

Chapter – 1

A BIREF SURVEY OF LITERATURE

(A) SANSKRIT SOURCES

(B) PERSIAN SOURCES

Chapter – I

A BRIEF SURVEY OF LITERATURE

A number of Sanskrit and Persian works were written in India during the medieval period on Alchemy and Chemical Sciences¹ which contain information on their various aspects like metallurgy, iatrochemistry, perfume-making, transmutation, pyrotechnics, etc. Most of these texts, compiled during the period, still exist in different libraries, academic institutions and private collections in the country and abroad.

(A) SANSKRIT SOURCES:

Many Sanskrit texts of the medieval period deal with the evolutionary trends in Dravyakarma or Alchemy. Some of them supply only partial information on alchemy while others completely deal with chemistry and its branches.² A brief account of the Sanskrit sources during the period is given below:

Nagarjuna's *Rasaratnakara* is the earliest available alchemical text in Sanskrit.³ The author also wrote some other texts like *Arogyamanjari*, *Kaksaputa Tantra*, *Yogasara* and *Yogasataka*.⁴ The *Rasaratnakara* is basically

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1. While the important Sanskrit texts on the subject were written between ninth and eighteenth centuries, the most of the Persian texts were compiled during the Sultanat and Mughal Period.
 2. The texts having partial alchemical ideas include Tantric texts like *Rasarnavakalpa*, *Rasakalpa* and *Matrkabhedatantra*.
 3. It is believed that this text was a part of a larger text, *Rasendramangala* by Nagarjuna.
 4. P. Ray, *History of Chemistry in Ancient and Medieval India: Incorporating the History of Hindu Chemistry*, Calcutta, 1956, p.116. Also see Vijaya Jayant Deshpande, "History of Chemistry and

a tantric text of the Mahayanist tradition and is relatively smaller than the later texts on the subject.⁵ An interesting feature of this text is that some chemical processes are described in dialogue form between Nagarjuna and others.

Another important text of the period is the *Rasarnava*. An anonymous tantric text of Saiva Cult, it is ascribed to the twelfth century AD⁶ and is quoted in *Rasesvara darsana* of *Sarvadarsanasangraha* by Madhavacharya (14th Century AD).⁷ A relatively systematic text, *Rasarnava*, is divided into eighteen chapters written in versified form⁸. It gives details about mercury and its purificatory processes, various apparatuses, purification of metals and minerals, and a number of alchemical processes. The last three chapters exclusively deal with transmutation of metals and physiological alchemy or elixir-making.⁹

The *Rasarnavakalpa* is an anonymous tantra text of 11th century AD.¹⁰ Written in versified form, it comprises 814 verses and is supposed to be a part of another tantra text *Rudrayamala*. Its manuscript was first noticed by Pandit Haraprasad Shastri who acknowledged among its contents the ‘alchemical

Alchemy in India from Pre-historic to Pre-modern Times”, in A.Rahman (ed.), *History of Indian Science, Technology and Culture AD 1000-1800*, OUP, New Delhi, 1999, p.157.

5. The identity of the author is a subject of controversy as some believe that he is the same Nagarjuna who founded the Madhyamaka School of philosophy. See in P. Ray, *op.cit.*, pp. 116-117.
6. *Ibid.*, p.119.
7. M.A. Alvi and A. Rahman, *Science and Technology in Medieval India – A Bibliography of Source Materials in Sanskrit, Arabic and Persian*, INSA, New Delhi, 1982, p.456.
8. *Rasarnava* was the first full and exhaustive text on Indian Alchemy.
9. Vijaya Jayant Deshpande, “History of Chemistry and Alchemy in India from Pre-historic to Pre-modern Times”, in A.Rahman (ed.), *History of Indian Science, Technology and Culture AD 1000-1800*, OUP, New Delhi, 1999, p.159.
10. As the vss.78-207 of the text occurs in *Rasarnava* its translators have dated it to 11th century. See *Rasarnavakalpa*: (Ed.) Mira Roy and B.V. Subbarayappa, INSA, New Delhi, 1976, p.2.

recipes and mercurial preparations'.¹¹ It has details about transmutation of base metals into gold and silver. Few methods of elixir –synthesis have also been discussed. It also describes the use of herbs and their extracts in the treatment of minerals and metals for internal use.¹²

