THE INFLUENCE OF EXCHANGEABLE IONS AND
NEUTRAL SALTS ON THE pH OF SOILS

M. PUFFELES

Sørensen and Palitzsch (11,3) in their investigations on the pH of salt solutions, came to the conclusion that two solutions containing some dissolved inorganic material show the same coloration when tested with an indicator if their pH's are similar. If the concentrations of the two solutions vary, however, the indicator does not show the same color. Thus, they demonstrated the lowering of the pH on the addition of some salt to one of the solutions having similar concentrations and naturally came to the conclusion that the addition of such a salt, whether neutral or not, increases the pH or its activity, which, in its turn, results in a lower reading. Later, they (12) also demonstrated that the determinations of the pH in a neutral salt solution do not agree when measured by means of electrometric and colorimetric systems. Their determinations gave a mean difference of 0.05 to 0.07 between the two methods. They also found that in a 3.5% neutral salt solution the pH is diminished by 0.24.

McBain and Colman (8) found that the rate of inversion caused by 0.25 N/HCl was increased by 8.47% on the addition of 0.25 N/KCl solution. Michaelis and Rona (9) have demonstrated that variations of color in a solution do not depend solely on the pH, but are also affected by the concentration of neutral salt in the solution. They think that changes in the color of the solution are due to the effect of the neutral salt on the dissociation constant of the indicator. They also found that by adding a neutral salt, such as NaCl, to a solution of acetic acid, the dissociation constant of the acid is increased. The influence of a neutral salt on lowering the pH of a given soil is now a well-known fact in the case of humid soils. Such lowering also serves as an index of the unsaturation of the zeolite-complex and of the amount of lime which should be added to the soil. In the case of arid soils very few investigators have observed a diminishing pH value following the addition of a neutral salt. Arrhenius (2) has shown that the presence of salts in certain Egyptian soils has prevented the formation of black alkali. He also points out that the addition of a neutral salt to an alkaline clay (considered an absorptive, saturated clay) produces a greater lowering of the pH than its addition to unsaturated soils and attributes this to the fact that the addition of a neutral salt activates the hydrogen ions and suppresses the OH group. As to the degree of activation exercised by the non-metallic ions on the hydrogen-ion concentration in the soil, Arrhenius found that Cl is more active than NO₃, while nitrate is more active.

1Contribution from the Central Laboratories, Dept. of Health, Government of Palestine, Jerusalem. Received for publication May 16, 1939.
2Chemist. The author wishes to express his thanks to G. W. Baker for his advice and corrections on this paper and to S. Adler for her assistance in the analytical work reported here.
3Figures in parenthesis refer to "Literature Cited", p. 766.