# cations and anions interrelationships during salinization and alkalization processes insqme soils of a.r.e

## Hassan Hamza Abbas Ramadan

This study was carried Out to investigate salinizationand alkalization processes in connection with movement(downward or upward) of saline water through sOil columns30-cm in height and 6 cm in diameter. Oownard movementwasUlfluenc:ed by surface addit.ions whe'reas upwardmovement 'was influenced by contacting bottoms of the soilcolumns with saline 'water in a form of NaCl solution.An empirical equation based On Gapon's equation forcation exchange equilibrium and similar to that of the U.S.Salinity Laboratory was established to deduce "ESP" as adiagnostic value of salt-affected SOils by means of SAR ofsoil extract at 1:5 SOil-water ratio. The reliabilities ofapplying the equation obtained in this work and three,other equations developed by u. S. Salinity Laboratory(Richards, 1954), Balba (1962), and El-Arquan and Kaoud If 1981)were examined. Other two equations were ~eveloped todeduce "ESP" through soluble (C03+ HC03) and pH of the1:5 soil water extract.To investigate the possibility that soluble anionsmight in some way influence the cation exchange equilibriumbetween adsorbed and soluble cations, samples of threeSOils and two clay minerals (presaturated with Ca or Mg)were equilibrated with solutions of Na in the form of Clor 804or C03• Also,·samples presaturated with Ca wereequilibrated with solutions of Mg in the form of Cl or804• The preference of the investigated samples for Na,Ca, and Mg was evaluated through calculating Vanselow'sselectivity coefficient for Na-Ca, Na-Mg, and Mg-Casystems.The results may be presented as fol16ws:1. With downward movement, soil salinity as well as solubleexchangeable Na were highest in the top layer of thesoil column (0-10 cm) and lowest in the deepest one(20-30 cm ), On the other hand, soluble and exchangeableCa, Mg, and K increased with depth. Bicarbonates andchlorides underwent a pattern of distribution similarto those of soil salinity and soluble Na, whereassulfates were comparatively lower in the top layer thanin the subsurface one.Increasing concentration, as well as, the number ofapplications of the saline water increased soil salinity,seluble and exchangeable Na, soluble Cl and HC03, but,in the same time, decreased soil content of soluble andexchangeable Ca, Mg, and K and did not affect soluble 804•2. With upward movement of saline water, salinity. as wellas , soluble Na were highest in the top layer, lowestin the middle layer and intermediate in the bottomOne. However, exchangeable Na. and consequentlyexchangeable Na percentage were lowest in the surfaceand highest in the deepest layer. Soluble. as well asexchangeable Ca. Mg. and K were highest in the surfaceand decreased gradually with depth. ChloridesaC;:~l!mu~ated in the top "layers in amounts far greater.than the layers below. Soluble bicarbonates underwentan OPPOsite pattern,whereas soluble .suLfet es war!'!d'ist"'ibutedwithin the soil column in a pattern similar to thoseof soi L salinity and soluble Na ,Increasing eoncent~ation of the saline water and durationof its contact with the soil increased salinity of the SOil?soluble and exchangeable Na. soluble Ca. Mg. K. and Cl.On the other hand, increasing input of salt decreasedsoil content of exchangeable Ca, Mg. and K. and did notaffect soluble HC03or S043. Deducing the ESP showed the following equations:(a) ESP = 100 (0.0056 + 0.0311 SAR)1 + (0.0056 + 0.0311 SAR)(b) ESP = 0.9299 + 9.5037 (CO + HCO )3 3(c) ESP = -92.0418 + 12.1571 pHCorrelating values of ESP calculated from equation (a)as well as the other three similar equations developedby u.S. Salinity Laboratory (Richards, 1954), Balba(1962)and

El-Arquan and Kaoud (1981) with actually determinedESP supported the validity of using SAR for predicting”ESp· of the soil with a reasonable degree of success.Correlations between determined ESP and each of soluble(C03 + HC03) and pH were highly significant indicatingthe suitability of these parameters for predicting ESP.4. There is specific anion effect on cation exchangeequilibria. The adsorbed Na was greater when theassoc~ated anion was C03 rather thanCl or S04. AdsorbedNa originated from the Na2S04 solution was greater thanthat of the NaCl one. The variations became greaterwith increasing salt concentration. The selectivitycoe.ff rcLent s calculated in terms of concentration ”Kv”were higher with S04 as associated anion than with Cl.The differences became less when selectivity coefficientswere calculated in terms of activi ty (Kvlt) but were noteliminated.For all the samples, the Mg-presaturated systemsadsorbed more Na than the Ca-presaturated ones. Also,selectivity coefficients of the former systems werealways higher than the latter ones.At e que Ivva Lue s of SAR, the corresponding valuesof ESR in the case of S04 systems were higher than thosein the case of Cl systems. When SAR~ (calculated onbasis of activity) was used instead of ”SAR” (calculatedon basis of concentration) the differences were reducedbut did not disappeared.Adsorption patterns of Mg were similar to those ofNa, however, at any equivalent fraction of the cation(Na or Mg) in the equilibrium solution the correspondingequivalent fraction of adsorbed cation in the Mg-Casystems was higher than in Na-Ca or Na-Mg ones, consequentlythe preference of the investigated sample for Ca, Mg, andNa followed the order, Ca> Mg.)..Na’