

POSSIBILITIES OF HEAVY CHEMICAL INDUSTRIES IN THE PUNJAB.

By J. L. SARIN.

(Read at Symposium, April 19, 1941.)

The importance of heavy chemicals to the various industries¹ of the country is illustrated graphically in fig. 1. This figure also shows the

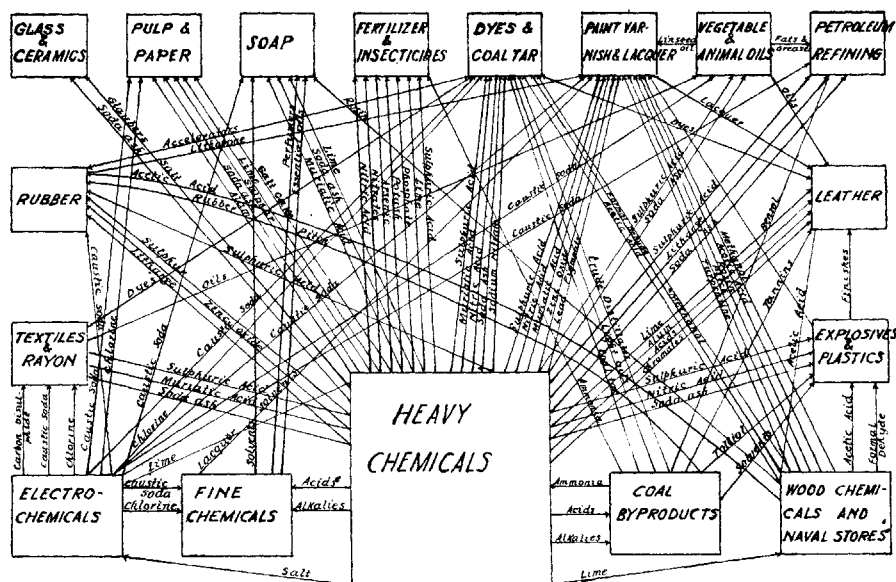


FIG. 1. INTERINDUSTRY MOVEMENT OF PRINCIPAL RAW MATERIALS
OF CHEMICAL ENGINEERING INDUSTRY

inter-industry movement of principal raw materials of the chemical engineering industries. It will be seen that the most important raw materials for heavy chemical industries are (1) Salt, (2) Limestone, (3) Sulphur, (4) Coal, and (5) Ammonia. All of them are found in the Punjab and can be used for the development of heavy chemical industries as would be seen from what follows immediately below:—

1. *Salt*.—Common salt is the starting point for alkali industry. The relationship of alkali industry to modern industries² is illustrated in fig. 2. The Punjab salt mines, situated in the Salt Range, produce about 150,000 tons of salt per year. Of them the principal is the Mayo Salt Mines at Khewra in which there lies a purely crystalline salt of light pink colour interbedded with some seams of impure red earthy soil (*kalar*) of the total thickness of 300 feet. Above this there is another bed of the thickness of about 250 feet. The upper deposit is not so pure as the lower, for it contains more intercalation of *kalar* and is associated with other salts, e.g. calcium sulphate, magnesium, potassium

and calcium chloride in great proportion. The lateral extension of the salt beds appear to be very great extending to several square miles in area. There

