Tribhuvandas Kalyandas Gajjar (1863–1920): the pioneering industrial chemist of Western India

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Tribhuvandas Kalyandas Gajjar (1863–1920) whose 150th birth anniversary falls this year was Western India's first industrial chemist. To him goes the credit for introducing German synthetic dyes into Indian textile engineering, initiating alcohol production on modern lines and producing synthesis of formal education and industrial chemistry. He is not so well known as his illustrious, Britain-trained, Presidency College Calcutta-based contemporary Prafulla Chandra Ray (1861–1944), who built an international reputation for himself and his chemistry school. Just as Ray founded Bengal Chemical and Pharmaceutical Company, Gajjar was the leading light behind Alembic Chemical Works. There is, however, a major difference between the two. While Ray's was a swim against the tide in Bengal, Gajjar was part of the flow in Western India.

Although the British colonialists in general were not interested in India's scientific development, chemistry was an exception to this general rule to a small extent because of its role in commerce, administration and good governance. Some enterprising Europeans in India tried to set up small manufacturing units, but in the absence of any encouragement or sustained support from the colonial government their success was limited and transient. Two essential commodities, sulphuric acid and nitric acid, being hazardous, could be brought from England only as deck cargo, which entailed heavy freight making the landed cost prohibitively high. At the same time, the quality was suspect. A bottle of nitric acid could be three-fourths filled with water. What the English manufacturer thought of India is summed up in the 'cockney phrase': 'My dear sir, this hat is not for sale – it is for the Ingee market'[1].

Probably the first to manufacture acid in India was James Dinwiddie (1746–1815), who had been a scientific member of the unsuccessful 1792 Macartney embassy to China and who stayed in Calcutta from 1794 till 1805 before returning to England. 'By his suggestion and under his management', the government set up a manufacturing unit for sulphuric acid, 'the high price of which had hitherto been a great drawback to the indigo and other manufactures'. In addition, he set up a private unit for producing nitric acid which he supplied to the dispensary on contract[1]. Both the plants however did not survive Dinwiddie's departure. Manufacture of acid was again taken up half a century later when a Scottish immigrant David Waldie (1813–89), who arrived in Calcutta in 1853 set up chemical works for large-scale production. There were another three or small units which produced limited amounts though 'primitive and wasteful' methods[2].

In the meantime, in 1811, the expedition for the capture of Java was delayed because of want of cartridge paper. One William Jones (d. 1821) known as Guru Jones and better remembered as the architect of Bishop's College, Calcutta rose to the occasion and set up a small paper manufactory from which he furnished all the paper that was required. His factory however closed 'as soon as the object of the expedition was accomplished'[3].

Chemistry education

Quite untypically the first modern chemistry professor in India was a missionary. The Baptist Reverend John Mack (1797–1845) came to Serampore College in the Dutch enclave near Calcutta in 1822 as professor of natural science. 'He was specially attached to the science of chemistry, which he had cultivated with success under the most eminent professors in London.' He additionally gave a series of 'chemical lectures' in Calcutta and even published an elementary treatise on chemistry in Bengali titled *Kimiyabidya Sar* [Essence of chemical science] in 1834 (refs 4 and 5). While Calcutta had no hesitation in requisitioning the services of William Carey (1761–1834) from Serampore to teach Sanskrit, Bengali and Marathi to its civil servants[6], it apparently had no use for Mack.

British India made a half-hearted attempt of its own to induct chemistry into the education system for the Indians. In 1823 Hindu College Calcutta came under Government control. The very next year David Ross[7], Foreman of the Calcutta Mint, was asked to teach chemistry. The experiment however was a failure[8]. 'The only thing he was conversant with was Soda, and he was never tired of dilating on its properties.' Quite unoriginally, his exasperated pupils named him Mr Soda[9]. If the plan had succeeded, chemistry-knowing young men could have found an opening in an opium factory. While chemistry was successfully taught in the Calcutta Medical College which was opened in 1835, it had to wait another four decades for entry into the general education system. In the meantime, Indians themselves became aware of the value of science. In December 1869, an M D-turned-homeopath Mahendra Lal Sircar began a campaign for the establishment of the Indian Association for the Cultivation of Science in Calcutta, which finally came up in 1876. Although Sircar failed in his goal of initiating scientific research under Indian auspices, he was instrumental in getting science introduced into the higher education system and in motivating better-quality Bengal students for a career in science rather than in law or government service[10].

