

ALCOHOLIC FERMENTATION TECHNIQUES IN EARLY INDIAN TRADITION

Nand Lal Singh*, Ramprasad*, P.K. Mishra*, S.K. Shukla*,
Jitendra Kumar** and Ramvijay Singh**

(Received 17 July, 2009; revised 6 May 2010)

Somarasa is an invigorating plant product generally prepared by squeezing juice from plants. That the Ṛgvedic people knew fermentation property of this drink is evident from the hymns praising *somarasa* (120 hymns). The *Śukla Yajurveda* describes the formation of two stimulating drinks – *Surā* and *Pariśrut*. Fermentation products, *ariṣṭa*, *āsava* and *surā*, were considered potent medicinal drugs in Vedic age. In the post Vedic period, two new preparations known as vinegar and liquor from bread were added. The *Kātyāyana Śrauta sūtra* also gives a complete description of the preparation of *Surā*. References to the medicated liquors and a number of other fermented liquors with their respective medicinal values are found in *Caraka* and *Suśruta-Saṃhitās*. The survey aims to chart out the facts relevant to *somarasa* drink in Vedic and early historic period.

Key words: Alcoholic beverage, Fermentation, *Somarasa*, *Surā*, *Pariśrut*

INTRODUCTION

The fermentation techniques involve a variety of processes having a large number of uses. It also laid the foundation of alchemy and chemistry. The term fermentation is derived from the Latin word *Fermentum* that stands for boiling. Fermentation is the process of digesting certain substances that leads to chemical conversion of organic substances into simpler compounds. Fermentation techniques began with sweet substances (vegetable or animal) in different parts of the world. The process of fermentation was probably discovered by observing the changes in the juices of several fruits and other substances that had been kept for a day

* Department of Chemical Engineering and Technology, Institute of Technology, Banaras Hindu University, Varanasi-221005, India. email: nlr_sakshi@yahoo.co.in

**Sampurnanand Sanskrit University, Varanasi, India.

or more. It appears that fermentation techniques started simultaneously with settled agricultural practices during the Neolithic period. Archeological findings show that brewing with barley had developed into a serious art as early as 6000 years ago in the valley of the Tigris and Enphratus, Nile, Indus and other civilisations¹. This knowledge followed the advances in agriculture across Europe by the Celts, descendants of the Āryans of central Asia².

Even the Harappans (c. 3200 – 1500 BC) appear to have known not only the process of alcoholic fermentation but even of distillation.³ Mahdi Hassan⁴ has assembled a total distillation pots from clay items routinely found in Indus Valley excavations. Mahdi Hassan⁵ has also reported that even before Āryans entered India, which Max Muller dated as 3000 BC, the pre-Āryan hill tribes fermented *Mahuā*-flowers (*Bassia latifolia*) and distilled the liquor. The flowers are rich in sugars but also in glucosides which causes diarrhea so that the fermented liquor has to be distilled. The hill tribes in Bihar still continue to do so.

The fermentation techniques as developed in Vedic (c.1500 BC-600 BC), Post-Vedic (600 BC- 1st century AD onwards) and Historical phase⁶ (1st century AD onwards) are now discussed systematically.

Vedic Period

The *Vedas* (from the root *vid*, to know) are the main scriptural texts of of the early tradition in India. The *Vedas* had a oral tradition based on student teacher relation. As per Vedic tradition, the sage Vedavyāsa divided the *vedas* into *Ṛgveda*, *Yajurveda*, *Sāmaveda* and *Atharvaveda*⁷.

Ṛgveda

The *Ṛgveda*⁸ (*RV*) reports that *soma* was a sacred plant, the juice of which (*soma-rasa*) was considered as the divine drink offered to Gods, contemplated with medicinal efficacy, used as natural restorative for health that makes the consumer awakened and alert. In vedic period, the *somarasa* was frequently consumed at religious festivals⁹. Another name popularly associated with alcoholic drink in ancient India was *drākṣāsava*. Findings of excavation of Harappan sites also confirm the use of alcoholic drinks in that era. In ancient Law Books, *soma* was regarded as a purified drink having exceptional qualities to an extent that a Brahmana (yogic elite) by drinking *soma*, was supposed to acquire supernatural powers, by which he could kill others merely by a glance. Moreover,

the alternative name of the Moon God ‘*candra*’ is *soma*, who controls the medicinal properties in plants and is authority of *amṛta* (i.e. nectar), the so called elixir of immortality.

