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وقل رب زدني علما

"صدق الله العظيم"

PHOSPHATE ADSORPTION ON TREATED CLAYS SEPARATED FROM SOME SOILS OF EGYPT

A THESIS

Submitted By

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CHAPTER 1

INTRODUCTION

1. INTRODUCTION

Retention of phosphorus by soils plays an important role in determining the ultimate availability of fertilizer phosphate to plants. When phosphatic (P) fertilizers are applied to soils and dissolved by soil water or are applied as liquid fertilizers, reactions occur among the phosphate, soil constituents, and the nonphosphatic fertilizer compounds which remove phosphorus from the solution phase and render the phosphate less soluble. The maximum phosphorus retention is a product of one or more systems including (a) the adsorbed phosphate ions on the positively charged sites of the colloidal phase which differ from one clay type to another, (b) precipitated mono or multilayers of dicalcium phosphate or the more basic phosphate on the freshly divided calcium carbonate particles, (c) the retained phosphate in the clay - Ca-phosphate system, and (d) an other unknown system which may depress the phosphate ion activity in the soil (Olsen and Watanabe, 1957).

Many researchers have found that organic matter affects the reactions of phosphate in soils. Holford and Mattingly (1975a) have suggested that, in calcareous soils, organic matter and phosphate compete for the same sites for adsorption on $CaCO_3$ surfaces. They concluded that the adsorption of organic matter on the studied soils has decreased the bonding energy of adsorbed phosphate. In contrast, Appelt et al. (1975) reported that simple organic acids, fulvic and humic acids had no effect on phosphate adsorption by volcanic ash derived from soils. Several investigators have reported positive relationships between the organic matter content of soils and phosphate adsorption (Holford and Mattingly, 1975a).

Calcium carbonate and hydrous oxides of Fe and Al played key roles in phosphate retention. Phosphate was either precipitated as Ca-,Fe-, or Al-phosphates or that the phosphate was chemically bonded to these cations at the surface of the soil minerals. Aluminum and iron oxides and hydrous oxides can occur as discrete compounds in soils or as coatings on other soil particles. They can also exist as amorphous Al hydroxy compounds between the layers of expandable Al silicates. These compounds account for much of the phosphate retention. The adsorption was postulated to be an exchange reaction between phosphate ions and hydroxyl ions associated with the metal. Cole et al. (1953) found that Langmuir adsorption isotherm described adsorption of phosphate by $CaCO_3$ at relatively low phosphorus concentrations. Kuo and Lotse (1972) have suggested that phosphorus may replace adsorbed water molecules, bicarbonate ions, and hydroxyl ions when it is adsorbed by calcite, with adsorbing strength depending upon the solubility of the compound formed with the surface calcium ions.

The need exists to evaluate the effects of some constituents on phosphate adsorption. Therefore, this study is carried out to investigate the effect of removal of organic matter, calcium carbonate, free iron oxides, and amorphous silica & alumina on phosphate adsorption by soil clays separated from 1 2

different soils in Egypt. The used soils include cultivated soils in the Nile Delta and uncultivated soils in the New Valley in the Western Desert of Egypt.