SOME OBSERVATIONS ON THE HEAVY CHEMICAL INDUSTRIES OF INDIA.

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A discussion on heavy chemical industry immediately brings in the question of sulphuric acid. It is often said, and very rightly indeed, that the industrial development of a country is measured by the quantity of sulphuric acid it consumes. The subject of sulphuric acid again brings in the problem of sulphur of which there is no appreciable source in this country. India, like many other countries, has to depend upon imported sulphur. From the amount of sulphuric acid produced in different centres an amount of the sulphur consumed may be judged.

Centre.	Production of sulphuric acid in tons per day.
Amritsar	10
Jamshedpur	50
Cawnpore	10
Bombay	5
Madras	5
Mysore	30
Calcutta	45
TOTAL ..	160 tons.

Taking the sulphur content about 33%, daily consumption of sulphur is about 50 tons. Previous to the war the main source of supply of sulphur was Sicily, on account of the Sicilian sulphur being free from arsenic. But since the outbreak of the present war America has become our main source of sulphur. But the shipments are so irregular that at any time there can be a crisis in the manufacture of sulphuric acid. A source of sulphur has recently been found in Baluchistan, which was in fact known long ago. It can be worked out now and the Government of India have already taken up the work in hand. But transport difficulty and other consideration stand in the way of its economic exploitation at the present moment.

There are, however, good deposits of pyrites and gypsum in India which contain a fair proportion of sulphur. But all the sulphuric acid plants in India are equipped with sulphur burners.

Industry in this country sprang up and developed at the natural instinct of some of the great men of the country. There was no national planning of industries. Countries, where industries have been set up on national plannings, are not threatened to-day with such a crisis. Their big industries are planned

on local advantageous circumstances. Manufacture of sulphuric acid from pyrites is being carried out in many countries. Gypsum seems to have attracted lesser attention, yet a major portion of the U.S.S.R. acids are known to be produced from this source to suit their local conditions.

It must be admitted on all facts that the individual manufacturers in this country are now busy beyond their normal capacities. It is, therefore, in our opinion, one of the foremost duties of the Board of Industrial and Scientific Research to work out and set up a pilot plant for sulphuric acid manufacture from pyrites and gypsum after having explored the possibilities of all raw materials, specially of gypsum and pyrites, and this will be of great help to the manufacturers.

There is, however, one difficulty with regard to the use of Indian pyrites. As far as we know, there is hardly any deposit free from arsenic. Gypsum, however, is quite pure and may serve as a supplement for the manufacture of acids used for medicinal or other purposes of human consumption.

There are some who hint at the inefficiency of Indian manufacturers and criticise adversely the protective measures under which they are working. If a foreign manufacturer can produce and export a commodity at lower price, it is, in their opinion, unreasonable to ask for any protection after the expiry of a long period of spoon feeding and thereby indirectly taxing the poor rate-payers. While their reasonings are perfectly sound, their analysis of the situation is, however, hardly correct. The manufacturers are neither deriving a high profit nor are their production efficiency low. It is the great handicap under which they work which makes the price of their goods higher than expected.

In the first instance the raw materials are to be brought from a very great distance. Railway freight naturally is very high—in some cases two to three times the price of the stuff itself. An interesting instance on this point might be cited here. A few years back, the railway freight of bauxite to Howrah Station was double that at the jetty. It was in the interest of Government to get a cheap export, so the freight by steamer had been reduced to the lowest limit. But to ask for such help in case of the poor Indian manufacturer will bring in the paraphernalia of Committee, Commission and similar dilatory tactics and ultimate shelving of the question itself.

Secondly, we find exorbitant freights charged on acids for their inland transport. Due mainly to this reason, heavy chemical industries are all situated near about big metropolis where the cost of labour and taxation are extremely high. Had such factories been distributed all over the country, consumers would have been saved the cost of transport which, again, is not a negligible factor of the price of cheap domestic articles like alum, mag. sulph., ferri sulph., etc. In this connection we should consider another possible danger that is lurking in the horizon. If Calcutta is subjected to an air raid similar to that of London, all Indian industries will cease to function in a day. It is

high time for the Government to think in this line and consider what steps should be taken to transfer some of the key industries deeper into the country.

