred to the preparations of cosmetics and perfumes. Cosmetics and perfumes making were mainly practiced for the purpose of worship, sale and sensual enjoyment. Main fragrant items used by the ancient Indians were sandalwood, camphor and musk (gathered from the secretions of the gland of the male musk-deer).

Lac is the substance secreted on trees by the lac insect. It was used to varnish on wooden furniture or as a dye for cloth and finger nails.

Different areas were known to produce pottery in the historic period of ancient India. There were 18 cities

from the 5th to 1st century BCE in Northern and Central India that were known for making pottery including Sarnath, Mathura, Sanchi, Patna and other towns in this area.

Alcoholic liquors were also prepared and used in ancient India. 'Somrasa', mentioned in the Vedas was probably the earliest evidence of the use of intoxicants in India. About 60 Tamil names of liquors were mentioned in Sangam literature. A variety of liquors such as Medaka, Prasanna, Asava, Arista, Mareya and Madhu is shown in Kautilya's Arthashastra. Charaka Samhita also mentioned sources such as cereals, sugarcane, fruits, flowers, leaves, woods, roots etc. for making various asavas.

Preparations of salt petre and gunpowder were known in ancient India. Firearms were mentioned in Rigveda, Atharvaveda, Arthashastra, Manusmriti and Tamil texts describe the preparation of fireworks using sulphur, charcoal, salt petre, mercury, arsenic, camphor etc.

An inkpot was also found during the excavations of Taxila which shows that ink was known and in use in India from the fourth century B.C. The recipe for ink was given in Rasratnakara of Nityanath.

Conclusion:

Thus, it was proved by the evidences found in the archaeological excavations and in number of ancient texts that India was the leader of the ancient world in chemical activities. Chemical practices had been common to ancient Indians from the prehistoric period. Archaeological excavations have proved that the people of Indus Valley civilization were skilled in various chemical activities. India was widely known for the high level metallurgical skill in the then known world. Apart from the metallurgy, chemical knowledge, acquired by the ancient Indians regarding the use of alkalis, acids and salts, preparations of cosmetics and perfumes, glass, firework display and the like was doubtlessly excellent.

In this manner it can be said evidently that India was the standard bearer in the ancient world in chemical practices. Although, chemical practices remained more as useful arts than as branches of developing chemical knowledge.

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