Lohapaddhati or *Lohasarvasva* by Suresvara is a text of eleventh century.¹³ It deals with the processing of iron, gold, mica, copper, etc. and their medicinal uses in poetic form.¹⁴ Another eleventh century text is the *Rasopanisad*¹⁵ which is considered to be one of the largest Sanskrit treatises on alchemy. It contains 18 chapters consisting of 2,500 verses. It primarily deals with the transmutation of metals and alchemical experimentation. All of the chapters are devoted to gold and silver making processes. There is a great deal of information on the use of plants and their products in alchemy. The author of the text employed a variety of crucibles in the alchemical and chemical operations.¹⁶

Matrakabhedatantram,¹⁷ an eleventh or twelfth century AD tantrik text, contains alchemical ideas relating to transmutation processes, preparation as

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11. Shastri, Haraprasad, Catalogue of Mss, on Tantra, Asiatic Society of Bengal, Calcutta, p.67. No. G8375.
 12. *Rasarnavakalpa*: (Ed.) Mira Roy and B.V. Subbarayappa, INSA, New Delhi, 1976.p.6.
 13. Suresvara was a court physician to kind Bhimapala of Padi. Cf. M.A. Alvi and A. Rahman, *Science and Technology in Medieval India – A Bibliography of Source Materials in Sanskrit, Arabic and Persian*, INSA, New Delhi, 1982. p.461.
 14. He is also the author of *Sabdapradipa*, which is a dictionary and *Vrksayurveda* which was probably known to *Sarngharapaddhati*, a work of the 14th century.
 15. Sambasivasastri, K. (ed.), *Rasopanisad*, printed by the Superintendent, Govt. Printing Press, Trivandrum, 1928, Trivandrum Sanskrit Series No. XCII. Cf. Vijaya Deshpande, “Vangastambhanasodhanam: A Chapter on Metallurgy of Tin in Sanskrit Alchemical text Rasopanisad”.
 16. The text contains a separate chapter devoted to gold and silver making processes. There is a great deal of information about metallurgy which will be dealt later.
 17. See *Matrakabhedatantram*, edited by Cintamani Bhattacharya, Calcutta Sanskrit Series, Calcutta, 1933

well as powers of mercurial compounds and the *rasalinga*¹⁸. It contains 573 verses divided into fourteen chapters. It is in dialogue form between Shankara and Chandika. This text talks about the use of *shambala* in the conversion of copper into silver, process of converting mercury into *bhasma*. Another text, the *Rasahridayatantram*¹⁹ of Govinda Bhagavatpada²⁰ (c.11th century A.D.), consisting of nearly 600 verses, also deals with the processing, essences and use of mercury, mica, copper, alkalies, sulphur, salts gold, silver and transmutation of metals. Similarly, Somadeva's *Rasendrachudamani*, primarily based on the then chemical treatises, is probably a 12th or 13th century AD text.²¹ The *Rasaprakasa-sudhakara*, written by Yasodhara, is an important 13th century text which has a great deal of information on the metallurgy of zinc.²² *Rasaratnakara*²³ of Nityanatha Siddha²⁴ supplies information about alchemical processes, mercurial and other chemical preparations, apparatus and medical

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18. The concept of *rasalinga* clearly implies the male-female symbolism associated with mercury and sulphur. *Rasalinga* in this text is dealt in the eighth chapter.
19. *Rasahridayatantram* of Govinda Bhagavatpada, edited by B.V. Subbarayappa, M.M. Sastry, B.S.Rao and S.R.N.Murthy, in *IJHS*, Indian National Science Academy, New Delhi, Vol.32 , 1997, No.1-2.
20. The author gives details about his personal life at the end of the text. He seeks blessings from *Tathagata* in the end and this shows that he was a Buddhist. He names Madanaratha, the king of *Kirata* (area adjoining modern Bhutan) as his mentor. The latter himself was an expert on mercury. Cf.P.Ray, op.cit,pp.148-49
21. See *Rasendrachudamani* by Somadeva, edited by Yadav Sarman, Motilal Banarasidas, Lahore, 1932.
22. See *Rasaprakasa-sudhakara* by Yasodhara, edited by Jadav Trikunji Acharya, Ayurvediya GranamalaNo.2, Mumbai, 1911.
23. See P. Ray, (Ed.) *History of Chemistry in Ancient and Medieval India*, Indian Chemical Society, Calcutta, 1956. p.159.
24. Son of Sankhagupta and Parvati and author of works like *Indrajala*, *Kamaraatna*, *Tantra Kosa*, *Rasaratnakara*, *Siddhakanda*, *Bandhayavali* and *Siddhasiadhanta paddhati*. See M.A. Alvi and A. Rahman, *Science and Technology in Medieval India – A Bibliography of Source Materials in Sanskrit, Arabic and Persian* , INSA, New Delhi, 1982, p.451.

