

THE EFFECT OF SODIUM CHLORIDE IN IMPROVING THE PERMEABILITY OF ALKALI SOILS

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THE ascent of an aqueous solution of sodium carbonate through a column of black cotton soil has recently been discussed.¹⁻⁴ It was shown that the capillary rise with a *very dilute* solution of sodium carbonate is slightly greater than with water, and as the concentration rose the permeability rapidly deteriorated. But when the concentration was further increased (say, 5% to saturation) the permeability was restored owing to the chemical action of the sodium carbonate solution on the colloidal fraction of the soil. These results have been discussed in the *Proceedings of the Indian Academy of Sciences* (Vol. 25, Pt. 6—in Press).

In the present note we shall discuss some interesting results obtained recently on the effect of *sodium chloride* in restoring the permeability of a column of black cotton soil previously rendered impervious with sodium carbonate solution. The upward and downward movements of *sodium chloride* solution in the "Bari" (alkali) soil of the Punjab are also discussed.

I. EXPERIMENTS WITH THE BLACK COTTON SOIL OF POONA

(a) *Capillary rise*.—Glass tubes containing air-dry black cotton soil of Poona, passed through a 1 mm. sieve, were dipped in 1 per cent. solution of sodium carbonate till the capillary rise of the solution stopped (i.e., the height of the soil column visibly wetted by the solution ceased to increase further). The tubes were then dipped up to the level already wetted by the sodium carbonate solution in reservoirs containing (1) a 1 per cent. solution of sodium carbonate, (2) a 5 per cent. solution of sodium chloride and (3) water, respectively.

Table I gives the ascent of the two solutions and water through the columns. It will be seen from Table 1 that the ascent of a 5 per cent. solution of sodium chloride is about four times that of sodium carbonate and twice that of water.

In the next experiment the ability of sodium chloride to improve the permeability of the soil after carbonate treatment was further examined.

(b) *Percolation through soil layers*.—In this experiment the percolation of the three liquids was studied by maintaining 10 cm. layers of the liquids in different tubes containing the soil. First, 10 cm. layers of black cotton soil were packed in three tubes in the usual manner and 1 per cent. solution of sodium carbonate added above the soil column. After seeing that there was hardly any percolation of the sodium carbonate solution even after two days, the solution was removed from two of the tubes and replaced with the same volume of a 5 per cent. solution of sodium chloride in one tube and with water in another, while the third tube served as control.

TABLE 1
Capillary ascent in black cotton soil (in cm.)

Time (Days)	First dipped in 1% sodium carbonate solution		
1	3.3	3.3	3.3
2	4.3	4.2	4.3
3	4.3	4.3	4.3
then dipped in			
	Sodium carbonate 1%	Sodium chloride 5%	Water
1	0.6	0.9	0.9
2	1.1	1.8	1.5
3	1.5	2.8	1.9
4	1.7	3.6	2.3
5	2.0	4.3	2.5
6	2.2	4.9	2.8
8	2.6	6.1	3.4
10	2.8	7.0	3.7
12	2.9	7.6	3.9
14	2.9	8.1	4.1

The values for percolation are given in Table 2.

TABLE 2
Percolation in c.c.s. through 10 cm. column of Poona soil

Time (Days)	10 cm. column of 1% sodium carbonate		
1	0.0	0.0	0.0
2	0.1	0.1	0.1
	1% sodium carbonate	Solution replaced by 5% sodium chloride	Solution replaced by water
1	2.5	4.0	2.5
2	3.0	14.0	3.5
4	3.0	39.0	4.0
6	4.0	89.0	5.0

It is obvious from Table 2 that sodium chloride restores the permeability of the black cotton soil, previously rendered impervious by sodium carbonate.

II. EXPERIMENT WITH "BARI" (ALKALI) SOIL OF THE PUNJAB

Next a naturally alkaline soil like the "Bari" soil of the Punjab was similarly tried. This soil is very impervious to water due to the presence of considerable quantities of sodium carbonate and sodium sulphate. Experience showed that care is necessary in packing the "Bari" soil so that breaks in the column do not occur on wetting. This is ensured by loosely packing the soil in the tubes. Tables 3 and 4 give the values for capillary rise in and percolation through the "Bari" soil.

TABLE 3

Capillary rise in "Bari" soil (in cms.)

Time (Hours)	Water	5% Sodium chloride
1	2.4	8.2
2	3.4	14.0
3	4.0	17.2
4	4.4	21.2
22	10.3	46.7
28	11.2	51.3
48	12.7	61.0

It is clear from Tables 3 and 4 that the movement of a 5 per cent. solution of sodium

chloride is much faster than that of water in the "Bari" soil.

TABLE 4

Percolation in c.c.s. through a 10 cm. column of "Bari" soil

Time (Hours)	Water	5% sodium chloride
1	0	0
2	0	1.0
3	0	3.0
21	0	16.5
27	0.5	21.0
48	1.0	48.0
71	2.5	74.5
96	3.0	121.5

The applications of the above findings to the leaching out of the salts from alkali soils are being investigated. Similar experiments with other salts are in progress, and the results will be reported in a later communication.

1. Ramdas, L. A., and Mallik, A. K., *Proc. Ind. Acad. Sci.*, 1942, 16 A, 1.
2. —, *Ibid.*, 1942, 16, 16.
3. — and Pandit, U. P., *Curr. Sci.*, 1942, 11, 288.
4. Ramdas, L. A., and Mallik, A. K., *Curr. Sci.*, 1942, 13, 42-288.

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THE PROCESSING OF MAIZE TO IMPROVE ITS VALUE AS AN ARTICLE OF HUMAN FOOD

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MAIZE is one of the more important millet crops of India. It is also grown quite extensively in other parts of the world and very large quantities have been imported into India in recent years. It is used as an everyday article of diet in certain parts of the country, while, in other parts, its use is rather unfamiliar or unpopular. Persons accustomed to rice, wheat, tapioca and such other food materials do not like maize because of its hard and fibrous coat, the bitter principle usually associated with the skin and the oil present in its germ. The latter also tends to turn rancid on long storage and renders the grain unpleasant as an article of food.

WHOLE-MAIZE IS NOT POPULAR OVER A LARGE PART OF THE COUNTRY

During recent years, several attempts have been made by the Central and Provincial Governments and also by the States to popularise the use of maize as an article of food. These efforts have met with only moderate success because the average consumer, say, of rice, prefers to go on a reduced ration of his favourite cereal, rather than have extra food in the form of maize which he does not like and which he finds to be coarse and difficult to digest. This is chiefly due to the fact that the maize is supplied to him either as a whole-grain or as whole-flour (coarsely ground), neither of which he is able to utilise satisfac-

torily. The position will be very different if the grain can be processed to remove the undesirable constituents and then supplied to the public as an article of food.

THE 'AMERICAN FLOUR'

A few decades ago, processed maize flour was introduced into India, the supplies coming chiefly from America. The product soon became very popular so much so that it found application in a variety of food preparations. In South India, it became very popular as 'American flour' and there was a very great demand for it, though only a few people knew what it was made of.

PROCESSED MAIZE PRODUCTS AND THEIR USES

In Europe and America, processed maize flour is finding extensive application. It is the basis for the usual thickeners of soups, breakfast cereals, various types of sweets as well as meat puddings, ice-cream and so forth. Other preparations like spaghetti and macaroni which are also familiar to the Indian consumers are prepared out of maize flour.

Considering all available evidence, it would appear to be extremely important that maize should be first processed and preferably converted into a clean, attractive flour before it could find general, popular favour in India. The husk and the germ can be separated, the former being used as an animal feed, while the latter can be crushed and used for preparing