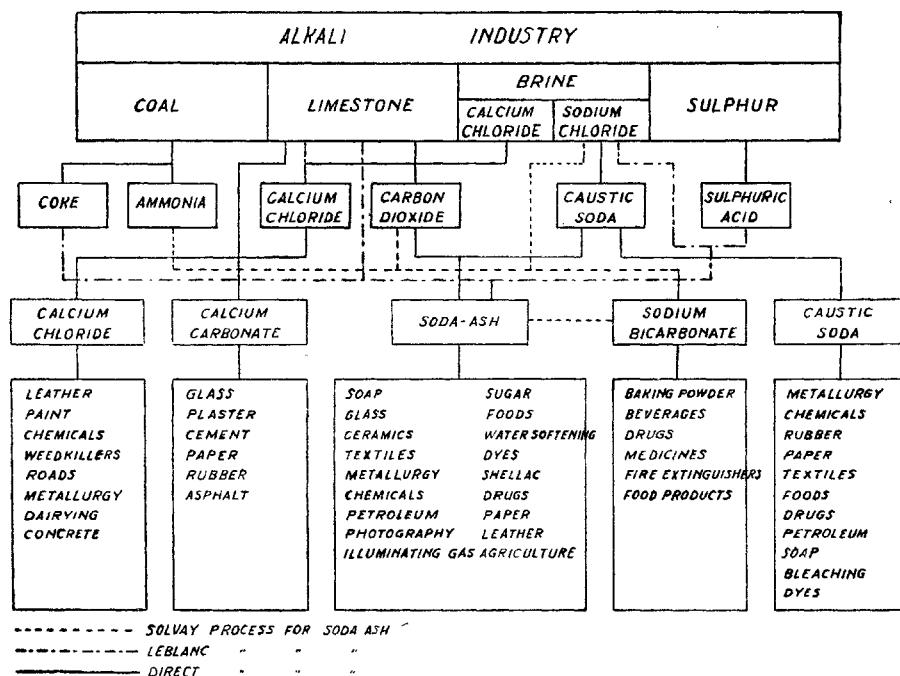


FIG. 2. RELATION OF ALKALI TO MODERN INDUSTRY

is thus a very large supply of salt from the Khewra deposits. Until recently the entire salt was distributed all over Northern India for edible purposes. Now a large factory is being erected by the Imperial Chemical Industries for the manufacture of soda ash from this salt at Khewra. When this factory starts producing soda ash, a number of industries which consume soda ash would grow and the existing ones would extend, resulting in the subsequent development of the alkali industry itself. Of these industries, the glass and soap industries are the most important. There were numbers of glass factories working in the Punjab, but on account of difficulties in securing supplies of soda ash most of them have closed down.

The Imperial Chemical Industries do not propose to produce any caustic soda in the Punjab. If my information is correct, I understand they are putting up a caustic soda plant at Calcutta. Those who have seen the Salt Range might have noticed that a very concentrated brine is pumped out ruining the agricultural fields round about the mines. It is not known whether the Imperial Chemical Industries propose to use the waste brine, in case it is found suitable for the electrolytic decomposition.

2. *Lime*.—Lime is a primary material of great importance in chemical industries. Its utility lies in the fact that being the cheapest form of alkali it has extensive application, as in conversion of sodium carbonate to caustic

soda, in the liberation of ammonia from ammonia salts, in the purification of sugar and in the manufacture of dyes intermediate.

Limestone of great purity is found abundantly in the Salt Range. At present it is mostly used for the production of quick lime for building trade. Some whiting is also prepared from it.

Lime is also used in the manufacture of Portland cement. One factory has already been working for the manufacture of this article for some time past and another factory has recently been started. There are, however, still greater possibilities for the utilisation of this raw material in the manufacture of cement of various other kinds.

3. *Coal*.—Coal is a raw material on which the industrial supremacy of a number of countries, particularly Great Britain and Germany, has been established. India is also a large producer of coal, but we have not exploited it for the industrial growth of our country to the same extent to which other countries have done. As a fuel it is required directly or indirectly by almost all industries. In the Punjab the coal deposits are not very extensive, the annual production is only a few thousand tons. All the coal produced is at present used in firing brick kilns, etc. Sample of this coal was sent to England and the analytical examination showed that this coal was very suitable for low temperature carbonisation. Within the last forty years, specially since the last war, increasing attention has been given to methods whereby coal can be converted into smokeless fuel and also may yield valuable by-products, particularly oil. It appears that the possibilities of starting low temperature carbonisation for production of crude coal tar, smokeless fuel, crude petrol and other products are bright in the Punjab. The Punjab coal is known to possess high percentage of sulphur³ and the recovery of this material, if ascertained to be a possibility, may form a source of this important