use of the metallic preparations. Govindacharya's *Rasasara*²⁵ also is an important 13th century treatise containing the details about the 18 operations on mercury. Interestingly, the author mentions opium or *aphiphenā* which he believes is derived from poisonous 'sea-fishes' or snakes.²⁶

The *Rasa Ratna Samuccaya* is a very popular Sanskrit text of medieval period on Indian alchemy and pharmaceuticals. It also deals with many important concepts relating to alchemy, metallurgy, pharmaceuticals and therapeutics. Many details regarding metallic transformation (*Lohavedha*) and the transformations of body tissues (*Dehavedha*) are also described in this text. The methods for using metals/minerals internally for maintaining health, and preventing and curing diseases are further mentioned in this work. Apart from the above, the following most essential pharmaceutical processes considered necessary for the conversion of drug materials into dosage form are discussed: (i) purification (*Sodhana*), (ii) incineration (*Marana*), (iii) metallic extraction (*Satvapātana*), and (iv) liquefaction (*Druti*). In addition, a well equipped pharmaceutical laboratory (*Rasa sala*) along with its employees, working divisions, apparatuses, heating devices and fuel materials is described in the text. It is a very valuable and authentic text compiled by Sri Vagbhata approximately either in the later part of the 13th or early part of the 14th century A.D.²⁷ Likewise, the *Sarangadhara-samgraha*²⁸ is also an important

25. *Rasasara*, (ed.)Jadavji Triakumji Acharya, Ayurvediya Granthamala No.2, Mumbai,1912.

26. P. Ray, op.cit. p.160.

27. See *Rasa Ratna Samuccaya*, ed. By Dr. Damodar Joshi, *IJHS*, Vol. 11, INSA, New Delhi, 1989, p.13

28. The author dates his work in *Samvat* 1420 or A.D. 1363.

compilation by Sarangadhara. Strikingly, this work is based on both Ayurvedic and Tantrik chemical treatises. While discussing the purification and incineration of metals the author surprisingly does not mention zinc. However, nine metals and two alloys viz. brass and bell metal (a mixture of Copper and tin) are found mentioned²⁹ at the end of the text.

*Rasendrasarasamgraha*³⁰ by Gopalakrishna, is a compilation based upon many tantric texts. It specially deals with the therapeutic efficacy of mineral preparations.³¹ The *Dhaturatnamala* of Devadatta, (14th century) is another noteworthy work devoted to the processes of killing metals and minerals. The metals are named as gold, silver, copper, lead, tin and iron. Strangely, *kharpara* or calamine is taken as synonymous with *jasada* or zinc.³²

Similarly, Anandabharati's³³ *Anandamala*³⁴ explains the processes for purifying mercury. It also gives information on mercurial compounds and diagrams of eight types of apparatus. His another work, *Yogasastra* or *Yogamala*, divided into 14 chapters, is a compilation from different medical works and has information on purification of metals.³⁵ The *Rasasanketikalika*³⁶ by Cuda Camunda³⁷ is a 15th century text comprising 357 stanzas. It deals with

29. Cf. P.Ray, op.cit., p.160

30. *Rasendrasarasamgraha* by Gopalakrishna (ed.) by Upendranath Sen Gupta, Dhavantari Press, Calcutta, 1912.

31. Cf. P.Ray, op.cit. p.161.

32. *Dhaturatnamala* of Devadatta: PLG Ms. No.60. See also, P.Ray, op.cit. p.161.

