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## Effect of some inorganic salts on infiltration rate of soils of several parts of Mehsana and Patan district (North Gujarat)

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**ABSTRACT**

*Soil samples were collected from several parts of Mehsana district (Clay Type : Montmorillonite) and Patan district (Clay Type : Kaolinite – Illite) of North Gujarat, were used for infiltration studies. Both are saline alkaline affected area. Samples were collected from virgin land at different places. The infiltration rate of the soil samples were measured by using the modified Dettmann Emersion technique. Solution of NaCl and $NaHCO_3$ used for infiltration study. On the basis of the above observation it is reported that effect of inorganic salts will responsible for the maintenance of sufficient permeability to permit salinity control and reclamation that will ultimately decide the suitability of any soils for a specific crop.*

**Keywords :** Soil, Saline-alkali, Infiltration, SAR (Sodium Adsorption Ratio).

### INTRODUCTION

The effect of electrolyte has been studied by quirk J.P AND suggested that a loam soil , saturated to varying degrees with Na, decreases in permeability when observed below a certain concentration of electrolyte[1]. Out of 329 million hectares of land in the country, about 175 million ha. (53 %) is suffering from degradation in some form or the other. There are 7.61 M ha of salt affected soils in India as per the Ministry of Agriculture. The extent of this problem area as given by different sources varies from 8.56 M ha to 10.9 M ha. Water logging affects another 8.52 M ha mainly in the irrigation commands, which includes some of the saline-alkali soils also. In some part of india have substantial areas of irrigated lands are affected by some inorganic salts alkali and water-logging problems[2-4].

It is well known that soils differ widely in their infiltration rates. This behavior of showing varying infiltration rates has been considered by variation in the soil pores spaces[5,6]. From the experiments on the rate of flow of air into a column of soil ,that clay controlled the physical property of soil due to the high surface area of colloids will form larger aggregation due to the presence of high amount of sodium or insoluble carbonate. Saline and alkali soils are found distributed in all parts of India[7-9].

It is therefore, In the present investigation, it is planned to determine the soil structural deterioration induced upon the use of waters are evaluated in terms of effect of NaCl and $NaHCO_3$ on infiltration rate (IR) reduction.

## EXPERIMENTAL SECTION

In the present work Soil samples were collected from several parts of Mehsana and Patan district of North Gujarat. Both are saline alkaline affected area. Soil samples were collected from virgin land at different places. The surface layer of 2"- 5" depth was removed and representative layers of the profiles were sampled after digging a pit of 2' x 2'. The various portions of particular depth at different intervals were intimately mixed. Each sample was placed in a jute bag showing the location of site and date etc. About 1 Kg. of the original sample was stored in wide mouth glass bottle for observation of the structure and colour etc. The remaining samples were ground in wooden pestle and mortar without crushing the ultimate particles and kept in sunshine for air drying. The samples were sieved through 2.0 mm (10 mesh u.s. standard). The stone separated and organic residue removed if any. The bulk sample was thoroughly mixed and then was used for chemical mechanical analysis and for the preparation of saturated soils [10].

The samples were selected for determination of infiltration rate with respect to The infiltration rate of the soil with respect to NaCl and $NaHCO_3$ solutions(500 and 1000 ppm) were measured by the tube method described below. To understand the nature of infiltration rates continued over a short period the slight modified technique of the tube method [11] was used. In order to obtain comparative infiltration rate for different sols, the soil was filled in hard glass test tube of height 20 cms. and diameter 2.6 cms. with an arrangement of transverse hole to maintain 2.0 cms hight of water or solution over the soil. Soil was filled in a test tube by strck method [12]. In the lower part sand was filled. The level of the water or solution was maintained constant by adding solution from the reservoir. The infiltration rate was determined by the method of Marshall and Strike [13] at the sites using double ring infiltrometer method.

## RESULTS AND DISCUSSION

Soil samples of different types of from Patan district (Clay Type : Kaolinite – Illite) and Mehsana district (Clay Type : Montmorillonite) of North Gujarat were used for infiltration studies. Mixed soil with (1) Na+Mg. show wide variation in initial and final stages Infiltration rates were measured by using the modified Dettmann Emersion technique[14].Comparing infiltration rate for the NaCl solution for K – I (Patan district:44 % clay soil, infilteration rate are lower then those of K-I soil. The percentage of clay also play its own role.