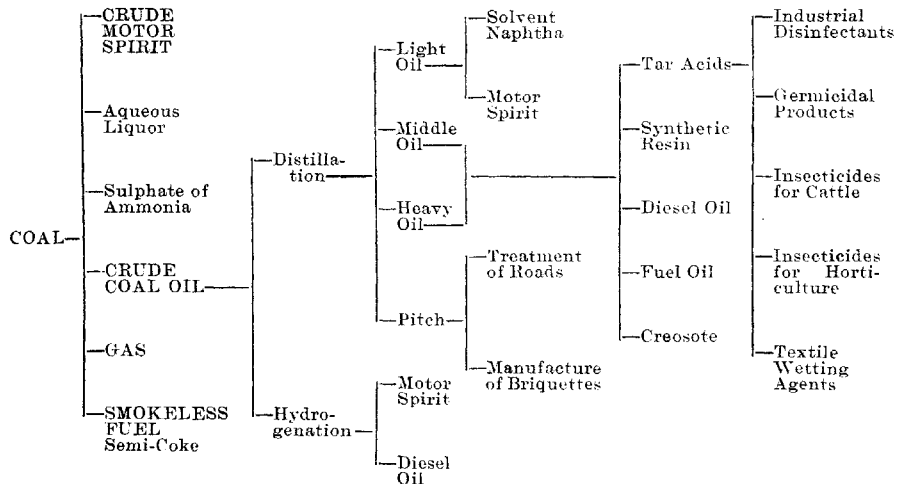


FIG. 3. Low Temperature Carbonisation of Coal.

raw material. The different products that can be obtained from low temperature distillation⁴ are illustrated in fig. 3. The Punjab Government has recently sanctioned a sum of Rs.10,000 for carrying out research in this direction, and it is hoped that as a result of this work, coal distillation would be started in the Punjab in the near future.

4. *Sulphur*.—Sulphur in its natural form is not found in the Punjab. As in the case of other provinces of the country, the natural consequence is that sulphuric acid cannot cheaply be manufactured in the Punjab. There is, however, one redeeming feature, that is, in the Punjab gypsum and pyrites are known to be found in abundance. Gypsum is found in the Salt Range and pyrites deposits are found in the Simla hills, and in the form of pyritous shale at Kalabag and Dandot collieries in the Salt Range. Some deposits of pyrites have also been located in the Kangra valley and a representative sample collected by a member of the staff of the Industrial Research Laboratory is under examination. Neither has any attempt been made so far nor any investigation undertaken to study the economic production of sulphuric acid from gypsum. Pyrites found in the Simla hills are now used successfully in the manufacture of sulphuric acid in the adjoining province of the U.P. at Agra. The presence of sulphur has recently been located in Baluchistan by the Geological Survey of India. Wadia, in his book on 'Geology of India', mentions the occurrence of sulphur in Baluchistan⁵ and Cumming in his monograph on 'Suggestions for the Industrial Development of Baluchistan' has described the occurrence of sulphur in workable quantities at Siln and a number of other places.

It appears that in the Punjab hills, particularly Himalayas, extensive amount of pyrites exist, and if they are properly exploited, the absence of sulphur as the primary raw material for the production of sulphuric acid would not be felt, and the Punjab would be able to produce sulphuric acid cheaply.

In the foregoing I have dealt with two principal sections of the heavy chemical industries, namely, alkali and acid industries. Besides these, there are a few other raw materials which can be used for the development of some other important sections of heavy chemical industries. Of them the most important are salts of potassium, borax, ammonium and magnesium.

Potassium Salts.—After Bihar, the Punjab is the most important province in which saltpetre or potassium nitrate is collected. Saltpetre is the natural product formed in the soil of alluvial districts by natural process under peculiar conditions of climate prevailing in these districts. Exact figures of production of this important salt are not available, but there is a belt which runs across in the centre of the province starting from the Salt Range in the Kalabag district to Delhi in the south. In this area there are about 10 to 12 factories which work to produce saltpetre of sufficient purity. Besides this source of potassium salt, there are found in the Salt Range some other salts of potassium of which the most important are kainite, blodite, etc. None of these salts are at present put to any economic or industrial use and the possibilities

of starting the industry of potassium salts for use as fertilisers and manufacture of explosives require consideration. It appears that caustic potash and potassium chloride could be produced from these sources.

The possibilities of manufacturing pearl ash from organic sources, e.g. the forest undergrowth and waste, have been investigated and it has been found that in some of the districts of the Punjab, particularly Simla and Kangra, its production can be organised on commercial scale during the present days of war. The industry can be developed successfully and recently a demonstration party has been organised to work in this district with this end in view.