In the Vedas, *soma* is portrayed as sacred as a God (*deva*). The God, the drink and the plant were probably referred to the same entity, or at least the differentiation was ambiguous. In this aspect, *soma* is similar to the Greek ambrosia (cognate to *amṛta*); it is what the Gods drink, and what made them deities. Indra and Agni are portrayed as consumers of *soma* in large quantities. The consumption of *soma* by human beings was probably under the belief that it bestowed divine qualities into them.

A sweet substance known as *soma* juice prepared by the vedic Āryas is supposed to be the first product of fermentation in India. The *Ṛgveda*⁸ (c.1500 BC) reports that fermentation technique took its first step in connection with the preparation of *soma* juice in India. Another drink, known as *surā* (wine/beer), was also prepared by fermentation. These two preparations have also been used in different medicinal preparations, surgical procedures and in many chemical and alchemical operations.

Somarasa, which was mentioned in the Vedas, was probably the earliest evidence of the use of intoxicants in India. About 60 Tamil names were found in Saṅgam literature, which suggest that liquors were brewed in south India since the ancient times. Medieval alchemical texts also mentioned fermented liquors and their methods of preparation. Alcoholic liquors were classified into various categories depending on their applications in alchemical operations:¹⁰ *Dasanapasani* and *Raṅjani surā* were used in the dyeing operations, whereas, *Sarvacāraṅī* and *Drāvani surā* were used as solvent. *Rasabandhanī* and *Rasampātani* were used for purification of mercury.

In the beginning, fermentation was mainly associated with the preparation of spiritual drinks, but later on it was used for other purposes also. The different terms associated with fermentation in various texts are¹¹: *asuta* (begetting a new form), *abhisuta* (extraction, may indicate extraction from fermented smash), *pariśrut* (‘foaming’, ‘fermenting’, that is, the state of fermenting) and *sandhāna* (complete absorption of ferment with fermenting material). All these terms, chiefly signifying “brewing”, were part of the process of fermentation. Except the last term, all other terms have reference in vedic literature. Fermentation techniques was mainly based on the base material (*yoni*), ferment or yeast (*kinva*, *nagnā*

hu) and auxiliary (*sambhara*), which provides flavor and good taste to liquor. Heating or digesting was generally done in fermenting vessels.

The fact that Ṛgvedic people knew fermentation of drinks is evident from the hymns praising *somarasa*. There are about 120 hymns praising it. *Soma* is an invigorating plant product generally prepared by squeezing juice from plants and preserving it in special condition. There are many statements in Ṛgveda which give an indication of fermentation.⁷ “A mixture of a thick juice of *soma* with barley powder (*RV. IX. 68.4*).” This statement is a clear indication of fermentation using barley as base material. “Fifteenth day old highly intoxicating *soma*” (*RV. X.27.2*), which probably refers to the broth fermented in the vat for 15 days. The statement “We have drunk *soma* and become immortal; we have attained the light, the God is discovered. Now what may foeman’s malice going to harm us? What, O Immortal, mortal man’s deception? (*RV.VIII.48:3*)” refers to the exceptional powers of *soma*.

The Ninth *mandāla* of the Ṛgveda is known as the *Soma mandāla*. It consists entirely all the hymns related to *soma pāvamana* (“purified *soma*”). The drink *soma* was kept and distributed by the Gandharvās. The Ṛgveda associates the *Susōma*, *Arjikiya* and other regions with *soma* (e.g. *RV. VIII.7.29*; *RV. VIII.64.10-11*). *Sharyanavat* was possibly the name of a pond or lake on the mountains where *soma* could be found. The plant is described as growing in the mountains, with long stalks, and of yellow or tawny (*hari*) colour. The drink is prepared by priests pounding the stalks with stones, an action that creates *tapas* (literally “heat”, later referring to “spiritual excitement” in particular). The juice so gathered is mixed with other ingredients (including milk and honey) before it is drunk.

Growing far away, in the mountains, *soma* had to be purchased from traveling traders. The plant supposedly grew in the *Hindukuś* and thus it had to be imported to the Punjab region. Later, knowledge of the plant was lost altogether, and Indian ritual reflects this, in expiatory prayers apologizing to the gods for the use of a substitute plant (e.g. rhubarb) because *soma* had become unavailable.

