A phosphate sorption and desorption study on an acid sandy clay soil

by

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Abstract

The desorption kinetics of residual and applied phosphate to an acid sandy clay soil were investigated over a 56-day period using hydrous ferric oxide in dialysis tubes as a specific phosphate sink, followed by a sequential phosphate fractionation. The long-term phosphate desorption kinetics were describe with a two component first order model. The assumptions made were that two discrete phosphate "pools", with different exchangeability, participated in the desorption process and that the two phosphate pools follows first order kinetics. The desorption kinetics of the soil were describe relatively well according to the determination coefficients (R^2) (R^2 = 0.9730 for the control and R^2 = 0.9528 and R^2 = 0.9870 for the phosphate treatments of 75 and 150 mg kg^{-1} respectively) with the two component first order model. The more exchangeable pool (pool A) of the different treatments were depleted within the 56 day period. Extrapolation of the data showed that in the long term, desorption kinetics are controlled by the less exchangeable pool B. The total of mount phosphate desorbed in the 56-day period were virtually equal to the decrease in the NaOH extractable inorganic phosphate fraction (OH-Pi fraction) of the different treatments indicating that the OH-Pi fraction or "pool" is quite labile and actively involved in the desorption process. The $NaHCO_3$ extractable

inorganic fraction (HCO_3-Pi fraction) of the different treatments were virtually depleted in the 56-day period but contributed considerably less to the total phosphate desorbed than the OH-Pi fraction. The calculated total extractable phosphate of the different treatments were ± 54% of the day 1 values of the OH-Pi fractions and ± 50% of the day 1 values of the HCO_3-Pi + OH-Pi fractions. If the hydrous ferric oxide simulates phosphate uptake by plants then the calculated total exchangeable phosphate represents the long-term plant available phosphate. For this particular soil it seems that half of the phosphate extracted with NaOH (24 hours) gives a good estimation of the long-term plant availability of the solid phase phosphate in the soil.

Keywords: Desorption maximum, hydrous ferric oxide, phosphate desorption kinetics, two component first order model, sequential phosphate fractionation, NaOH extractable inorganic phosphate, $NaHCO_3$ extractable inorganic fraction.

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