Indian J.Sci.Res.2(4) : 117-119, 2011

THE EFFECT OF SALTS OF THE HYDRAULIC CONDUCTIVITY OF THE SALINE ALKALI SOIL

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ABSTRACT

The effect of various salts on the saline alkali soils were saturated with 1N solutions of Sodium Chloride, Sodium Sulphate, Soidium Carbonate, Calcium Chloride, Calcium Carbonate and Magnesium Sulphate also a mixture of these solutions with the same concentration. It was found that some salts present in the soil have great effect on the hydraulic conductivity of the soil. Whereas others act as aggregate former of the soil. That improves the physical properties of the soil.

KEYWORDS : Saline alkali soil, effect of salts, hydraulic conductivity

One of the major concerns in irrigated agriculture in the maintenance of sufficiently high soil permeability for salinity control. Indices of soil permeability are hydraulic conductivity and infiltration rate. Increasing of pH and decreasing of EC of the solution affect soil permeability (McNeal et al., 1966) as a result of clay dispersion and blockage of pores (Pupisky and Shainberg, 1979). Salts dissolution in water leads to changes in various physico-chemical attributes, such as surface tension, density, viscosity, reaction etc. These ought to influence the movement of water in the soil (Silin-bick Chorin, 1965) whenever salts solution comes in contact with the soil, physico-chemical properties influenced due to exchange reaction between soil solution and exchange complex. This cause a change in electrokinetic forces of the soil water systems. These changes will no doubt affect the water movement in the soil for which Hydraulic conductivity can be considered as a main function. The different salts influence moisture retention of soil differently and as a result, this could change the hydraulic conductivity and attractive forces of soil water (Al-abi, 1967, 72; Pandey et.al., 1974).

The knowledge of the amount of changes in hydraulic conductivity value of the soil caused by different salts might lead to make some correction the various calculations. The aim of these investigations to find out the changes in the hydraulic conductivity of the soil during leaching of different salt solutions.

MATERIALS AND METHODS

The study was conducted on a sandy loam soil. The method of analysis were used the same as given in the U.S. Salinity Laboratory, Agriculture Hand Book No.60.

The disturbed soil samples were saturated for twenty four hours with 1N solution of NaCl, Na_2SO_4 and Na_2CO_3, $CaCl_2$, $CaCO_3$, $MgSO_4$ and also a mixture of these salts solutions were prepared with the same normality. Tap water was used as a control treatment. Hydraulic conductivity was determined by using (5.4×16 cm) Plexi glass column. Five replicates of each treatment allowing the 5 cm constant hydraulic head parameter method. (Amana et al, 2011).

Measurements were initially carried out using the previously mentioned solutions and continued till a constant value was reached. This value was taken as Ks. Then each salt solution was replaced by tap water and the same procedure was repeated. The obtained values were taken as Kw. The value Kw/Ks was considered to represent the change in the Hydraulic conductivity which might have taken place during leaching.

RESULTS AND DISCUSSION

The results shown in table-2, it is clear that the tested salts have a great influence on the Hydraulic conductivity value. The Ks value for the NaCl and Na_2SO_4 treatment was 16, 8 cm/day and the zero value was obtained when these solutions were replaced by tap water. Ks value

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for Na_2CO_3 was zero and the same value was obtained when the sodium carbonate solution replaced by tap water.

For $CaCl_2$ and $MgSO_4$, Ks values were 97 cm/day and 28 cm/day, respectively. The Kw remained slightly constant. Values were 47, 21 cm/day alternatively. When the $MgSO_4$ solution was replaced by tap water, Kw values were slightly affected. The Kw values of $CaCO_3$ treatment decreased about 67% of the Ks value but it was still very high as compare to other Kw values.

These results can be explained through the action of sodium ions on the structure of the soil. When tap water replaced the solutions, for sodium solutions the dominant ion on the exchange complex will be sodium and this will cause the deterioration of the soil structure. For Ca and Mg slats, the dominant ions will be Ca and Mg which have no negative influence on the soil structure while on the other hand Ca ions improves soil structure.

Although the results presented in this paper cannot be used for quantitative recommendation but for qualitative purpose. They can evidently be used fro estimating the possible changes that might occur in the values of the hydraulic conductivity during the leaching of saline-alkali soils in table 1.

These results may however lead to the following general conclusions :

The presence of high concentration of different sodium salts in the soil reduces the hydraulic conductivity of the soil during leaching. As a result, the time required to drain the leaching water increases and thus delays the process of desalinization of saline alkali soils.

The anions seems to play a great role in determining the influence of the cat-ions on the hydraulic conductivity.

High contents of Mg ion seems to have no negative effect on hydraulic conductivity of the soil.

The presence of Ca and Mg ion in equal percentage with the sodium ion in the soil reduces the acute influence of Na on the hydraulic conductivity value.

ACKNOWLEDGEMENT

The authors are thankful to the Head of the Department of Botany for providing necessary facilities and thankful to the Principal for providing concerning facilities for completion of work.

Table 1: Some Physico-Chemical Properties of the Saline Alkali Soils

Texture	Sandy Loam
Bulk Density	1.59
Clay	9.80
Silt	10.20
Sand	74.12
Ex. Na (%)	123.20
CEC (%)	7.6
pH (1:5)	10.2
Ec mm hos/cm	56.4
Na^+ meg/1	100.3
K^+ meg/1	8.9
Ca^{++} meg/1	3.2
Mg^{++} meg/1	2.8
Cl^- meg/1	120.0
Sou^{--} meg/1	75.0
CO_3^{--} meg/1	8.0
HCO_3^- meg/1	7.7

Table 2 : The Influence of Salts on the Hydraulic Conductivity of the SalineAlkali Soils

Salts	Hydraulic Conductivity (cm/day)									
	Days									
	1	2	3	4	5	6	7	8	9	10
NaCl	35	22	18	17	16	16	16	16	16	16
Tap Water	00	00	00	00	00	00	00	00	00	00
Na_2SO_4	28	17	12	11	10	09	08	8	8	8
Tap Water	00	00	00	00	00	00	00	00	00	00
Na_2CO_3	01	00	00	00	00	00	00	00	00	00
Tap Water	00	00	00	00	00	00	00	00	00	00
$CaCO_3$	72	78	71	70	7	72	72	72	72	72
Tap Water	46	48	50	50	51	50	50	50	50	50
$CaCl_2$	90	95	101	102	100	98	98	97	97	97
Tap Water	45	48	52	53	48	49	48	48	48	47
$MgSO_4$	28	29	32	31	29	28	28	28	28	28
Tap Water	25	26	30	27	25	23	22	21	21	21
Mixture of Salts	27	29	26	25	25	24	23	22	21	21
Tap water	11	10	09	08	08	07	7	6	6	6
Tap water(Control)	05	03	02	02	01	0.7	0.5	0.5	0.5	–

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