Borax.—Borax as a raw material is not found in the Punjab, but the industry of refining borax has been carried out in the town of Jagadhari from very old times. Borax, which occurs as a natural salt, is obtained from lake deposits of Tibet and Kashmir. Before the advent of the imported material there were working in this town of Jagadhari about one dozen factories producing 30 thousand maunds of borax per year, but now they have all stopped working and recently an attempt has been made to revive this industry by introducing better methods of refining and recrystallising this material so as to produce a product which can match foreign one.

The possibilities of preparing boric acid from borax by decomposing this chemical with hydrochloric acid and sulphuric acid are being investigated and if the process can be worked commercially, it will be introduced in the province. The importance of borax industry need not be stressed, since there is no other source in Northern India from which this material can be made available at present, and the industry requires encouragement.

Ammonium Chloride.—Salts of ammonia are of great importance and specially in these days of war no country can afford to be without them. In India the sources of supplies of ammonia salts are very limited and the development of this industry has not been considered from national point of view so far. In the Punjab the supplies are almost restricted. In spite of the fact that the Punjab has good coal for distillation, no coal distillation plants have been installed there. The Punjab has thus been deprived of the advantage of supplying ammonium sulphate to other provinces of the country. To compensate this loss, however, we had in a particular area of the province an industry which produced ammonium chloride from very old times. This industry has, however, died out due to foreign competition and recently efforts have been made to revive it. Ammonium chloride is collected in raw form from old brick kilns. The mechanism of the process is under investigation. It cannot be said whether it is obtained from the clay which is used in making the bricks, or the fuel which is burnt to fire them. The production of ammonium chloride on systematic lines has, however, been started. Ammonium chloride of good purity has been produced and marketed. Due to success the industry has met, the production of ammonium chloride from ammonium sulphate and sodium chloride has also been taken in hand. This was necessary due to large demand of the salt which has recently arisen and due to the paucity of supplies of raw

ammonium chloride that can be collected from indigenous kilns. These kilns which had practically been lying idle have now again become active and it is hoped that if the study of the mechanism of the process of production of ammonium chloride provides a workable clue, a new type of tunnel kiln may be made by which the process of production can be modernised.

Magnesium Salts.—In the Salt Range, intermixed with salt bed, are also found certain salts of magnesium of which the most important are epsomite, kieserite and glauberite. The extent and workability of these deposits have not yet been investigated.

The products of heavy chemical industries find use in a number of chemical industries. The inter-industrial movement of the raw materials produced by these industries have been shown in fig. 1. It will be seen that the most important industries which use products of the heavy chemical industries are glass and ceramics, pulp and paper; soap; paints, varnishes and lacquers; vegetable and animal oils; petroleum refining; leather; wood chemicals; naval stores; textiles and rayons; explosives and plastic materials; dye products; fine chemicals; electro-chemicals; and rubber. With the exception of the last seven industries, all other industries have developed to some extent in the Punjab. If heavy chemicals can be made available abundantly and cheaply, the development and growth of these industries would be multiplied, since the primary raw materials on which these industries are dependent are all found in the province in large quantities. Their location in proximity to each other is another important factor which would stimulate the growth of these industries.

As stated above almost all the raw materials are found in the Salt Range which is an ideal locality for the growth and development of these industries. Already the industries for the manufacture of soda ash and cement and petroleum refining have been built up in this locality. Besides, there are numbers of other industries, of which coal distillation, dye products, fertilisers are the most important, that can also be developed there. The Salt Range, which presents from a distance the appearance of 'ruined walls and fortification', treasures in its heart raw materials of great industrial value which are easily approachable and extractable in immense quantities. In any other country of the world, such a locality would hum with industrial life and activity; but in the Punjab, in tune with other national institutions, this locality lies passive and dormant waiting perhaps for some distant but bright future.

REFERENCES.

- ¹ Stine Charles, M. A. (1933). Relation of chemical to other industry. *Jour. Ind. Eng. Chem.*, **25**, p. 437.
- ² *Ibid.*
- ³ Report of Tests on Dandot Coal—Coal Treatment Laboratory, The University, Edgbaston, Birmingham, 1927.
- ⁴ Morgan, G. and Pratt, D. D. (1938). *British Chemical Industry*, p. 227.
- ⁵ Wadia, D. N. (1939). *Geology of India*, p. 377.
- ⁶ Cumming, J. W. N. (1918). *Suggestions for the Industrial Development of Baluchistan*, p. 18.