In spite of the difficulties enumerated above, perhaps a time has come when we should look forward. India has got huge deposits of bauxite, chromite, magnesite, pyrolusite and many other rich ores. We have copper, iron, lead and other metals. Our coal resource is not low. What difficulties we have are all artificially created and can be brushed off with united efforts.

We should try to reduce as far as possible the free exports of the valuable ores. If they are to be exported, they must go out as finished stuff. It is high time that the manufacturers in the line put their heads together and devise means for it.

While we find good strides have been made in the production of heavy chemicals after the last Great War, the problem of potash industry still remains unsolved. India is entirely dependent for her supply of potash and soda on foreign imports though we have well-established industries for the salts of aluminium, zinc, copper, lead and iron. Chromium industry also is rapidly being extended and there are several firms seriously working with manganese compounds.

Before the outbreak of war, most of the potassium salts were imported from Germany, Holland and France. At present America has captured the market, though its potash resource is not a very big one. Prices, therefore, have gone up enormously as is evident from the following schedule:—

Items.	Pre-war Price.	Present Price.
Potassium Carbonate ..	Rs.21 per cwt.	Rs.60 per cwt.
,, Bicarbonate ..	Rs.26 ,, ,,	Rs.86 ,, ,,
,, Bichromate ..	Rs.36 ,, ,,	Rs.104 ,, ,,
,, Ferrocyanide ..	Rs.68 ,, ,,	Rs.400 ,, ,,
,, Sulphate ..	Rs.7 ,, ,,	Rs.15 ,, ,,
,, Cyanide ..	Rs.1-4-0 ,, lb.	Rs.2-8-0 ,, lb.
,, Caustic ..	Rs.27 ,, cwt.	Rs.70 ,, cwt.

Even before the war, prices of potassium salts were comparatively higher. A consideration of this fact prompted the reduction of import duty from 30 to 25%. The plight of the consumers at the present market can, therefore, be easily imagined.

Wood ash was the only starting material for potassium salts, even up to the closing years of the nineteenth century. Great forests of the U.S.A., Canada and Russia have dwindled, yielding its potassium throughout the whole world. Gradually, however, the molasses from beet sugar has taken up its place, from which source France, Belgium and Holland produce a very large quantity of potassium compounds. In Germany, an additional source is utilised, that is the great Stassfurt Deposit. Though the residue left after the fermentation of this molass is rich in potassium salts, the preparation of potassium carbonate from it entails a very lengthy process. The composition

of the calcined stuff from molass will give an idea of the extent of impurities to be removed. It contains:—

	1	2	3
Potash	51·72%	47·67%	50·38%
Soda	8 ,,	11·43 ,,	8·29 ,,
Lime	5·04 ,,	3·6 ,,	3·12 ,,
Magnesia	·18 ,,	·10 ,,	·18 ,,
Carbonic Acid	28·9 ,,	27·94 ,,	28·7 ,,

The remainder consists of phosphoric and silicic acids, chlorine, oxides of iron, etc., amounting 10 to 20%. Nor is the manufacture from pot. chloride of Stassfurt less elaborate, since the simple ammonia process is not suited for it. If the countries mentioned above control the potassium market of the world, it is only because of their initial start and the large production they command.

Forest is a natural resource of India. Excepting perhaps Bengal and Bihar, wood is used as fuel all throughout for domestic purpose. Even factory power in tea-gardens and industry situated in the interior of the country is obtained from wood fire. In Southern India groundnut mills are run by burning the husks. These ashes are fairly rich in potassium carbonate. While it may be difficult, if not impossible, to gather the domestic wood ash, those from industrial centres are easily procurable. Usually they are run to waste. So a very small price will suffice to attract them.