The drinking of *somarasa* was ritual oriented, offered to Gods and was not meant for a common man. The *soma* drink was praised with different adjectives in different hymns of Ṛgveda, such as: *Śukra RV.IV.27.5* (gives contentment), *Śubhra RV.IX.62.5* (beautiful), *Madhu RV.I.13.4* (sweet), *Madya RV. VIII. 92.1* (priority for consumption), *Gorjika RV. VII. 21.1* (free from excreta), *Vivakśasva*

RV. VIII.1.25 (to be praised aesthetically), *Manīśīnaḥ* RV.II.19.1 (enrich cheerfulness), and *Sudakśa* RV.VIII.92.4 (cream of the food) etc.⁷

Yajurveda

The *Śukla Yajurveda* (ŚY) describes the formation of two stimulating drinks – *surā* and *parīśrut*. *Surā* was supposed to be prepared from germinated paddy, germinated barley, and parched rice with the help of ferment. Yeast was used most often as the fermenting agent.¹²

- दीक्षायै रूप शष्पाणि प्रायणीयस्य तोक्मानि ।
क्रयस्य रूप सोमस्य लाजाः सोमा शवो मधु ॥ (ŚY, XIX.13)
- आतिथ्यरूपं मासरं महावीरस्य नग्नहुः ।
रूपमुपसदामेतत्तिस्रो रात्रीः सुरासुता ॥ (ŚY, XIX.14)
- सोमस्य रूपं क्रीतस्य परिस्रुत्परिषिच्यते ।
अस्विभ्यां दुग्धं भेषजमिन्द्रायैन्द्र सरस्वत्या ॥ (ŚY, XIX.15)
- आसन्दी रूप राजासन्धै वेद्यै कुम्भी सुराधानी ।
अन्तर उत्तरवेद्या रूपं कारोतरो भिषक् ॥ (ŚY, XIX.16)
- एतावद्रूपं यज्ञस्य यदेवैर्ब्रह्मणा कृतम् ।
तदेतत्सर्वमाप्नोति यज्ञे सौत्रामणीसुते ॥ (ŚY, XIX.31)
- सुरावन्तं बर्हिषद सुवीरं यज्ञ हिन्वन्ति महिमा नमोभिः ।
दधानाःसोमं दिवि देवतासु मदेऐन्दुं यजमानाः स्वर्काः ॥ (ŚY, XIX.32)
- यस्ते रसः संभृत ओषधीषु सोमस्य शुष्मः सुरया सुतस्य ।
तेन जिन्व यजमानं मदेन सरस्वतीमस्विनाविन्द्रमग्निम् ॥ (ŚY, XIX.33)
- यमस्विना नमुचेरासुरादधि सरस्वत्यसुनोदिन्द्रियाय ।
इमं त शुक्रं मधुमन्तमिन्दु सोम राजानमिह भक्षयामि ॥ (ŚY, XIX.34)
- यदत्र रिप्त रसिनः सुतस्य यदिन्द्रो अपिबच्छचीभिः ।
अहं तदस्य मनसा शिवेन सोम राजानमिह भक्षयामि ॥ (ŚY, XIX.35)
- तदस्विना भिषजा रुद्रवर्तनी सरस्वती वयति पेशो अन्तरम् ।
अस्थि मज्जानं मासरैः कारोतरेण दधतो गवां त्वचि ॥ (ŚY, XIX.82)
- सरस्वती मनसा पेशलं वसु नासत्याभ्यां वयति दर्शतं वपुः ।
रसं परिस्रुता न रोहितं नग्नहुर्धीरस्तसरं न वेम ॥ (ŚY, XIX.83)

पयसा शुक्रमृतं जनित्र सुरया मूत्राज्जनयन्त्र रेतः।
अपामतिं दुर्मतिं बाधमाना ऊवध्यं वात सब्बं तदारात्॥ (ŚY, XIX.84)

Kātyāyana Śrautasūtra

The *Kātyāyana Śrautasūtra*¹³ also gives a description of the preparation of *surā*. According to this method either boiled rice or boiled barley was mixed with the ferment and also with *māsara* and the entire mixture was kept in a jar. The jar was then kept in a pit for three nights. Meanwhile, cow's milk and powdered parched rice were poured in the pit. (*Kātyāyana Śrautasūtra*, XV.9.28, XV.10.19, XIX.01.01, XIX.01.02, XIX.01.18)

Post-Vedic Period (600 BC to 100 AD)

In this period, two new preparations known as vinegar and liquor from bread were added by adopting new methodologies. Later on some other drinks were also prepared by using fermentation techniques. Various developments took place in the field of fermentation techniques during the post-vedic period.