**Table : 1. Physical Analysis of soil**

| **Particle size (mm) Distribution** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Place of sampling | Depth cms. | % Coarse sand (2.0 –0.2) | % Fine sand (0.2 – 0.02) | % Total sand (2.0-0.02) | % Slit (0.02-0. 002) | % Clay (0.002) | Clay mineral |
| Patan | 0 – 10 | 22.88 | 55.14 | 78.62 | 10.06 | 11.32 | K – I |
| Mehsana | 0 - 10 | 22.00 | 36.00 | 58.00 | 15.20 | 26.80 | M |

**Table : 2. Effect of NaCl on Infiltration rate of different soils of various clay types with mix cation status of Na+Mg**

*PATAN : Clay Type : K – I*
*MEHSANA : Clay Type : M*

| Time in min. | Infiltration rate cms / hr. | | | | | |
|---|---|---|---|---|---|---|
| | **NaCl :500 ppm** | | | | | |
| | **Na:Mg =20:80** | | **Na:Mg =40:60** | | **Na:Mg =60:40** | |
| | K- I | M | K- I | M | K- I | M |
| 1 | 190 | 208 | 220 | 176 | 182 | 166 |
| 2 | 56 | 74 | 108 | 84 | 56 | 162 |
| 3 | 44 | 62 | 56 | 50 | 38 | 56 |
| 4 | 36 | 50 | 34 | 42 | 32 | 48 |
| 5 | 36 | 42 | 34 | 36 | 18 | 24 |
| 6 | 20 | 42 | 30 | 36 | 18 | 24 |
| 7 | 20 | 38 | 30 | 30 | 12 | 20 |
| 8 | 14 | 24 | 18 | 30 | 12 | 18 |
| 9 | 06 | 24 | 12 | 24 | 06 | 18 |
| 10 | 06 | 18 | 12 | 24 | 06 | 12 |

**Table : 3. Effect of NaCl on Infiltration rate of different soils of various clay types with mix cation status of Na+Mg**

*PATAN : Clay Type : K – I*
*MEHSANA : Clay Type : M*

| Time in min. | Infiltration rate cms / hr. | | | | | |
|---|---|---|---|---|---|---|
| | **NaCl :1000 ppm** | | | | | |
| | **Na:Mg =20:80** | | **Na:Mg =40:60** | | **Na:Mg =60:40** | |
| | K- I | M | K- I | M | K- I | M |
| 1 | 250 | 182 | 262 | 182 | 264 | 196 |
| 2 | 110 | 74 | 108 | 74 | 104 | 74 |
| 3 | 74 | 60 | 74 | 48 | 74 | 50 |
| 4 | 74 | 50 | 64 | 48 | 74 | 38 |
| 5 | 64 | 42 | 64 | 36 | 62 | 38 |
| 6 | - | 38 | 64 | 36 | 62 | 30 |
| 7 | - | 24 | 60 | 36 | - | 30 |
| 8 | - | 24 | 60 | 24 | - | 30 |
| 9 | - | 12 | - | 24 | - | 24 |
| 10 | - | 12 | - | 24 | | 18 |

**Table : 4. Effect of $NaHCO_3$ on Infiltration rate of different soils of various clay types with mix cation status of Na+Mg**

*PATAN* : *Clay Type* : *K – I*
*MEHSANA* : *Clay Type* : *M*

| Time in min. | Infiltration rate cms / hr. | | | | | |
|---|---|---|---|---|---|---|
| | **$NaHCO_3$ :500 ppm** | | | | | |
| | **Na:Mg =20:80** | | **Na:Mg =40:60** | | **Na:Mg =60:40** | |
| | K- I | M | K- I | M | K- I | M |
| 1 | 182 | 198 | 212 | 166 | 170 | 158 |
| 2 | 56 | 62 | 98 | 62 | 70 | 60 |
| 3 | 44 | 48 | 56 | 56 | 56 | 38 |
| 4 | 36 | 42 | 46 | 50 | 36 | 30 |
| 5 | 30 | 42 | 46 | 24 | 30 | 24 |
| 6 | 18 | 30 | 36 | 24 | 18 | 24 |
| 7 | 12 | 24 | 30 | 18 | 12 | 18 |
| 8 | 12 | 24 | 12 | 18 | 06 | 12 |
| 9 | 06 | 18 | 06 | 12 | 06 | 12 |
| 10 | 06 | 12 | 06 | 12 | 06 | 12 |

**Table : 5. Effect of $NaHCO_3$ on Infiltration rate of different soils of various clay types with mix cation status of Na+Mg**

*PATAN* : *Clay Type* : *K – I*
*MEHSANA* : *Clay Type* : *M*

| Time in min. | Infiltration rate cms / hr. | | | | | |
|---|---|---|---|---|---|---|
| | **$NaHCO_3$ :1000 ppm** | | | | | |
| | **Na:Mg =20:80** | | **Na:Mg =40:60** | | **Na:Mg =60:40** | |
| | K- I | M | K- I | M | K- I | M |
| 1 | 240 | 166 | 142 | 166 | 256 | 186 |
| 2 | 104 | 60 | 96 | 62 | 92 | 62 |
| 3 | 78 | 48 | 70 | 48 | 76 | 40 |
| 4 | 72 | 42 | 66 | 36 | 70 | 36 |
| 5 | 72 | 34 | 60 | 30 | 60 | 36 |
| 6 | 64 | 34 | 60 | 30 | 60 | 30 |
| 7 | 60 | 24 | 36 | 30 | 54 | 30 |
| 8 | 48 | 24 | 36 | 24 | 30 | 24 |
| 9 | 36 | 12 | 30 | 24 | 18 | 24 |
| 10 | 30 | 12 | 18 | 12 | 12 | 12 |

