The distribution of inherent phosphorus in fifteen water treatment residues from South Africa

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Abstract

Water treatment residues (WTR), the by-products of the production of potable water, are chemically benign, inorganic materials which are suitable for disposal by land application, though they are frequently reported to have high phosphorus (P) sorption capacities. An understanding of the distribution of inherent P in WTR is, however, required, if sorption-desorption processes are to be correctly interpreted. The aim of this investigation was to characterise the chemical properties relevant to P-sorption/desorption processes of 15 South African WTR and to determine the inherent distribution of P within the WTR using a chemical fractionation procedure. The pH, exchangeable Ca and organic carbon content ranged from 4.77 to 8.37, 238 to 8 980 mg·kg^{-1} and 0.50 to 11.6 g·100 g^{-1}, respectively. Dithionate, oxalate and pyrophosphate extractable Al fractions ranged from 741 to 96 375, 1 980 to 82 947 and 130 to 37 200 mg·kg^{-1}, respectively, and dithionate, oxalate and pyrophosphate extractable Fe ranged from 441 to 15 288, 3 865 to 140 569 and 230 to 90 000 mg·kg^{-1}, respectively. Mechanisms of P-retention are residue specific, being dependent on the chemical properties of the WTR. Elevated Ca and amorphous Al and Fe concentrations did, nevertheless, suggest that all residues had the capacity to adsorb high amounts of P and to retain this P in forms unavailable for plant uptake.

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