A large number of base materials were began to be used as base material as rice and barley among cereals; grape, palm, mango, wood-apple and sugarcane, etc, among fruits; *madhuka* (*Bassia latifolia*) and jasmine among flowers and barks of *mesaśṅgi*, *putraka*, etc¹¹. Earlier honey was mostly used as a ferment, but later on treacle (*ĀŚ. II.25*) also began to be used and became very popular in a short span of time. *Sambhara* (*ĀŚ. II.25*) which was an extract of cinnamon, *Plumbago zeylanica*, *Emblia ribes* and *gaza-pippali* (elephant pepper plant) had also began to be used as ferment. It was also used for providing flavor and taste to other drinks. The drink made from *sambhara* was known as *sambharikī*.

Medaka (spiced rice beer), *prasanna* (spiced barley or wheat beer), *āsava* (sugarcane beer), *ariṣṭa* (medical tincture), etc, were some of the most popular drinks of that period. Different varieties of fermented liquor provide us the knowledge of different fermentation processes developed during that period.

Kauṭilya's *Arthaśāstra* (321-150BC) discusses "alcoholic beverages made from fruit". A variety of liquors such as *medaka*, *prasanna*, *āsava*, *ariṣṭa*, *maireya* and *madhu* are listed in this text. Baring a brief description of the preparation of *surā* in the *Kātyāyana Śrautasūtra*, although alcoholic liquors are mentioned from the *R̥gveda* onwards in Sanskrit literature, only in the

Arthaśāstra of Kauṭilya, the detailed methods of preparation are outlined. These descriptions are extremely terse, and each translator, such as Shama Sastry¹⁴, Sten Konow¹⁵, and Kangle¹⁶, has their own rendering. Some of them are discussed below¹⁴.

“*Medhaka* was manufactured with one *drona* (about 10kg) of water, half an *āḍhakā* (1.2 kg) of rice and three *prasthas* (1.6 kg) of ferment.”

“Twelve *āḍhakās* (about 27 kg) of flour, 5 *prasthas* together with the bark of the fruits of *putraka* (an unidentified plant species), constitute *prasana*.”

“One hundred *palas* (3.5 kg) of *kapittha*, 500 *palas* (17.5 kg) of *phanita* (translated as sugar but actually molasses) and one *praṣṭha* (560 g) of honey form *āsava*.”

“The preparations of various kinds of *ariṣṭa* for various diseases are to be learnt from physicians.”

Period of Scientific and Technical Literature (100 AD onwards)

A large number of digesting methods came into existence in the period. The fermenting vessel was deposited into the earth and sometimes the vessel was covered with horse dung. The vessel was in other cases placed on heap of grains and sometimes it was also exposed to sun.

Some new recipes of fermentation were also formulated. One such recipe for production of yeast (*kinva*) is described in *Rasopaniṣat* (RP. XV 251-253).¹⁷ According to this best bulbous plant having latex, rice or *kodrava* (*Paspalum scrobiculatum*) and *madana* (emetic nut) combined with whey of buffalo or cow-milk was used to be kept in the close vessel in the sun. The acidic residue thus obtained was *kinva* (yeast).

The alcoholic fermentation and acetous fermentation began to be used for several purposes by changing the base material or by slightly modifying the digesting methods. Base material was referred as *yoni* and the fermented produces as *tri-yoni*, *dvi-yoni*, etc. The juicy produce that was obtained from the fermented smash was known as *Jatarasa*.

Fermentation products, *ariṣṭa*, *āsava* and *surā*, were also considered potent medicinal drugs. Similarly, *aranala*, *cukra*, *dhānyamala*, *kañjīka*, *sauviraka*, *sukta*, *tusambu*, etc, were not only used for medicinal purposes but also for washing of metals and minerals and for different mercurial operations.

Manufacturing of Spirituous Alcoholic Fermentation¹⁸

Suśruta-Saṃhitā (SS.Cikitsā.10.6-8) used the word *kahala* for alcoholic beverages; perhaps the modern word alcohol is derived from it. A large number of alcoholic preparations were described in the text.

Ariṣṭa: Powder of certain selected drugs of desired medicinal properties and fermenting properties mixed with water, iron powder and treacle was used in specified ratios for the preparation of *ariṣṭa*. Water taken was about half of the weight of the powder while iron powder and treacle taken were 28½ times the weight of water. All of these ingredients were placed in an earthen vessel. The earthen vessel was coated with a mixture of honey, butter and powdered long-pepper plant from inside. Now the sealed earthen pot was placed in a mass of barley for at least seven nights for fermentation to take place.

