

## Preparation of Fine Chemicals.\*

By B. H. Iyer, M.Sc., A.I.I.Sc.

WITH the development of chemical industry in an organised form from the middle of the 19th century, the entire chemicals have been classified into two main divisions, *viz.*, Heavy Chemicals and Fine Chemicals. Mineral acids like sulphuric, hydrochloric, nitric and phosphoric, caustic alkalies of soda and potash, their carbonates and bicarbonates and many of the inorganic salts manufactured on a tonnage basis belong to the class of Heavy Chemicals. Analytical, pharmaceutical, photographic and rare earth chemicals, synthetic essences and perfumes, synthetic dyestuffs and research chemicals are considered as Fine Chemicals. As the organic compounds constitute a major portion of this class of substances, the progress of fine chemical industry has been intimately connected with the successful utilisation of the petroleum and coal-tar products—the two chief sources of organic compounds. For nearly half a century ending with the commencement of the Great World War in 1914, Germany was holding the sole monopoly for all fine chemicals. The War having shown the need for self-sufficiency, Great Britain and America mustered up their energies and creditably built up their respective national fine chemical industries. The humble but successful efforts to prepare the necessary research chemicals made by Prof. C. G. Derick of the University of Illinois in 1916 and ably continued by Prof. Roger Adams and others, brought into existence, the valuable 'Department of Synthetic Chemistry' of the Eastman Kodak Company, Rochester. While nations all around have been developing this very necessary branch of chemical industry, India has been depending on foreign countries for her needs.

The various processes employed in the preparation of these substances, may be divided into three groups :

(1) Inorganic Chemicals, (2) Organic Chemicals, and (3) Chemicals prepared by the action of biological agents. Inorganic chemicals are smaller in number than the organic compounds. Inorganic reactions are comparatively simple and the yields therefrom are better than in organic reactions. In the organic field, the process is hindered by the formation of more products than one, due to side reactions. The factors which decide the production of a desired product in good yield are temperature, pressure, concentration and the agent used for

bringing about the reaction. Catalytic oxidation and reduction play an important part in synthetic chemistry. Employment of high temperature and pressure has enabled chemists to conveniently prepare very many of the compounds which could be obtained only in small quantities with great difficulty, before. Soda-water bottles lodged in iron frames and provided with rubber washers pressed in position by a screw arrangement, offer a convenient method of carrying out reaction under pressure. The insertion of a capillary tube in the cork used for sealing facilitates release of pressure, if present, at the end of the reaction. The process of fermentation by fungi, moulds or bacteria is revolutionising some of the synthetic methods. Although intensive research has enabled chemists to synthesise many of the natural products, their methods are entirely different from those adapted by Nature which does not involve the employment of such high or low temperatures or pressures or such strong acidic or alkaline media which are proved necessary for the manufacturing processes. Biochemistry would do a real service when it explores the subtle secrets of Nature and enables scientists to copy *in toto* the natural methods in the synthetic experiments.

The spread of civilization and the progress of research in this country demand an early establishment of a fine chemical industry in India. Although there are no separate statistical import figures, the knowledge that on an average 474 lakhs of rupees worth of chemicals, drugs and medicines and another 390 lakhs of rupees worth of dyes and colours are imported annually into British India, ought to be sufficient to set the industrial mind thinking as to what should be done.

In August 1930 a Preparation Section attached to the Department of Organic Chemistry, Indian Institute of Science, Bangalore, was started, for the first time in India, due to the efforts of Dr. P. C. Guha. This Section prepares almost all organic research chemicals necessary for work in the laboratories. Within these three years, more than a hundred different chemicals have been prepared in considerable quantities. This enterprise has proved useful in making special chemicals of requisite purity immediately available for research at low cost. Most of the chemicals costing more than Rs. 15 per kilogramme have, in fact, been prepared with a large margin of profit. The Section has proved useful in imparting valuable training in preparative chemistry to post-graduate research students.

\*Abstracted from a lecture given under the auspices of the South Indian Science Association, Bangalore, on 24th November 1933.