Chemistry of Indian Opium

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OPIUM is the spontaneously coagulated latex which exudes when the partly ripened capsules of *Papaver somniferum* L. are lanced on the living plant. On exposure to air, the white, pale-yellow or pink latex turns darkish brown and, increasing progressively in viscosity, finally becomes quite hard. The product, called 'raw opium', is brown and soft inside, and has a characteristic smell and bitter taste. As marketed, raw opium contains about 15 per cent of water, some sugar, salts, albuminous substances and colouring matter. Its most valuable constituents are varying amounts of the meconates of some twenty-five alkaloids, the chief of which is morphine. At the time of collection, the content of morphine in Indian opium is not less than 8 per cent, though 16–20 per cent has been recorded when only latex from first lancings were taken. Narcotine (5–7 per cent); codeine (1–2 per cent), papaverine (0·4–1 per cent), thebaine (0·2–0·5 per cent) and narceine (0·5–1 per cent) are also present.

Opium waste products and contraband opium are used for the manufacture of morphine and other opium alkaloids. Excise opium is used in medicine, but in India much is chewed in harmless quantities.

The Hague Convention and the Dangerous Drugs Convention of 1925 have given international definitions to the two other varieties of the commercial drug, "prepared opium" and "medicinal opium". For the latter, selected chaláns of raw opium containing 9·5–10·5 per cent of morphine are employed.

In 1926, the Government of India discontinued the auctioning of "provision" opium for export and undertook the sales direct, the policy for many years having been to deal only with Governments. Also the supplies to Far Eastern countries for purposes other than medical and scientific were reduced by 10 per cent annually so as to extinguish exports by December 1935. This decision has involved great financial sacrifice to India, the sales in 1926–27 having yielded 3·36 crores of rupees (a crore is ten million rupees, approximately £750,000), while, in 1936–37, no revenue was collected under this head.

Experts have been frequently employed to report on the preparation of standard opium for sale and, for nearly thirty years, the technical side of the factory has been under the control of a chemist. W. A. Davis[1], indigo research chemist to the Government of India, deputed to report on the manufacture of medical opium and opium alkaloids at Ghazipur, recommended the installation of modern factory and laboratory research equipment, and showed how the Ghazipur Factory could produce a standard opium in sufficient quantity completely to replace that from Turkey and Persia in the English and American markets. Indian medical opium, the manufacture of which at Ghazipur was first undertaken during the Great War to replace the supplies no longer available from Turkey owing to international hostilities, is a better standardized product than that from Turkey. Indian opium also contains more codeine (2–4 per cent) than the Turkish variety (less than 1 per cent).

H. E. Annett and his co-workers[2] have made valuable contributions to the chemistry of opium and its alkaloids. With Bose, he showed that the observed increase in the percentage ash of the latex of the opium poppy at each successive lancing up to the fourth is accompanied by a decrease in the total alkaloid content of the latex. The principal loss was in morphine, while the codeine–morphine ratio rapidly increased at successive lancings. They failed to establish any relationship between the nature of the soil and the morphine content of the opium grown on it, though there was clearly some local factor influencing the power of a plant to produce the alkaloids. Different races of poppy possibly produced opium of varying morphine content and special strains could be produced by selective manuring. Organic manures caused an increased yield of opium of higher morphine content. Similar results with superphosphate linked the beneficial effect with the phosphoric acid in the manure.

Indian opium was, and still is, inferior to Turkish opium in morphine content. This can be ascribed to such factors as faulty methods of harvesting, defective lancing and collecting, the deterioration of opium on storage and environmental conditions in India, which are unfavourable when compared with those of Turkey, where the latex is collected in a moist atmosphere with a falling temperature, while the reverse conditions, favourable to bacterial deterioration, prevail in India.

In cloudy or moist weather a brown, watery substance called 'pasewa' exudes from opium. It used to be employed as 'lewa', a mixture of pasewa and inferior opium, in pasting poppy petals as a protective layer round the balls of provision

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opium. Opium mixed with excess of pasewa is termed 'pasewa amez', but little is known of the genesis, chemistry or properties of pasewa and its peculiar sensitiveness to climatic conditions.

Considerable controversy arose over the assays of opium and its alkaloids submitted to the English market for sale. These differences between results of the English chemists and the Indian factory analysis were traced to different methods being employed for the evaluation of the opium and the purity of morphine hydrochloride, and the interpretation of the results.

In 1915, the chemical work of the Ghazipur Laboratory was done by the assistant opium examiner, W. W. Todrick. His staff was augmented in 1915 by a chemical assistant, J. N. Rakshit (Rai Sahib, 1926), who eventually succeeded Todrick. Later he was designated factory chemist, but in 1929 he was appointed to the newly created post of opium chemist to the Government of India.

