HEAVY CHEMICAL INDUSTRIES.

By G. C. MITTER, *O.B.E., M.Sc., F.I.C., Chief Assayer, His Majesty's Mint, Bombay.*

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India's industrial development took a sharp turn during the last war. The growth of various post-war industries caused a marked decline in the import of certain classes of finished articles, e.g. soap, rubber goods, pottery, paint, etc. But while the import of manufactured goods have shown a steady and marked decline, there are two important categories in which there has been a phenomenal increase. These two categories are machineries and chemicals. The gap in the industrial structure of the country to which much attention has recently been given both in the press and in public primarily concerns *machineries and chemicals.* Rectification of this deficiency in the industrial equipment of the country can to a great extent be achieved with the development of (1) *the Metallurgical Industry,* and of (2) *the Basic Chemical Industry.* In fact a co-ordinated scheme of development of these two industries should be taken up simultaneously.

Heavy chemicals, as usually classified, include amongst others the following:—

Acids, alkalis both caustic and carbonated and salts, e.g. ammonium sulphate, sodium sulphate, sulphides, hydrosulphites, hypo-sulphites, sodium silicate and bichromate; magnesium, zinc and lead compounds, copper sulphate and calcium carbide.

Acids.—It is well known that for the development of Indian chemical industries there should be cheap and abundant supply of H_2SO_4. As the manufacture of this acid depends on the supply of sulphur or pyrites, a survey of such sources is the first step to be undertaken. Acid made in India from imported sulphur can neither be cheap nor abundant. The activities of the Board of Scientific and Industrial Research have, within the short time of its existence, been very encouraging in this direction. They are enumerated below:

1. Possibilities of mining sulphur were indicated in the Survey Report of the Geological Survey in Sind and Baluchistan and attempts are being made to exploit it.
2. The recovery of sulphur from benzol by the two important factories at Jamshedpur and Bararee are going to be attended to.
3. Particular attention is being drawn to the SO_2 set free during metallurgical operations involving the use of pyrites particularly during the manufacture of copper and zinc as it is considered as a rich and potential source of the acid.
4. Sulphur from coal and oil are being examined for utility in trade.

In my opinion the source of SO_2 supply from the metallurgical operations need urgent and prompt attention. *The dilution of SO_2 set free in the manufacture of copper may be an apparent hindrance but intensive research may help to improve the methods of manufacture and evolve a method of utilising the waste SO_2 gas.*

Sulphuric acid is cheap in Europe but owing to its corrosive quality and high freight this industry in India has enjoyed a natural protection. But its restricted output and high cost raises the cost of the manufacture of materials derived from this basic chemical. The foreign manufacturers have taken full advantage of this situation as the import value of salts derived from this acid mounts up to a respectable figure.

Alkalis.—The other important heavy basic chemicals which require our attention is the manufacture of alkalis, both caustic and carbonated. The value of import of alkali and their products easily derived from it exceeds a third of the value of the total chemicals imported into this country. It is natural therefore that the enterprising firms of the Tatas and I.C.I. decided to start manufacture of this important basic material in this country. The Mettur Industrial and Chemical Corporation are, I understand, also in the field for the manufacture of caustic soda and bleaching powder. The I.C.I. factory in Bengal is now producing caustic liquor and hypo-chlorite solution which finds a ready market in that part of the country. A good portion of the requirements of bleaching powder and caustic alkali is going to be met from these newly developed sources.

The manufacture of the *carbonated alkali* (soda ash) need not be confined to the electrolytic process. In places where the raw materials for the electrolytic process are not easily available but where plenty of ammonia may be made available, synthetically or otherwise, the possibilities of the new process in which liquid ammonia is used as solvent may well be investigated. Japan, Russia and Germany have by different modifications of this process, the underlying theoretical principle being the same, started on soda ash manufacture on a commercial scale.

Calcium carbide.—The question of supply of ammonia suggests the possibilities of the carbide industry in this country. But the claim of this industry is supreme from the point of view of a country's safety, well-being and prosperity. As a source of acetic acid and acetone it has its utility in industries connected with (1) artificial silk, (2) plastics and rubber, (3) varnishes and pigments (lead), (4) dyestuff and perfumes, (5) explosives, (6) artificial leather, and (7) pharmaceutical products. The use of cyanamide as a fertiliser cannot be too strongly recommended in a predominantly agricultural country such as ours. It is true that a certain amount of some of these products are being obtained in this country by wood distillation and the possibility of preparing acetone by fermentation and as a by-product of the petroleum industry are being actively investigated, but students of chemistry are well aware that synthetic acetic acid, acetate of lime and acetone obtained from

acetylene are fast appropriating the place occupied by the same products obtained by the foregoing processes.

It is, therefore, necessary that where cheap power and good lime are available a carbide plant should be installed. Between Bihar and Bengal, in regions near the coalfields there are good lime quarries. The next suitable place for a carbide plant will be Madras where hydro-electric power is cheap. Here, if the coal supply is not so abundant, plenty of charcoal is available at a cheap price. And there already exists a large market for this commodity at both the places. It has been estimated that on a rough estimate the cost of production will be somewhere about Rs.230 per ton while its pre-war price was quoted at Rs.430 per ton. The economic unit will be a plant of five ton capacity.

Alumina and aluminium.—In view of the growing importance of aluminium, the new French process (Seailles) of treating bauxite for alumina is worth notice. Limestone and bauxite are calcined at a temperature of 950–1,100°C. The crude aluminate of calcium is treated with water on the counter current principle under controlled conditions and the resulting solution of calcium aluminate is filtered and immediately treated with carbon dioxide obtained from the first calcination, a mixture of anhydrous alumina and calcium carbonate being produced. The final separation of anhydrous alumina from calcium carbonate can be brought about by treating a suspension of the mixture with water saturated with carbon dioxide when the bicarbonate of calcium formed goes into solution leaving anhydrous alumina behind. In view of an ample supply of bauxite in this country, this process has much to commend for production of aluminium.