In 1872, Calcutta University permitted First Arts (F A) students to opt for chemistry in place of psychology. Also, B A was split into two streams: the traditional A course (literature) and the new B (science) course. Two years later chemistry (along with physical geography) was made a compulsory subject for the B course, whereas two papers in physical science were made optional[11]. Science gained immediate popularity. In 1874, there were 96 regular F A candidates from the Presidency College, out of which as many as 83 opted for chemistry. Similarly, in the B A examination 60 out of 84 opted for science in the third year and 48 out of 84 in the fourth year[12].

It was left to the far-sighted and therefore unpopular Lieutenant Governor of Bengal, Sir George Campbell (tenure 1871–74) to ask for specialist professors in chemistry and botany[9]. Alexander Pedler (1849–1918) joined Presidency College in 1874 and later rose to become

the Vice-Chancellor of Calcutta University. He can truly be called the founder of chemistry education in India. Similarly, [Sir] George Watt came as a professor of botany at the Hooghly College and later moved to Krishnagar. 'Under instruction from the Government', Pedlar 'came with a considerable supply of chemical apparatus' and started practical classes in 1875 (ref. 9). One of the first experiments he was asked to do dealt with the chemical analysis of cobra poison with a view to finding effective antidotes[13]. As far as the students were concerned, the Presidency College, Calcutta was the best funded college in the whole of the country and the only one in Calcutta apart from the Jesuit St Xavier's which offered science. Other private colleges did not have the resources to do so. Their students were however permitted to attend classes in Presidency College on payment of a small fee. The popularity of science can be gauged from the number of these 'out-students'. The number was four in 1871 and zero in both 1872 and 1873. But with the arrival of new equipment, the number rose rapidly. It was 14 in 1874, 21 in 1875, 45 in 1876, and as high as 63 in 1882 (ref. 8).

Pedler was also an analyst to the municipality. Among his duties in this capacity was to send a daily report on the analysis of municipality water and gas supplies. He also had a private practice testing wines for big import firms. Ruchi Ram Sahni (1863–1948), the first Indian officer in India Meteorology Department, spent three months in Calcutta, January–March 1885, as a trainee. Still nominally an M A student in Government College, Lahore, he was permitted as a guest student in Presidency College, Calcutta. It was the first time he was seeing a chemistry laboratory. Sahni describes the wine-testing hierarchy. For the analysis of each bottle Pedler was paid a substantial sum of Rs 32. He kept the money and passed on the bottle to his official assistant, who in turn passed on a small quantity of the wine to Sahni and happily enjoyed the rest. Sahni at the lowest rung of the ladder was happy that he got valuable laboratory experience, be it on water, wine or gas[14].

The Government of India instituted competitive Gilchrist scholarships to send two candidates every year to UK for higher studies in science, law and literature, the first examination for which was held in January 1869. Although the scholarships were available to all the three Presidencies, it was only Bengal candidates who opted for science. A candidate who made the grade in 1871 was Aghornath Chattopadhyay (1850–1915), better remembered as Sarojini Naidu's father. He has the distinction of being India's first doctorate in science, but regrettably he failed to live up to the promise. He availed of the scholarship at Edinburgh where in 1875 he was selected for the Hope Prize Scholarship. Next year, in May 1876, he won the two-year Baxter Physical Science Scholarship. 'The Scholarship is held subject to the condition that the holder shall have taken the Degree of Doctor of Science in the first year of his tenure of it.'[15] On return to India Chattopadhyay moved to Hyderabad, where he rose to be the principal of Nizam College. Curiously his brilliance as a student notwithstanding, he became a firm believer in alchemy.

Calcutta

Two Gilchrist scholars who made science their career were the geologist Pramatha Nath Bose (sent in 1874), who advised the Tatas on iron ore for their Jamshedpur steel plant, and P. C. Ray who went to Edinburgh in 1882, obtained his D Sc in 1887 and became a Hope Prize Scholar like Chattopadhyay. He was elected the Vice-President of Edinburgh University Chemical Society and presided over its meetings in the absence of the President. Ray returned to Bengal in 1888 and remained jobless for about a year. Pedlar had earlier recommended the appointment of an additional member of faculty in chemistry. The addition, in July 1889, was Ray. Very far-sightedly, Ray had brought with him description of the Edinburgh laboratory, including diagrams and drawings. Pedler on his part collected some plans of German laboratories. Using these inputs, the Presidency College chemistry laboratory was refurbished in 1893. It helped Ray attain international fame as an experimental chemist for his work on mercurous salts, as also to found a flourishing school.