Āsava: A mixture of either cold alkaline water or sesamum and juice of sugarcane was taken for the preparation of *āsava*. These were taken in the ratio of 2: 3 respectively. The process of fermentation was the same as that of *ariṣṭa*.

Surā: In the preparation of *surā* a decoction of a mixture of desirable drugs was taken with the ferment. This preparation was also similar to that of *ariṣṭa* and *āsava*.

In addition to the medicated liquors described above, number of other fermented liquors with their respective medicinal values are also been reported in *Caraka*¹⁹ and *Suśruta-Saṃhitā*¹⁸. The famous Ayurvedic scholar Suśruta wrote that the best *soma* is found in the upper Indus and Kashmir region (*Suśruta-Saṃhitā*: 537-538, SS.CS. 29.28-31). *Caraka Saṃhitā*¹⁹ also mentioned number of sources as cereals, fruits, roots, woods, flowers, stems, leaves, barks of plants and sugar cane for making various *āsavas* as referred below:

प्रकृत्या मद्यमम्लोष्णमम्लं चोक्तं विपाकतः ।
सर्वं सामान्यतस्तस्य विशेष उपदेक्ष्यते ॥ (CS, 27.178)

कृशानां सक्तमूत्राणां ग्रहण्यर्शोविकारिणाम् ।
सुरा प्रशस्ता वातघ्नी स्तन्यरक्तक्षयेषु च ॥ (CS, 27.179)

मुखप्रियः सुखमदः सुगन्धिर्बस्तिरोगनुत् ।
जरणीयःपरिणतो हृद्यो वर्ण्यश्रव शार्करः ॥ (CS, 27.183)

सुरासवस्तीव्रमदो वातघ्नो वदनप्रियः ।
छेदी मध्वासवस्तीक्ष्णो मैरेयो मधुरो गुरुः ॥ (CS, 27.187)

सुरा समण्डा रूक्षोष्णा यवानां वातपित्तला । गुर्वी जीर्यति विष्टभ्य लेष्मला तु मधूलिका ॥	(CS, 27.190)
हर्षणं प्रीणनं मद्यं भयशोकश्रमापहम् । प्रागल्भ्यवीर्यप्रतिभातुष्टिपुष्टिबलप्रदम् ॥	(CS, 27.194)
सात्त्विकैर्विधिवद्युत्तया पीतं स्यादमृतं यथा । वर्गोऽयं सप्तमो मद्यमधिकृत्य प्रकीर्तितः ॥	(CS, 27.195)

Manufacturing of special *Surā* for purification¹⁸

A mixture of decoctions of prescribed plants and sugar was taken in the ratio of 2: 3 respectively (SS. 44.29-34). This mixture was then boiled over fire. After boiling the mixture, the solution was kept for cooling. After this, the solution was generally placed in an earthen jar for about a month. The time period was taken in such a way that half of this period fell in the winter and the other half in the anterior or posterior of winter. This must be for providing better environmental condition for microbial activities. The fermentation process took place during this period. Some references of alkaline water, cow's urine, etc. as constituents of fermentation processes are also available in the literature.

The amount of research carried out on *soma* drinking in Āyurveda tops the list among all the efforts made by Āryas to explore the benefits of the plant. *Suśruta-Saṃhitā*¹⁸ (SS) has mentioned 24 varieties of *soma* based on the differences in their habitat, name, shape and specific potencies. As a general characteristic, all the *soma* varieties were furnished with 15 leaves, the character contradicting to the vedic description that the plant was leafless. However, all the varieties had possessed a bulb, a creeper like morphology and secreted milky juice. Interestingly, the emergence of 15 leaves in all these 24 varieties, one by one daily keeping pace with the *tithis* (lunar days) of bright fortnight (*Śukla pakṣa*) and becoming well furnished with 15 leaves on full-moon day (*pūrṇimā*). Subsequently, they lose the leaves one by one in the same order of *tithis* of dark fortnights (*kṛṣṇa pakṣa*) and finally on no-moon day (*amāvasyā*) remained in the form of a leafless stump (SS.29.20, 21 and 22)⁹.

The juice (*somarasa*), as described was having characteristic sharp taste and was taken in pure or mixed form along with milk, curd, grain or honey²⁰. Hardly, there was any time left between the extraction and administration which rules out any possibility of fermentation. The effective stimulus at intellectual level provoked complementary thoughts to compose maxims and hymns²¹.