33. The author is also known as Ananda Siddha. His probable period may be 1503-1600 A.D. See, Alvi and Rahman, op.cit, p.435.

34. Alvi and Rahman, op.cit, p.436.

35. *Ibid.*, p.436.

36. *Rasasanketa-kalika* of Camunda (ed.) by Jadavji Tricumji Acarya, *Ayurvediya Granthamala*, 6, Bombay, 1912.

37. The author seems to be a contemporary of King Rajamalla(1474-1509) of Mewad. His other works include *Varnanighantu* and *Jvaratimtrabhaskara*. See Alvi and Rahman, op.cit, p.438.

the medicinal preparations of mercury and metals like copper, iron and gold. The *Rasapaddhati*³⁸ by Bindu Pandita is concerned with the preparation of *Rasakarpura* or calomel.

Moreover, Another important Sanskrit text of the medieval period on Alchemy and chemical sciences is the *Rasapradipa*³⁹ which provides us a detailed process on the preparation of mineral aids by distillation. Similarly, the *Rasakaumudi*⁴⁰ of Jnanacandra Sarman belongs to the same period and both opium and mineral acids are prescribed in it.

There is yet another Sanskrit text, the *Akasabhairav-Kalpa*⁴¹ which gives valuable information on fireworks in the fifteenth-sixteenth century. In the like matter, the *Kautukacintamani*⁴², by Gajapati Prataparudradeva⁴³ of Orissa, is an important text containing valuable information on the manufacture of a special type of fireworks. There are various formulae prescribed for their preparation. The work also gives a list of ingredients of pyrotechnic mixtures.⁴⁴ *Sukraniti* or the 'Elements of Polity' of Sukracharya is an important sixteenth century text which provides various gunpowder recipes.⁴⁵ Ray considered it to

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38. *Rasapaddhati* of Bindu Pandita : with commentary of Madhava Pandita, (Ed.) Jadavji Tricumji Acharya, Ayurvediya Granthamala, Nos. 14 and 15, Mumbai, 1915.
 39. *Rasapradipa* of Ramchandra (with the commentary of Pranath): Banaras Ms.No.111.
 40. *Rasakaumudi* of Jnanacandra Sarman: (Ed) S.S. Pranacarya, Bombay Sanskrit Press, Lahore, 662 Lahore, 1923.
 41. *Akasabhairava-Kalpa*, Patala 62, vide. *Akasabhairava-Kalpa*, an unknown source of the history of Vijayanagara by P.K.Gode, *Studies in Indian Literary History*, Bhandarkar Oriental Research Institute,Poona. Vol.II, 1954, p.133.
 42. Found by P.K.Gode this text is available at the Bhandarkar Oriental Research Institute, Poona. Cf. P.K.Gode, "The History of Fireworks in India", in *Studies in Indian Cultural History*, Vol.II, pp.31-56.
 43. The author is famous for his works on *dharmasastra* like *Sarasvativilasa*, the author is supposed to have lived in the period (A.D. 1497-1539).
 44. P.K.Gode, "The History of Fireworks in India", in *Studies in Indian Cultural History*, Vol.II, pp.43-44.
 45. *Sukraniti* of Sukracharya tr. into English by B.K. Sarkar, *Sacred Books of the Hindus*, No.13, Allahabad, 1914.

be a patch work with the addition of portions about gun powder after its introduction in India by Babur.⁴⁶

The next important work, *Bhavaprakasa* of Bhavamisra, is a compilation based on earlier texts like *Rasapradipa*, *Rasendrachintamani* and *Sarangadhara*.⁴⁷ The treatment of *phirangaroga* (syphilis) with *rasakarpura* (calomel) and *Chobchini* (China root, *Smilax china*) is also discussed therein. *Dhatukriya*⁴⁸ of *Rudrayamalatantra* is in dialogue form and belongs to 16th century. Notably the use of *Dahajala* (Burning water) for sulphuric acid is witnessed for the first time in it.⁴⁹