It was left to Ray to initiate chemical and pharmaceutical manufacturing activity in Bengal with 'the idea of wiping out the reproach that the Bengalees were good for nothing in business affairs'[16]. It was important for him to succeed. Ray was born in an old wealthy, landed and cultured family, but his idealist but impractical father managed to impoverish the family. Witnessing loss of family wealth converted young Ray into an entrepreneur. Ray was clear in his mind from the beginning that he wished to start industrial production utilizing 'the thousand and one raw products' available in Bengal. While his academic training would come in handy, he was conscious that his impressions about manufacture in Britain would be quite irrelevant in the local conditions. Without hesitation, he enlisted the support of Pedlar's lecture assistant, Chandrabhushan Bhaduri, who had assisted him in performing classroom experiments, but was otherwise much lower than Ray in the professional hierarchy. After some false starts, such as extracting citric acid from lemon juice (commercially unviable) and manufacturing carbonate of soda (less pure and more expensive than the imported stuff), Ray succeeded in producing large quantities of phosphates of soda and superphosphate of lime using the easily available cattle bone as the raw material. This was particularly satisfying because the bones were being exported abroad for processing. He happily used the roof of his residence to dry animal bones, much to the chagrin of his neighbours and suspicion of the policemen.

About 1891, Ray purchased a crude acid plant against his future earnings from University examination work, but failed to turn it around. It had to be sold off at a loss, 'but the experience thus gained proved to be a valuable asset, which was turned to good account several years later'. In 1892, Ray set up a private firm with the long but descriptive name Bengal Chemical and Pharmaceutical Works[17]. The company took to making various syrups and tinctures according to the British Pharmacopoeia specifications (ref. 2, pp. 98–99). To get the flavour of the time, we may look at excerpts from an advertisement prepared by Ray himself and published in 1894 in *Sanjivani*, the widely read Bengali newspaper:

'With the help of Dr Prafulla Chandra Ray, D Sc (Edin.) and the well-known medical practitioner Dr Amulya Charan Bose, M. B., in this allopathic manufacturing concern some three hundred medicines have been prepared and are for sale. Our preparations are made according to the latest scientific methods… Syrup of Hypophosphite [sic] of Lime for colds, coughs, catarrh, asthma, phthisis,

bronchitis and other lungs-diseases: A never-failing remedy. It is sweet and agreeable to the taste and of beautiful rose colour. Trial of last two years has proved that because it is freely prepared, its efficacy is superior to that of the imported article. The leading physicians of Calcutta are prescribing it.' (ref. 17, p. 11)

The experience of Ray and his colleagues with indigenous drugs has a contemporary ring about it. From the traditional physicians (kavirajs), a number of Ayurvedic 'formulae and recipes' were received whose efficacy 'had been proved beyond doubt by their universal use in the households of Bengal'. 'All that was needed was their active principles should be extracted according to scientific up-to-date methods and that they should receive the imprimatur of the practitioners.' A strong representation was made by the Council of the Congress 'urging the official recognition of some of these drugs and the British Pharmacopoeia authorities were at last prevailed upon to find a back seat for them in the Addendum.' (ref. 2, p. 105)

In April 1901, the privately owned Bengal Chemical was converted into a public limited company. The idealism and hard work notwithstanding, the company was not doing too well – shortage of capital being the main reason. When a shareholder called for his dividend of ten annas (that is five-eighth of a rupee), 'the coffers of the Company were so empty that the paltry sum had to be borrowed from the durwan [porter]' (ref. 16, p. K173).

At the outbreak of the First World War, the president of London Chemical Society wrote to Ray asking for his help in the war effort. Responding positively, Bengal Chemicals not only increased its production but also introduced new processes and products. Additional chambers were erected for sulphuric acid; caffeine was extracted from tea dust; fire extinguishers and surgical bandages were manufactured, and photographers' hypo was produced on a large scale (ref. 2, pp. 317–318). Also, chemical balances were manufactured for the first time in India. More generally, for the nascent and struggling Indian industry, be it chemicals or iron and steel, the First World War came as a godsend.

There had been rumours that Ray's factory was supplying the revolutionaries knowhow for making bombs. The rumours were strong enough for the police to investigate them. In 1912, when Ray was made Companion of Indian Empire, he jokingly told the CID official that he could not touch him now because while he was CID, Ray was now alphabetically superior to him by being CIE (ref. 17, p. 19). In 1919 when Ray was awarded a knighthood, his war services would have been taken into account.

