Abstract

Intermolecular interaction of $Fe_3(PO_4)_2.8H_2O$, $FePO_4 \cdot 2H_2O$, $AlPO_4 \cdot 2H_2O$ and $MnHPO_4.H_2O$ were studied by using Fourier Transform Infrared (FTIR) spectroscopy and dilution technique. Anion-water interactions were determined in three replication samples by observing the uncoupled ν_{OH}(HOD) vibrations. The lowering frequency of uncoupled vibrations ν_{OH}(HOD) lead to the enthalpy of hydrogen bonding $(-\Delta H_H)$ of $Fe_3(PO_4)_2.8H_2O$ $FePO_4 \cdot 2H_2O$, $AlPO_4 \cdot 2H_2O$ and $MnHPO_4.H_2O$ to be 10.70, 12.72, 12.18 and 14.68 kJ mol^{-1}OH, respectively. The water of crystallization of $Fe_3(PO_4)_2.8H_2O$ was found to be 8.30 by Karl-Fischer method, where as that of $MnHPO_4.H_2O$ was found to be 0.84 and 1.32 by Karl Fischer method and TG/DTG/DTA method, respectively. For the cases of $FePO_4 \cdot 2H_2O$, $AlPO_4 \cdot 2H_2O$, the mole number of water of crystallization agree with the formula as confirmed by Karl Fischer, TG/DTG/DTA and gravimetric methods.

The effect of Fe(II):Mn(II) mole ratios were studied in 5 catigories, 1:1, 1:2, 1:3, 2:1 and 3:1. The preparations for phosphate hydrates were carried out according to each type of phosphate hydrates. Each mole ratios were prepared in three replication. The vibrational spectra of those obtained phosphate hydrates were recored on a FT-IR/FT-Raman Spectrophotometer (Perkin Elmer Spectrum GX) in the range of 4000 – 370 cm^{-1}.

The vibrational spectra of the synthesized phosphate hydrates from all mole ratios were to exhibit approximately the spectra of $Fe_3(PO_4)_2.8H_2O$ .In order to simulate the experimental conditions close to the nature, sodium chloride (NaCl) were added to the reaction mixtures in various amounts corresponding to the salinity levels confirmed by measuring electrical conductivites. Initial pH of the phosphate hydrates preparations were followed up for the salinity level : non saline (S_{ns}), Slightly saline (S_{ss}), Moderately saline (S_{ms}) and vary strongly saline (S_{vs}). It was found that the initial pH for the case Fe(II) were not significantly changed. The case of Mn(II) showed the decreasing of pH in such a way that $S_{ns} > S_{ss} \approx S_{ms} \approx S_{vs}$.

The mixed cations systems by varying the Al(III)/Fe(III) mole ratios in the preparation of $FePO_4 \cdot 2H_2O$, and $AlPO_4 \cdot 2H_2O$ were studied. The results support the existence of the compound in the formula of $(Al,Fe)PO_4 \cdot 2H_2O$.

The availability of Fe(II) and Mn(II) for plants is suggested to be monitored by the existence of Al(III) and Fe(III) in the saline soil.