With the growth of the importance and consumption of power alcohol, fermentation industries are coming more into the field. Recent U.P. move for the compulsory utilisation of power alcohol has given a great impetus. It is, therefore, expected that the molass-residue left after fermentation will attract greater attention for its utilisation. Considering the cheap fuel-value, particularly in Bengal, this valuable by-product is worth evaporation and calcination, whereby at least a good concentrated potass manure may be obtained. A sample of such a liquor on evaporation and calcination yield a product differing from the foreign ash only in having a large percentage of sulphates.

But potassium is found in a more concentrated form in the Punjab, the U.P. and North Bihar as nitrate. It appears on ground as an efflorescence which is collected and sold as such by cultivators. There are purifying factories who produce an almost pure salt by simple crystallisation.

Unfortunately we have no statistics at hand to show what amount of nitrate is annually produced. But from our experience of Calcutta market, we know shiploads of this nitre are exported every month to Java, China, Japan, Hongkong and Australia. Naturally, there exist all facilities for chief transports to port and there being no restriction or duty, export is very easy. It is not known what price the original substance brings to the cultivators; but after several transference of hands Calcutta price ranges from Rs.12 to Rs.13 per cwt. for a variety of 99% purity. Price for lesser purity are much lower. For instance, a 90% variety can easily be bought at Rs.10

per cwt. These prices are all of the present market which before war was about 33 to 50% lower. It is the general impression that these exports are meant for manurial purpose. Being a combined potassium and nitrogen source, perhaps it is true for consignments to Java and similar cane-producing countries. But considering the stress given by exporters on quality this explanation seems untenable. An industrial utilisation can reasonably be suspected.

In this connection, one curious fact needs some comment. When taxations are heavily levied directly and indirectly on already over-burdened rate-payers, it is a mystery why such an important item like nitre may be allowed to be exported free. It may be argued that such a duty may prove detrimental by the increase in price and inhibit the existing business. But considering the fact that nitre market is never a fixed one and is subject more or less to the whim of middleman in Calcutta, an addition of 10 to 15% of export duty is hardly expected to be of any untoward effect. Moreover this charge will either fall on the foreign purchaser or be borne by exporting houses. Stoppage of the Norwegian and German synthetic soda nitre has greatly increased the demand of Indian nitre. Whole of this benefit is being enjoyed by middleman, actual producers remaining ignorant of it. Money obtained from this source may be utilised for their benefit, for the betterment of the cultivation as a whole, like jute in Bengal.

Nitre is an excellent starting material for the preparation of all potassium salts. Mixed with charcoal or half-dry molasses it burns well with a good heat efficiency. The ash left behind is almost pure carbonate. An average composition is as follows:—

K_2CO_3	95%
Na_2CO_3	nil
Unburnt carbon	2%
KNO_2	1%
KNO_3	nil
Sulphide and silicate	trace

This can be transformed into caustic if mixed with lime, at the time of combustion. Dichromates and sulphates may be obtained by double decomposition with the respective sodium salts.

A very important factor for the commercial success of potassium industry is the purity of potassium nitrate readily obtained in the market. It requires practically no big installation or plant to prepare potassium carbonate, caustic or sulphate. Ferrocyanide and cyanides would require a reverbatory furnace. Costs of production obtained from our experimental trials as shown below are not very high.

Items.	Pre-war import costs.	Manufactured costs based on pre-war nitre price.
Potassium Carbonate ..	.. Rs.21 per cwt.	Rs.20 per cwt.
Caustic Potash ..	.. Rs.27 ,, ,,	Rs.26 ,, ,,
Potassium Sulphate	.. Rs.7 ,, ,,	Rs.7 ,, ,,
,, Dichromate	.. Rs.36 ,, ,,	We have not yet come to a definite figure.

They come very near to the wholesale import price of the foreign materials. With better experience, these are expected to go lower down, and there is no reason why we should not be able to normally compete with the importer. We have not yet arrived at any figure for ferrocyanides and cyanides, but since the raw materials for these are very cheap, there is no reason why their economic aspects should be less optimistic. Yet, it must be clearly stated, it will be impossible to bring such an industry to a successful end without the help and active co-operation of the Government. It may be necessary to protect it by a special tariff till the stage of infancy is passed.