Baroda and Bombay

Given the general anti-entrepreneurial Bengali mindset, Ray's industrial initiative was a defensive action. In contrast, for his counterpart in Bombay it was only natural to try to put modern chemical knowledge to industrial use. Gajjar is significant on another count. By and large, fruits of the Western education went to the upper castes. Gajjar strove to extend these benefits to members of artisan castes, to one of which he himself belonged. He was born in Surat in the Suthar caste traditionally associated with carpentry[18,19]. His wealthy and well-regarded father Kalyandas (1829–1915) owned two large timber shops in Surat and Ahmedabad, and was a noted civil engineer. He compiled and published a number of books on *shilpashastra*, the traditional science of architecture. As a high-school student in Surat, Gajjar would often take broken pieces of laboratory equipment home, re-assemble them and do experiments. He successfully combined the formal Western education with family tradition. While he learnt mechanical drawing in school, he acquired skills of carpentry using tools and implements in his father's workshop. After passing his matriculation examination in the first division in 1879, Gajjar joined Elphinstone College, Bombay and earned the B A degree in chemistry in 1882, standing first in the examination. His friends and well-wishers came up with a number of suggestions for his future course of studies. He toyed with the idea of studying law or Sanskrit and philosophy. It is noteworthy that by this time Sanskrit was no longer the preserve of the Brahmins. Finally, he opted for science and did his M A in chemistry in 1884. Gajjar's first efforts were to set up a polytechnic in his home town, but the plan failed to materialize. In 1886, he joined Baroda College as professor of chemistry. Established in 1881 for art subjects alone, the College had that year started science classes but without success; all the students who wrote the first B Sc examination in 1887 failed. The young Maharaja Sayajirao Gaekwad (also spelt Gaekwar) (1862–1939) was an enlightened ruler to whom Gajjar had access through his friend, Yashvant Vasudev Athalye, known as Bapusaheb (1863–1894), who was the Deputy Diwan[20]. Accepting Bapusaheb and Gajjar's proposal for a polytechnic institute, the Gaekwad founded Kala Bhavan in 1890 with Gajjar as the principal. 'A good deal of money was spent in engaging competent German and other teachers, in giving scholarships and assisting students. Bapusaheb and Prof. Gajjar had to empty their pockets for the cause in hand.' In May 1895, on Gajjar's recommendation two *mistris* from Kala Bhavan, Lallubhai Mansukhram and Bhaichand Chelabhai, were sent to London to participate in the Empire of India exhibition organized by the Society for the Preservation of Indian Art. Bapusaheb's death in 1894 robbed Gajjar of valuable support. Even at the best of times 'the Gujarat public and the narrow-minded official bureaucracy of Baroda could hardly appreciate the work in this new line'. But now 'day by day the conviction began to grow on his mind, owing to various circumstances, that Baroda was not the proper place for his work'. Accordingly, Gajjar resigned his post in 1896, and moved to Bombay.

The Kala Bhavan offered practical training in a number of areas: civil, mechanical and electrical engineering, drawing and printing, architecture and photo engraving, textile chemistry including dyeing, bleaching, sizing and printing, oil and soap-making, etc. Incidentally, one of the earliest students at Kala Bhavan was Dadasahib Phalke (1870–1944), recognized as the father of Indian cinema. In 1896, out of the 204 students, 39 (19%) belonged to the artisan castes and another 44 (22%) were sons of farmers and cultivators. In 1907–08, the Kala Bhavan had 570 students on its rolls, out of which 70% were from Baroda state, as many as 18% from Bombay Presidency and the remaining from other states.

To Gajjar and Kala Bhavan goes the credit for introducing synthetic dyes in Indian textile industry. As he recalled in 1907: 'When our vegetable colours were driven out from the world's market, which they had held for centuries, by the marvellous colours modern chemistry

