Abstract

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Chemical behavior of phosphorus in some Egyptian soils

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The current of this work aims to throw light on some factors affecting phosphate adsorption in some Egyptian soils and the role of organic anions to decrease and/or inhibit this process. To fulfill these purposes, seven representative soil samples (0-30 cm depth) collected in this investigation. The tested soils have different chemical and physical properties and represent to the different abundant Egyptian soil textures (loamy, sandy, calcareous, and clay). An incubation experiment-for six months- was carried out at 30^{o}C at rate of P concentrations of 0, 10,20,30,...,90 mg P/kg as KH_2PO_4 .The investigated soils were found to have a moderate agreement with the linear **Langmuir** isotherm equation where their correlation coefficients were 0.500 , 0.618 , 0.521 , 0.101, 0.687, -0.235 , and 0.787, respectively, and for **Freundlich** isotherm equation the corresponding values of their correlation coefficients were 0.800, 0.867, 0.925, 0.524, 0.825, 0.858, and 0.853, respectively, whereas for the **Temkin** isotherm equation the corresponding correlation coefficients were 0.659, 0.752, 0.813, 0.293, 0.729, 0.899, and 0.775, respectively. Generally, **Freundlich** equation gave the best fit for the equilibrium P adsorption data than did the **Langmuir** and **Temkin** equations at range of P concentration of 0-90 mg P/l. The observed moderate values in their correlation coefficients of soils with the linear **Langmuir** isotherm equation are may be due to the presence of $CaCO_3$ contents in relatively amounts in these soils. Where, $CaCO_3$ has two or more adsorping sites having widely different affinity to sorb phosphate groups. Concerning **Langmuir** isotherm equation the **MBC**(maximum buffering capacity) values were found to have an opposite trend with the $\mathbf{X_m}$ (adsorption maximum) values. Studding the effect of phosphate adsorption on pH of soil solution, the data showed that the pH of soil solution decreases with increasing the amount of P sorbed into soil surfaces. This may be attributed to the higher positive charge of clay mineral and the lesser competition of hydroxyl ions with phosphate into clay surfaces. The amount of adsorbed P was found to increase with increasing the time of incubation, that is probably due to the presence of $CaCO_3$ in high content and the higher pH values which ranged between 7.04 and 8.71 whereas the Ca-P compound are the dominant precipitates than that for Fe and Al ones. Fractionation analysis of soils by **Chang** and **Jackson** method showed that the abundance of different P fractions was in the order of : Ca-P > Al-P > NH_4Cl-P > Fe-P > citrate-dithionate –P (CDP) in the treated and untreated soils. Treatment of the investigated soils- after removing of their organic matter by using concentrated H_2O_2- by different types of organic anions (citrate, oxalate, and tartrate) was found to reduce and/ore inhibit the adsorption of P. This may be attributed to that at high pH values the carboxylate group of the organic anion has a negative charge high enough to compete phosphate group on active sites. The obtained results declared that the ability of organic anions to decrease phosphorus adsorption on soil surfaces followed the sequence: citrate > oxalate > tartrate.

Key words: Phosphorus- $CaCO_3$- adsorption- pH- Organic anions- Langmuir- Freundlich- Temkin- Fractionation -Chang and Jackson method

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