*Suśruta-Saṃhitā*¹⁸ claims that, the person who uses the *soma* bears a new youthful body which is supposed to be not harmed by fire, water, poison or weapon. He enjoys the energy of a thousand elephants. He can walk unimpeded to any difficult place and bears the beauty of a *kandarpa* and the luster of a full moon. The entire Vedas with all its branches and sections become thoroughly mastered by him. He never meets failure in life and moves everywhere with a divine spirit. He gives pleasures to the minds of all leaving beings⁹.

CONCLUSION

The above discussion clearly indicates that the history of fermentation in India from the ancient times includes a variety of techniques which resulted in a rich repertoire of alcoholic beverages and allied products. This is also important that fire and heat were rarely employed for the process of fermentation. Since Vedic era, the theories and practices held a prominent place in different areas of learning in India. Eminent scholar P C Ray believes that the ancient Hindu scientists and philosophers had a remarkable insight into the nature of matter, although they had limited knowledge of equipments and techniques. This paper gives only few examples of geniusness of Early India science.

REFERENCES

1. Mcketta, J.J. (Ed.) *Encyclopedia of Chemical Processing and Design*, 1974, p. 108.
2. Singh, N.L.& Prasad R., *Studies on Alcohol Production from Molasses using Different Processing Strategies*, Ph.D. thesis, Department of Chemical Engineering & Technology, Institute of Technology, Varanasi, 1999.
3. Achaya, K.T., 'Alcoholic Fermentation and its Products in Ancient India', *IJHS*, 26.2 (1991) 123-129.
4. Mahdi Hassan, S., Distillation assembly of pottery in ancient India with a single item of special construction, *Viśveśvarānand Indological Journal*, 1979, Vol.17, p.264; *Viśveśvarānand Indological Paper Series* 457.
5. Mahdi Hassan, S., 'The earliest distillation units of pottery', *Indo-Pakistan Pak. Archaeology*, no. 8, p.159-168.
6. Roy, Mira. 'Fermentation technology', in *History of Technology of India*, A.K. Bag (Ed). New Delhi: The Indian National Science Academy, 1997. p. 437-447.
7. (<http://en.wikipedia.org/wiki/Vedas>).
8. Acharya, S.S.: *Ṛgveda*, Sanskrit Samsthān, Bareilly, India, 1992.

9. Pandhy S. and Dash S.K. *J. Hum. Ecol.*, 15.1 (2004) 19-26.
10. Agrawal D.P., *Indian Chemistry Through the Ages*, History of Indian Science & Technology. www.indianscience.org.
11. Goyal P., *Traditional Fermentation Technology*, History of Indian Science & Technology. www.indianscience.org.
12. *Sukla, Yajurveda Saṃhitā*, Edited by Vasudeva Lakshmana Sastry, Panasikara, with the commentaries of Uvatacārya and Mahidhara, Bombay, 1929.
13. *Kāṭayāyana Śrautasūtra*, Edited with the commentary by Karka, Parts I & II, Benares, 1928.
14. Shamasastri, R., *Kauṭilya's Arthaśāstra*, Weleyn Mission Press, Mysore, 2nd ed., 1923, p.143-146.
15. Sten Konow, *Kauṭilya Studies* (1945), Oriental Publishers and Distributors, Delhi, Repr.1975, p. 60-63.
16. Kangle, R.P., *The Kauṭilya Arthaśāstra* (1972, 2nd ed.), Motilal Banarasidass, Delhi, Repr. 1986, Vol.2, pp. 154-156.
17. *Rasopaniṣat*. Edited by K Sambasiva, Trivandrum Sanskrit Series, No.92 Trivandrum, 1928.
18. *Suśruta-Saṃhitā*, Edited by Jadavji Tricumji Acharya & Narayana Ram Acharya, Chaukhamba Orientalia, Delhi, 1987.
19. *Caraka-Saṃhitā*, Edited by G. Pandeya with commentary of Cakrapani. Kasi Sanskrit Series, No.194, Benaras. 1970.
20. MacDonell, A.A. & Keith, A. B.: *Vedic index of Names and Subjects* (#rd reprint, 1967) Vol. II, Motilal Banarasi Das Publication, Delhi-Patna, Varanasi 1912.
21. Kochhar, R.: Soma, *Ṛgveda and Āryan people. Times of India*, Feb. 10, 1996.
22. Ray P.C., *History of Hindu Chemistry* Vol I, The Bengal Chemical & Pharmaceutical Works, Limited, Calcutta, 1909, p.8.