had extracted from coal-tar; when our dyers and weavers were reduced to poverty, their occupations having been taken up by others, there was no recourse left but to make use of these new colours and not to pay unnecessarily for the process of dyeing carried on outside India. Germany, the home of these chemical dyes, was anxious to secure a market for them in India. Our mill industry also needed a healthy growth and development. These considerations led me to suggest to the great colour manufacturers of Germany to train students and instruct native dyers in the use of their dyes if they desired India to become one of their great consumers. They appreciated the suggestion and acted upon it, and started their first laboratory in this very city [Surat] and commenced to instruct students and native dyers in the processes connected with dyeing. When Mr J. N. Tata heard about this, he at once communicated with me and made up his mind to append a dye-house to his mill, with the help of dyers trained in my private laboratory at Baroda. Even a costly laboratory set of dyeing apparatus was presented to his mill through me by the German manufacturers. Dyeing schools were soon after opened at Ahmedabad, Delhi, Cawnpore, Amritsar and other places under my supervision and several trained dyers were sent round as travelling agents. There are now several laboratories in Bombay connected with German offices where students are trained. These are the educational methods the Germans adopted for their purely commercial purposes, and the result is the present remarkable revival in our dyeing industry.' 'The dyers and the experts of these German firms were assisted by the students of the Kala Bhavan in developing the dye-houses of our mills. They are saving the mill industry from stagnation, are giving remunerative work to thousands of workmen and showing productive investments of capital. They are successfully working the dye-houses which costly foreign experts failed to do.'[21]

While Gajjar was still in Baroda some 'German colour firms' offered him their agency. Those were the days when nation-building ranked higher than personal fortune building. Committed to the 'spread of technical education and of modern industries in his motherland', he declined the lucrative offer. The European gentleman who then secured it was able to make some lakhs of rupees by means of that agency[20]. On moving to Bombay, Gajjar joined Wilson College as professor of chemistry and almost immediately won professional and official recognition in a spectacular manner. In October 1896, someone disfigured Queen Victoria's marble statue by smearing it with tar with the result that it had to be removed from public view and 'boarded up'. Many European experts tried to remove the stains, but failed. Gajjar rose to the occasion and removed the stains, which to others had appeared indelible. For this service he was given a prize of Rs 2000 in 1897 (ref. 22). He was certainly an innovative chemist. He developed a new process to clean-up pearls that had turned yellow. His lasting contribution however is his gearing the Bombay University chemistry curriculum towards industry. In 1900, in consultation with and with consent from Justice Mahadeo Govind Ranade (1842–1901) and friends such as M. G. Deshmukh, M.D.'[20] he became the proprietor and director of a training institute named Techno-Chemical Laboratory in Girgaum, which trained graduates and undergraduates 'to enable them to think of starting new factories'. Such a private initiative would probably not have succeeded anywhere else in India than Bombay. Next, Gajjar in co-operation with the Jesuit Father H. Kemp of St Xavier's College persuaded Bombay University to make its courses for the degree in chemistry 'more practical and useful'[23]. His own laboratory was recognized by the University for M A in Chemistry in 1907 (ref. 24). An entrepreneur himself, Gajjar did not wish to risk other people's capital in new ventures. He therefore 'with his own money started new factories through his students'.

The most notable of his private students was Anant Shridhar Kotibhaskar (d. 1910), who went on to secure First Class Honours in M A and win the Chancellor's gold medal in chemistry. His initiative led to the establishment of Alembic Chemical Works. Another trainee at the laboratory was Bhailal Dajibhai Amin (1878–1950) whose forte was business management and who eventually became the sole proprietor of Alembic. In 1903, Gajjar started a small factory called Parel Laboratories after the location in Bombay for the manufacture of spirit and 'pharmaceutical products, toilet preparations and certain chemicals' based on it. Soon it was found necessary to have a factory for the large-scale production of spirit alone. For this it was considered advisable to go out of British India, 'as the Government of Bombay did not seem to be inclined to grant any concessions'. Kotibhaskar approached the Maharaja of Gaekwad as well as his Dewan Ramesh Chandra Dutt. Accordingly, a factory for the manufacture of spirit was started in Baroda in 1905. The name Alembic, broadly meaning distillation apparatus, was chosen to indicate 'that the works were principally started for the manufacture of spirit and its products'. Alembic acquitted itself well at the 1906 Calcutta National Exhibition, where its products were examined by 'reputed chemical experts' such as Dr David Hooper, curator of Indian Museum and Dr Rai Chunilal Bose Bahadur, chemical examiner to the Government of Bengal who certified them 'as possessing the highest chemical purity' (ref. 23, p. 4).