(B) PERSIAN SOURCES

Al-Biruni's *Kitab al Jamahir fi Ma'rifat al-Jawahir* (in Arabic) is an eleventh century text which comprehensively deals with mineralogy and metallurgy. Many scholars of India and Iran have based their treatises on his work and his theories. Notable texts among them are *Arais-ul Jawahir* of Abul Qasim Kashani⁵⁰ and the sixteenth century texts namely, Mohammad Fazil Samarqandi's *Jawahar-ul Ulum-i Humayuni*, Muhammad Ashraf bin Asad Istamrari's⁵¹ *Jawaharnama-i Humayuni* and Abul Fazl's *Ain-i-Akbari*. Except

46. P.Ray, op.cit. p.225.

47. The author is supposed to have lived in the time of Emperor Akbar. See,P.Ray,op.cit,p.163.

48. *Dhatukriya* of the *Rudrayamalatanra* (MS.) (vide *History of Chemistry in Ancient and Medieval India*, by P.Ray, pp.276-77)

49. P.Ray, op.cit, p.163.

50. A fourteenth century Persian text. Cf. I.G.Khan, "Some aspects of Chemical technology during Akbar's reign- A Historical and Scientific evaluation", *Proceedings of Indian History Congress*, Hyderabad, 1978.

51. This work describes the use of amalgamation as a method of detecting real gold from the artificial gold made by the alchemists. Cf.I.G.Khan, op.cit, p.216.

for the latter text the earlier three texts show almost identical purification techniques.⁵²

*Haft- Ahab*⁵³ by Qazi Hamiduddin Nagauri⁵⁴ is a treatise on Alchemy. The narrative in the preface shows that the work was written by seven friends including Shaikh Hamiduddin.⁵⁵ The text is divided into seven chapters (abwala, i.e. the plural of bak). Each of these chapters was written by each of these seven friends. Every chapter is further divided into four parts or *fasls*. There is a description of gold (*tila*), silver (*nuqra*), iron (*ahan*), zinc (*jast*), lead (*sisā*) and mercury (*simaab*) in the text.

*Maqalidu`l-kumiz*⁵⁶ written by Ahmad bin Arsalan is a treatise on chemistry and alchemy. Divided into twelve *babs* the text deals with names of different metals⁵⁷, methods of their sublimation, preparation of their simple and compound solutions, melting and liquefaction and preparation of their extracts. Shapes of various furnaces have been discussed in the text. Also, shapes and methods of making of crucibles and seals have been discussed. The text also comprises of chapters on poison testing, gold testing, and preparation of artificial silver and artificial gold⁵⁸.

52. Ibid,p.226.

53. *Haft-Ahab*, Ms. No. 77 CAS, Department of History, AMU, Aligarh.

54. A Qazi by profession he died in 1295 and was buried close to the tomb of Khwaja Bakhtiyar Kaki.

55. The names of the friends are Nagauri, Kiyān Nath Jogi alias Saadat Mand, Shaikh Sulaiman Mandavi, Mir Sayyid Hashim Bukhari, Miran Syed Tabib Awadhi, Shakih Nasiruddin Tartuni and Maulana Sadiq Muhammad Multani. See *Haft Ahab* ,p.2.

56. Alvi and Rahman, *Biblio*, pp.434-35.

57. Gold, silver, copper, iron, steel, tin, lead, quicksilver, brass etc.

58. *Shams* and *Qamar* are the words used in the text for gold and silver respectively. See, Alvi and Rehman, *Biblio*.p.434.

Adabu'l Harb wa'sh Shuja'at, written in 1229 by Fakhre Mudabbir, is a war and diplomacy manual for Iltutmish. The text lists some items as gifts to other monarchs like swords, utensils, daggers, shield, double pointed spears, arrows, bows, armors (such as coats of mail, doublets helmet shin and arm covers, cauldrons) as well as the usual items of luxury such as gems, silks, carpets, perfumes, drugs and ornaments.⁵⁹

Jami-ul Tawarikh by Rashidaldin Fadlullah contains references about various metallic articles sent by Sultan Allauddin Khalji to the Ilkhanid vazir c.1300 A.D. Another fourteenth century text of relevance is *Tarikh-i Firishta*, by Muhammad Qasim Firishta.⁶⁰ The text provides valuable information on gunpowder devices and their procurement. The author cites the information from *Tuhfatu's Salatin* by Mullah Daud Bidari but unfortunately the latter text does not exist.⁶¹

Baburnama or the Memoirs of Babur is yet another source of importance as it gives details about Cannon making and the techniques involved.⁶² *Jawahar ul ulum-i Humayuni* by Mohammad Faddil bin Ali bin Mohammad al Miskini al Samarquandi⁶³, is an encyclopedia which provides information about twenty seven types of minerals, corals, glass and stones. It

59. *Adabu'l Harb wa'sh shuja'at* (ed.) By A.S.Khwansari, Eqbal pubs. Tehran (1346 A.H.) pp. 147-8.

