

## TECHNICAL PRODUCTION OF POTASSIUM PERMANGANATE AND THE EXTRACTION OF POTASH SALTS IN INDIA.

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In this paper I would like to discuss briefly the possibility of preparing, on a large scale, potassium permanganate, potassium carbonate and other potassium salts in India, in which I have been interested for some time. To begin with, I should mention that the manufacture of potassium permanganate has already been undertaken by the Bengal Chemical & Pharmaceutical Works, Ltd., in Calcutta and their product is, I believe, already on the market.

Regarding the manufacture of potassium permanganate it is nowadays possible, according to the latest method, to oxidise as much as 99% of  $\text{MnO}_2$  of the pyrolusite to potassium manganate, which is then converted by electrolytic oxidation to permanganate. All the necessary conditions for the successful working of the process have been thoroughly worked out by the above-mentioned firm and it can reasonably be expected that the manufacture of this chemical is not likely to be affected by foreign competition after the war, provided, of course, the supply of potash at a moderate cost is always maintained. Before the war practically the whole of our supply of potash used to come from Germany. Since then, however, India has had to depend for its potash supply on Japan and America. If this supply is cut off, as it might be in the near future, this nascent industry will be seriously threatened. As for the other raw material, pyrolusite, India is fortunately independent of foreign supply. It is, therefore, high time to tap all possible sources of potassium compounds in India and try to develop methods for their extraction.

A fruitful source of potash salts is, as is well known, found in this country in the naturally occurring nitre beds. Potassium carbonate is now being prepared by several firms from this natural nitre and even exported in quantities to such a distant country like Australia. The method adopted for the conversion of nitre into potassium carbonate cannot, however, be considered economical, as it destroys the valuable nitrogen. Besides, even if the whole of the potash thus produced be consumed within the country, it can at most meet only a very small portion of our pressing demand. This makes it imperative to search for other available sources of potash in the country. I shall now discuss here some possible sources, which, in my opinion, offer promise of economic exploitation not only during the present war conditions, but also even after the end of the war against foreign competition. I shall deal with these sources, one by one, according to their relative importance.

1. *Potash from Molasses.*

Molasses from Indian cane-sugar industry have been found to be very rich in potassium salts. An average composition of molasses from Indian factories, as analysed in our laboratory, is given by:—

$$\begin{aligned} \text{Ash} &= 11.3-12.3, \quad \text{SiO}_2 = 0.18, \quad \text{P}_2\text{O}_5 = 0.10, \quad \text{SO}_3 = 1.30, \quad \text{Cl} = 0.70, \\ \text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3 &= 0.033, \quad \text{CaO} = 1.22, \quad \text{MgO} = 0.28, \quad \text{K}_2\text{O} = 5.15, \\ \text{Na}_2\text{O} &= 0.24, \quad \text{CO}_2 \text{ (by diff.)} = 2.3\%. \end{aligned}$$

This shows that about 50% of the ash consist of potassium compounds, or from every ton of molasses at least one cwt. of potassium salts can be recovered. If the Indian factories remove most of the crystallisable sugar from molasses, or if this sugar is previously removed by fermentation into alcohol, the residue will be still more rich in potash salts.

We are at present investigating the economic possibility of extracting the potash from molasses, which is likely to yield different kinds of potassium salts such as carbonate, chloride and sulphate. The work is being subsidised by the Board of Scientific and Industrial Research.

A method of extracting potassium salts directly from molasses has also been suggested by a French worker, Caspar Y Arnal (*Chim. Ind.*, 20, 1928, 27, T. 27). The process is worth a trial. It consists in precipitating the potassium salts from molasses by calcium ferrocyanide in the form of calcium potassium ferrocyanide,  $\text{CaK}_2[\text{Fe}(\text{CN})_6]$ , which is then decomposed by ferric sulphate when a solution of potassium sulphate containing some calcium sulphate is obtained, and the residue of Prussian blue is then treated with lime for the recovery of calcium ferrocyanide.

Methods have been suggested for the separation of potash from molasses in the form of potassium acid tartrate or potash alum. Neither of them can lead to a complete separation of the potash salts from molasses nor to a complete recovery of the reagent employed. These are, therefore, of little technical significance.

2. *Potash from Wool Scourings.*

Another rich source of potash salts is furnished from washings of sheep's wool. The crude unwashed wool contains about 10% of potassium salts of stearic, oleic and other organic fatty acids as well as a little chloride and sulphate. If these washings are collected, for instance, at Kashmir or even at the factories at Cawnpore and then evaporated the residue can be easily treated for the preparation of potash salts. Sheep's grease can also be obtained as a by-product. Notable quantities of potash salts are obtained from this source in France, Belgium, Germany and America.

3. *Potash from Plant Ashes.*

It is well known that ashes from land plants are rich in potassium salts and constituted one of the earliest sources of potash. Of these, special mention may be made of the following:—

Ash of plants.				K <sub>2</sub> O-content.
Sun-flower stem	..	..	..	36-37%
Chrysanthemum tegetum	..	..	..	24-25%
Cotton husk	..	..	..	10-42%
Banana stem	..	..	..	46-64%
Banana skin..	..	..	..	57-58%
Bamboo shoots	..	..	..	32-33%

Extraction of potash from the last four sources is well worth a trial.

#### 4. *Potassium Salts from Sea-water.*

The mother liquor from the separation of common salt also furnishes quite a rich source of potassium and magnesium salts. The average K<sub>2</sub>O-content of sea-water is 0.04%. About 18-40 gms. of KCl per litre have been found in the mother liquor remaining after the separation of common salt from sea-water. Potassium salts can be recovered from this without much difficulty either by stepwise or fractional crystallisation, or in a single step in a very pure form with the help of dipicrylamine.

#### 5. *Potassium Salts from Felspar.*

Several methods have already been patented in Germany and the United States of America for the preparation of potassium salts from felspar, mica dust and other potassium-containing silicate rocks, which may contain 10-15% of K<sub>2</sub>O. In some of these patents claims have been made for a recovery of as much as 80-90% of potassium present in the silicate rocks. Neither time nor space will allow me to go into details of these processes, though many of them appear quite attractive and promising with a prospect of giving rise to important by-products like cement and fertiliser.

An intensive work along all these separate lines is likely to lead sooner or later to some important developments in the potash industry in this land.

Finally, it will not be out of place to quote here the annual imports of potassium compounds in our country and their total values. These include bichromate, chlorate, cyanide, permanganate and other compounds.

Year.			Quantity.	Value in rupees.
1934-35	..	..	47,537 cwt.	13,05,428
1935-36	..	..	65,332 ,,	16,32,964
1936-37	..	..	49,072 ,,	11,38,980
1937-38	..	..	56,434 ,,	12,00,780
1938-39	..	..	42,360 ,,	11,08,545