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Phosphates in the Air-dried Residues of Water or Dilute Acid Extracts from Compost

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The content of P in compost is reported to be 4.43–48.6 g kg⁻¹ and P is mostly inorganic (Yokota *et al.*, 2003). With a rise in prices of chemical P fertilizers, P in the composts is expected to play a role of P fertilizer. So far, chemical forms of P in the compost have been estimated to be CaHPO₄·2H₂O or MgNH₄PO₄·6H₂O (Tanahashi *et al.*, 2010). However, it is not very facile to observe and detect these crystalline phosphates directly in cattle manure compost (CMC) using an electron microscope or X-ray diffraction. The objective of the present study was to examine chemical forms of P in the air-dried residue of water or dilute-acid extracts of compost.

Air-dried CMC, a product of Kawatabi Field Science Center, Graduate School of Agricultural Science, Tohoku University and commercially available fermented chicken manure pellets (FCMP) were ground to pass a 2 mm sieve. To 15 g each of these composts, 50, 49.25, 45, 40, 30 mL of pure water and 0, 0.75, 5, 10, 20 mL of 1 mol L⁻¹ HCl, respectively, were added, and shaken by hand. Regarding FCMP, 20 mL of 2 mol L⁻¹ HCl was used instead of 20 mL of 1 mol L⁻¹ HCl because of its high carbonate content. Then, the mixtures were allowed to stand at room temperature for 24 h with occasional swirling. After measurement of suspension pH, solutions were separated by filtration using Toyo No.5C filter paper. After measuring electric conductivity of the solutions, Ca, Mg, Na and K were analyzed by atomic absorption spectrometry and P concentration was determined by the molybdenum blue method. The remaining solutions were air-dried. After removing highly soluble salts from the air-dried residues with small amount of water, the residual precipitates were examined by X-ray diffraction, scanning electron microscope observation and energy dispersive X-ray analysis.

The amounts of Ca, Mg, K and Na extracted from two composts were greater than those of P. Among these, the amounts of Ca, Mg and P increased with decreasing pH of the extracting solution, compared with those of K and Na. Crystalline phosphates found in the air-dried residues from CMC were MgKPO₄·6H₂O, MgHPO₄·3H₂O, and CaHPO₄·2H₂O, depending on extracting pH. Non-crystalline Ca phosphate was included in the precipitates from acidic extracts. In the air-dried residues from FCMP, non-crystalline phosphates were found as major components, and small amounts of MgNH₄PO₄·6H₂O and CaHPO₄·2H₂O were also detected.