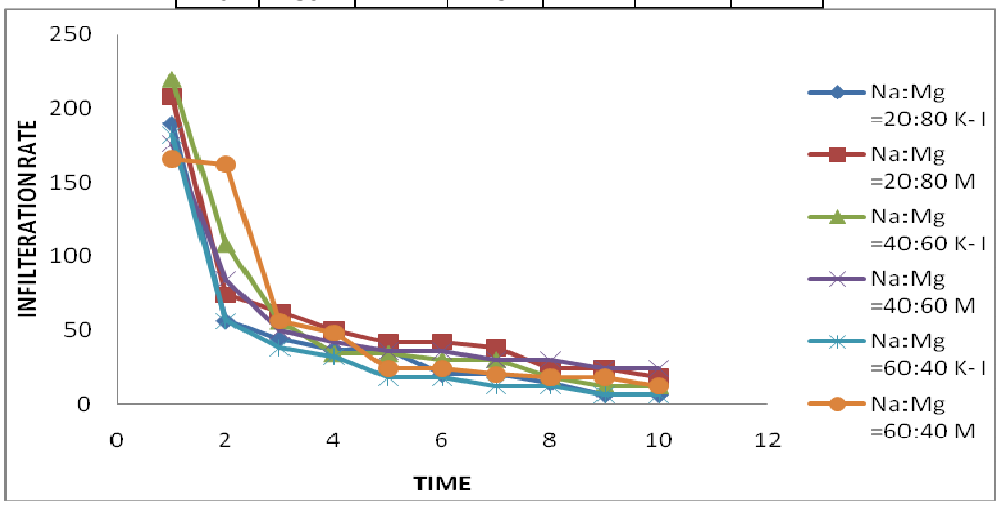


**Fig.1. Effect of NaCl(500 ppm) on Infiltration rate of different soils of various clay types with mix cation status of Na+Mg**

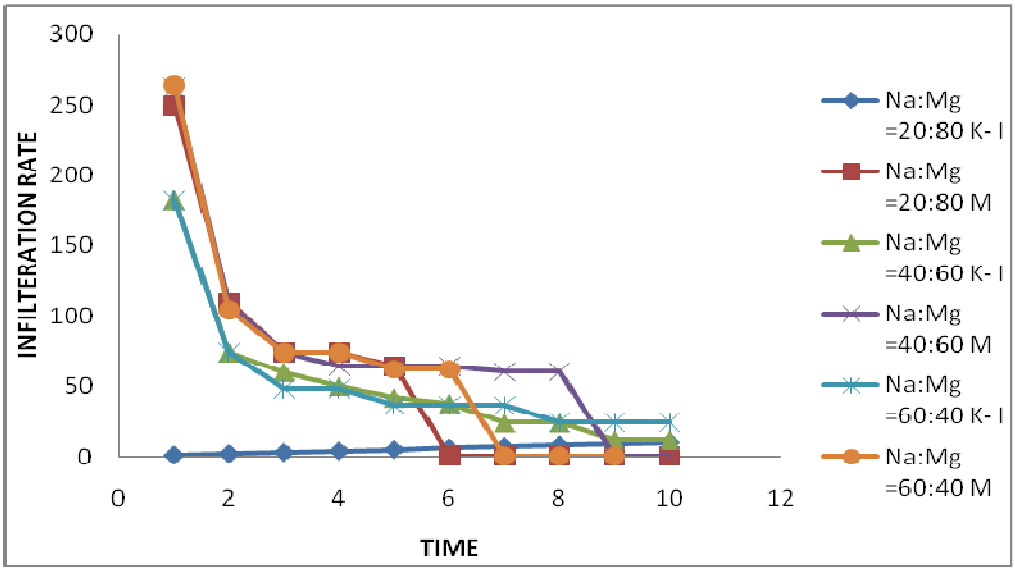


**Fig.2. Effect of NaCl (1000 ppm)on Infiltration rate of different soils of various clay types with mix cation status of Na+Mg**