60. *Tarikh-i Firishta*, Naval Kishore, Kanpur, 1884, vol. I, p. 290.

61. Cf. Khan, I.A., *Gunpowder and Firearms: Warfare in Medieval India*, OUP, New Delhi, 2004, p.204

62. *Baburnama*, (tr.) by Beveridge, A.S. Delhi, 1970, pp. 536-37.

63. The literal meaning of the title of the text is pearl of sciences. The text was written during 1530-58.

gives details for their recognition and medicinal properties and includes brief information about optics and alchemy.⁶⁴

The *Ain-i Akbari* is the third part of the *Akbarnama*, the official history of Akbar's reign. Its first two volumes are devoted to purely historical facts which are arranged in chronological order. The *Ain* was intended to be a record of such multifarious aspects of Mughal court-life as civil and military administration, palace management, regulation of the calendar, and other such interesting details.

Abul Fazl was not a scientist but he definitely was a rationalist.⁶⁵ Born (1551 A.D.) in a family of religious scholars (*Ulema*) he was educated in accordance with the syllabi prescribed in the Muslim *madrassahs*.⁶⁶ Later he received further instructions in the Graeco-Muslim Sciences and soon distinguished himself as a versatile scholar.

Abul Fazl's style is imbued with a verse characteristic of an unfathomable curiosity to know and to understand all phenomena. Like a philosopher he has a propensity to link factual statements with theoretical reasoning. Thus, while writing about calligraphy, he digresses into a discussion on the phonetics of the Arabic alphabet and further still, into the propagation of sound. Similarly while discussing mathematical geography he goes into a long

64. *Jawahar ul ulum Humayuni*, Ms. No. 87, Farsi Ulum, Maulana Azad Library, A.M.U., Aligarh.

65. For details on 'science' and 'rationalism', see Habib, Irfan: Science and Reason in Medical India", Proc. Of the Asian Studies Association of Australia, 1982.

66. The syllabi seem to have remained unchanged from the time of Nasiruddin Tusi (cir. 1290 A.D.). Compared Abul Fazl's description of the education system (*Ain* (N.K.) I, and Nasiruddin Tusi's classification of the sciences in his *Akhlaq-i-Nasiri*. See article on the subject by Stephenson in *ISIS*, V, pp. 334-5.

explanation of the ratios and proportions and relevant Euclidean theorems.⁶⁷ In alchemy he appears more inclined to distinguish the practically useful from the merely superstitious. Elsewhere he adopts an attitude of indifference while reporting the demonology and other superstitions of the Indian people.⁶⁸

It was perhaps these abolition which qualified him for the assignment of writing the official history of Akbar's reign. This assignment provided him with an opportunity to display his vast knowledge and versatility which was considered in medieval society to be the hall mark of a great scholars. To seek any original contribution to scientific theory in his 'discourses' or to look for creative potential expected of a scientist in his writings would therefore be futile. Yet, the scientific information found in the *Ain* is not merely a passive reproduction of the existing knowledge, on the contrary it is replete with evidences of the author's critical faculty.

An idea of the chemical science and chemical technology discussed (and their classification) by Abul Fazl can be formed from the following table :

Broad category of the subject	Specific nature of the Information	Chapter/Classification as per the <i>Ain</i> ⁶⁹
Chemical Technology	On the purification assaying, alloying and minting of bullion	On the Imperial Mint (<i>Ain</i> 4)

67 . *Ain-i-Akbari*, (ed.) Naval Kishore I, p. 127.