A Singapore newspaper report published in 1907 tells us about the state of affairs of Alembic at the time. While Kotibhaskar looked after 'the management of scientific and manufacturing work' with the assistance of three chemists, the 'management of business' was placed in the hands of K. B. Mavhankar [sic, Mavlankar?] about whom nothing is known. Significantly, Amin was not yet a part of the enterprise[20]. He was looking after the lac factory Gajjar had personally set up in Nadiad 'to serve as an outlet for use of spirit produced by the Alembic Works'. This unit had to be closed down (the factory was functional at least till May 1907) and Amin now got associated with Alembic. As Amin himself wrote in 1939: 'As the business of the enterprise increased, Prof. Gajjar and Prof. Kotibhaskar realized that in the interest of efficiency, the technical and the business sides should be put under separate management'. While Kotibhaskar continued to look after the technical side, Amin was appointed Business Manager (ref. 23, p. 5). Alembic came into existence on 30 July 1907 as a joint stock company. It was registered first in Bombay and then in Baroda. On 7 December 1907, it appointed the partnership firm of Messrs. Kotibhasker, Amin & Co. as its Managing Agents. Gajjar's minor son was one of the four partners of the firm[25]. Thus contrary to popular perception, the future owner Amin was not associated with Alembic when the work started in 1905, but entered the picture only in 1907 at the time of the registration of the

Company. Amin described Gajjar as a friend, guide and philosopher, Kotibhaskar as the commander-in-chief and himself as a quarter master general (ref. 23, p. 7). An important difference between Bengal Chemicals and Alembic should be noted. The former was established by a professor, while the latter was set up by students under guidance from their professor. Also, interestingly, while Calcutta's priority was medicines, Baroda's was alcohol.

Alembic's first big-time venture was a significant development on the technical front, but a colossal failure on the financial side. It took a three-year contract beginning April 1910 from the Baroda Government's Excise Department for supplying potable liquor. Although the raw material was the traditional mahura (or mahua) plant, the Company decided to process it in a scientific way. Kotibhaskar went to Europe in 1909 to obtain some experience in distillery and pharmaceutical work and returned with a French still. Kotibhaskar's death in 1910 was not a severe setback because Gajjar was at hand to take up the responsibilities of the technical director. If the Company had stipulated in the contract the quantity of spirit that it would supply to the Baroda state, it would have made a neat pile of money from the deal. However, as the contract stood Alembic was obliged to supply 'excessively large' quantities of alcohol way beyond its own production capabilities. As a result, the Company lost heavily on the contract. Although the Gaekwad 'graciously' granted Rs 30,000 as compensation, the amount was less than one-tenth of what the Company had lost[12]. Alembic was saved from a 'severe financial collapse' by a substantial loan of Rs 200,000 sanctioned by the Gaekwad-supported Bank of Baroda.

Like Bengal Chemicals, Alembic also profited from the First World War. Baroda'a modern distillation facilities received enthusiastic welcome from Europeans based in India, who could no longer get imported foreign liquor. 'Brandy, Whisky, Rum, etc. began to be manufactured in the factory, and found ready sales.' In the four-year period 1915–18, the Company's foreign liquor business showed an increase of 2700%, from Rs 28,000 to Rs 761,000. In this period, the pharmacy, foreign liquor and rectified spirit businesses taken together showed a tenfold increase from Rs 104,000 to Rs 1,022,000 (ref. 23, p. 56).

An account of Alembic's products and Gajjar's 'rational preparations' in 1915 was put out by their sole representatives for South India, Messrs S. Vaidya and Co. Alembic 'are manufacturers of chemical, pharmaceutical and toilet requisites, and they are distillers of rectified spirits, essential oils, and attars'. Gajjar's 'remedies are for such diseases as typhus, typhoid, and malarial fevers, plague, and cholera…good results have been obtained in cases of pneumonia, phthisis, and consumption.' It was further pointed out that 'Several gold and silver medals have been awarded to the proprietors for many of his [sic] specialties.'[26]

Speaking at the Alembic Works on the occasion of the Gaekwad's visit on 30 October 1912, Gajjar pointed out that while 'the original scheme of the Bangalore Institute as drawn up by Sir William Ramsay provided for the establishment of small model factories attached to the Institute itself, the project as finally adopted was only for pure research work'. In contrast, Gajjar noted with apparent pride that Alembic had laboratories attached to the factory which turned out research work that 'compared favourably with that attempted at the Indian Institute of Science, Bangalore' (ref. 23, p. 34).

Ray always starved of funds for his Bengal Chemicals noted with a tinge of envy that Gajjar's Alembic could fall upon the Gaekwad for its capital needs (ref. 16, p. 173). It however needs to be appreciated that more than the royal support, it was the general industrial culture that set Western India apart from Bengal.

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