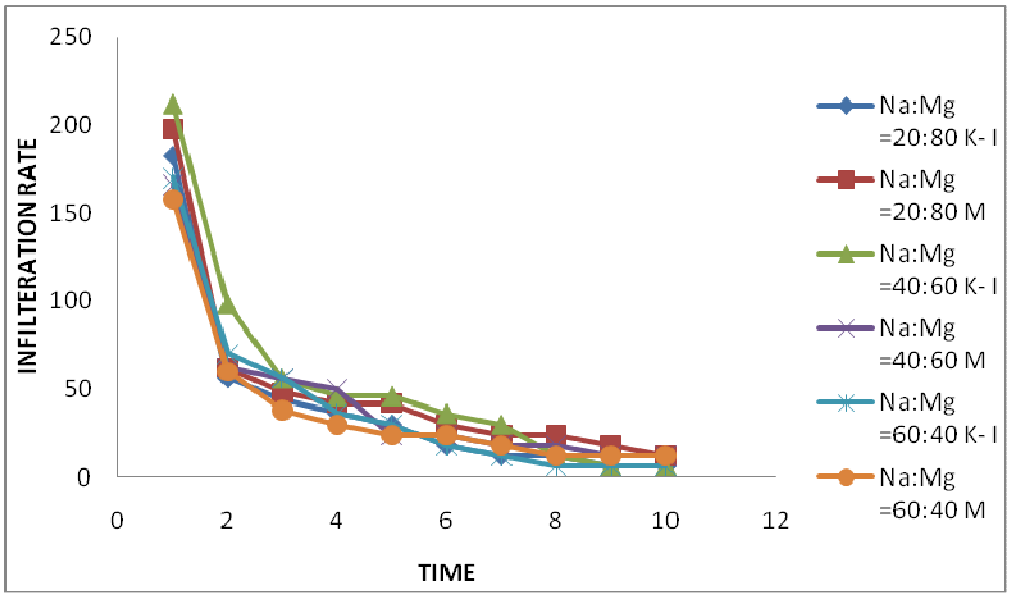


**Fig.3. Effect of $NaHCO_3$ (500 ppm)on Infiltration rate of different soils of various clay types with mix cation status of Na+Mg**

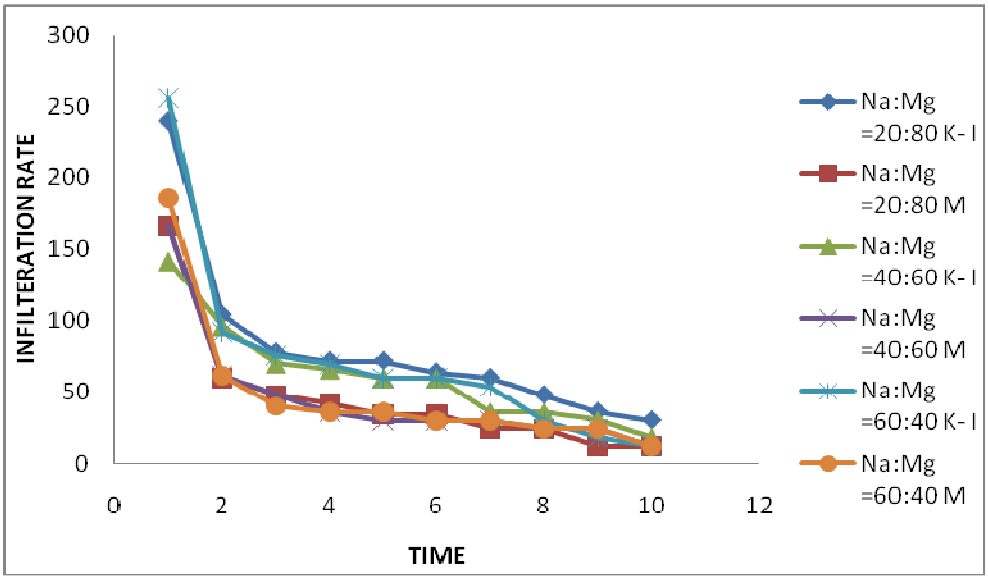


**Fig.4. Effect of $NaHCO_3$ (1000 ppm)on Infiltration rate of different soils of various clay types with mix cation status of Na+Mg.**

The above result shows that there is a prominent difference in infiltration rates of two soils : PATAN [ Clay Type : K-I , 44 % Clay ] and MEHSANA [ Clay Type : M, 22 % Clay ] and for waters with different salinity levels and different Sodium Adsorption Ratio (SAR).

It is seen that the infiltration rates are lower for $NaHCO_3$ as compared to NaCl, irrespective of concentration[15]. As the primary factor affecting the soil is dispersion by alkaline $NaHCO_3$ increase in sodium status, While NaCl affects only from sodium saturated aspect, such the SAR affects the built-up sodium level in soil and so, with high built-up exchangeable sodium percentage (ESP) will decreases the infiltration rates[16].

## CONCLUSION

On the basis of the above observation it is concluded that , the electrolyte effect, the clay Type and the Proportion will govern the infiltration rate in soil in any area and that will ultimately decide the suitability of any soils for a specific crop.

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