In 1917, Rakshit[3] showed that opium yields about 2·5 per cent ammonia, and, a year later, isolated a complex substance he called "opium wax"[4]. Its composition varies widely from different sources, giving saponification values, 113–126, acid values, 41–45, and iodine values 130–170. The presence of hydrocarbons is also indicated, and from two other components; J. N. Ray (Lahore, unpublished work) has separated acids melting at 76° and 178° respectively, the latter being most probably a resin acid. Hence Ray suggests that opium wax is probably a resin, since destructive distillation yields an oily product resembling the higher terpenes.

Rakshit[5] isolated porphyroxine from opium and reported it to be a crystalline compound with a sharp melting point different from the mixtures examined by Merck (1837), Dey (1883) and Hesse (1894). Rakshit's proposed structure for this compound has been the subject of criticism in view of the development of the chemistry of morphine.

The determination of the morphine content is a most important but controversial question, leading to modifications of standard procedure from time to time.

The Indian Opium Factory sales of medical opium of standard strength for supply to medical men and hospitals have increased from 511 lb. in 1922 to 1,800 lb. of medical opium powder and medical opium cake of B.P. 1932 strength in 1936. During the year ending September 30, 1936, 1578 lb. of crude morphine, 130 lb. of morphine hydrochloride, 14 lb. of morphine sulphate and 284 lb. of codeine were sold from the Factory. Cotarnine prepared by the oxidation of narcotine has been made to supply special orders.

Literature on the problem of the loss of morphine from opium on storage has been summarized in an article by Dunnicliff, Ray and Singh[6]. Their investigations show that the morphine content of Indian opium does not fall if it is stored under anærobic conditions in a moist condition but that, if dried at 60° and stored in contact with air, it suffers a rapid loss of the alkaloid. When dried at 98°–100° and stored out of contact with air, the fall in morphine content is small. Simple trituration of opium with lime shows that there are ammonium salts present, but it is claimed that their formation is not due to the degradation of morphine as hitherto believed.

The consumption of excise opium in India has decreased steadily for the last six or seven years, the issues from the Ghazipur Factory having fallen from 12,767 maunds in 1919 to 5,665 maunds in 1936. This decline is to be attributed partly to the economic depression of recent years and partly to the steady increase in the duty on opium. To a large extent, opium-eating in India is quasi-medical, being used by the poor as a very common and highly valued household remedy. Its physiological importance depends not only on its morphine content but also on the presence of alkaloids like codeine, papaverine, etc., which assist in the relief of many ailments.

The conclusion that opium may have an anti-malarial action was based on the low incidence of malaria in certain districts where opium was regularly consumed. Gordon affirmed the prophylactic value of narcotine against malaria, but Chopra and Knowles[7] have shown that it has neither curative nor prophylactic value in malaria, even in large doses.

Ahluwalia, Kochhar and Ray[8] oxidized narcotine to cotarnine in good yield and prepared a number of derivatives of cotarnine. One of these formed from resorcinol was found, like quinine, to be an antipyretic and toxic to Paramecia. Its acetyl derivative may possibly find some application in gynæcology, while cotarnine phthalate is a stypic.

The opium habit, the physiological results of smoking opium, the effect of opium and morphine on the human system and morphine addiction in India have all received the attention of scientific workers and official commissions[9], from the reports of which valuable information on these important sociological problems may be found.

[1] Report on the Opium Factory, Ghazipur, by W. A. Davis (Government Press, U.P., India, 1918.)

[2] *Bull. Agric. Research Inst. Pusa*, **116** (1921); *Mem. Dep. Agric. India*, **6**, 1, 2 (1921); **8**, 2, 3, 4 (1925); *Agric. J. Ind.*, **6** (1922).

[3] *Pharm. J.*, **98**, 255 (1917).

[4] *Analyst*, **43**, 321 (1918).

[5] *J. Chem. Soc.*, 455 (1919); *Ber.*, 2473 (1926).

[6] *Proc. Nat. Inst. Sci. India*, **1**, 107 (1935).

[7] *Indian J. Med. Res.*, **18**, 5 (1930).

[8] *J. Indian Chem. Soc.*, **9**, 215 (1932).

[9] "A.B.C. of Narcotic Drugs", by O. Anselmino. (League of Nations, Permanent Central Opium Board. Geneva, 1931.) Report of the Royal Commission on Opium, 1895. Report of the International Opium Commission, Shanghai 1909 (*North China and Daily News Herald Ltd.*, Shanghai 1909). "Indian Opium", *Bull. Imp. Inst.*, 1915, "The Truth about Opium", by W. Brereton (1882).

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