68 . e.g. his description of the liver-eater (*jigarkhor*) in which a sense of cynicism is more than evident. *Ain*. (translation) vol. II, pp. 338-340. Abdul Fazl also gives reasonable explanations for 'supernatural' phenomena such as the water turning to milk which he correctly attributes to the dissolution of upstream calcium deposits. *Ain* (tr. Jarret) II, p. 196.

69 . The following are titles as they appear in Blochmm's translation of the *Ain*, R.A.S., Calcutta (reprint) 1965, Vol. I.

Chemical Technology	On the preparation of perfumes, soaps, etc.	On perfumes and flowers (<i>Ain</i> 30)
Chemistry	On the classification of minerals	On the Birth of Metals (<i>Ain</i> 13)
Military technology	Description of some hand-guns and cannons	On Guns- and on cannons (<i>Ain</i> 36, 37)
Mechanicals	Describes the device used for cleaning 16 guns at one time, the mobile floor mill, etc.	On the manner of cleaning guns (<i>Ain</i> 38)

Tuzuk-i-Jahangiri or 'Memoirs of Jahangir' contains information about otter of roses, meteoric stones and precious stones.⁷⁰ *Majma'atu's-Sana'i* by Mir Yahya (c.1624) is divided into forty-three chapters. It particularly lays emphasis on the formulae of various chemical arts and crafts. The text deals with the art of making artificial pearls and precious stones, sword making, preparation of dyes, seven methods of processing cinnabar and various ways of coloring paper, oxides of various metals, making of various alloys, etc.⁷¹

Bayaz-i Khushbui, an anonymous work on household management was transcribed in 1697-98. But Irfan Habib assigns the work to the first two decades of Shahjahan's reign on internal evidence.⁷² Divided into seventeen *Bab*, the text deals with medicinal aids, perfumes, essences, salves, beverages, fire-works etc.⁷³

70. *Tuzuk-i-Jahangiri*, (ed.) Syed Ahmad Khan, Aligarh, 1864 also see in (tr.) Alexander Rogers and Henry Beveridge, London, 1909.

71. *Majma'atu's Sanai*, IO PMC, 1/1501; 2781. See, Rahman and Alvi, *Biblio*, p.448

72. See Irfan Habib, *Agrarian System of Mughal India*, Oxford University Press, New Delhi, 1963, p. 448.

73. *Bayaz-i-Khushbui*, I.O. 828, Rotograph no. 194, Department of History, A.M.U., Aligarh.

*Itriyat-i Nauras-i Shahi*⁷⁴ by Nizamu'ddin Mahmud Tarsan is an important treatise on the preparation of perfumes and scents .Divided into nine *maqalas* and eighteen *fasls*, it enumerates various animal and vegetable perfumes. Abdul-Karim's *Khulasah-i Mufidul-Insan* is an encyclopedic work on medicine and chemical technology (17th or 18th century).It comprises 15 *babs* and contains information on preparation of various salts, perfumes, elixir, oxides of metals, polishing of swords, pyrotechnics etc.⁷⁵

An attempt has been made in the preceding pages to study and present a brief survey of literature in both Sanskrit and Persian, comprising information on Alchemy and chemistry. Several Sanskrit texts of medieval period deal with the evolutionary trends in Dravyakama or Alchemy. Amongst the texts authored by Nagarjuna Rasaratnakara in the earliest alchemical text in Sanskrit. Rasarnava, Rasarnavakalpa are tantra texts containing information on alchemical processes. The other Sanskrit texts consisting alchemical ideas are the lohapaddhati, Matrakbhedaktantram , Rasa Ratna Samuccaya, Rasapradipa, etc. Amongst the Persian sources Haft Ahabab, Adabu'l Harb wa'sh Shuja'at, Jami-ul Tawarikh are sources of the sultanate period containing relevant information on alchemy and chemistry. The Baburnama, *Ain-i Akbari*, *Tuzuk-i Jahangiri*, *Bayaz-i Khushui* etc. are important Persian sources of the Mughal period containing rich material on alchemy and chemistry.

74. The text is dedicated to Ibrahim Adil Shah but it is difficult to trace whether he meant Adil Shah first or second. Considering this the text can be ascribed to 16th or early 17th century. See, Alvi and Rehman, *Biblio*,p.451.

75. *Ibid*, p.431.