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Phosphorous Speciation in WTR-treated Biosolids Using XANES

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The concept of co-application of biosolids and drinking water treatment residues (DWTRs) represents an environmentally sustainable and economically sound strategy for the management of municipal solid wastes. This study demonstrated the effectiveness of reducing water-soluble P in biosolids-amended agricultural soil by the addition of DWTRs. Results showed that total P in soil leachate was significantly reduced during the initial 42-days of a 200-day greenhouse study when biosolids (50 g kg-1) were applied along with DWTRs (40 g kg-1). Particulate P was the dominant fraction of P in the soil leachate, which decreases with increasing DWTR application rate. The application of DWTRs does not significantly decrease the growth and yield of wheat (Triticum aestivum L.). The primary P chemical composition in biosolids include cupper phytate [Cu(IP6)6], barium phytate [Ba6IP6], and cupper phosphate [Cu3(PO4)2]. The addition of DWTRs to biosolids alternated the P speciation, and the P speciation change became significant with increasing the incubation time of the mixture of biosolids and DWTRs. The chemical component of Cu3(PO4)2 became non significant (<5%) with the addition of DWTRs. During the 14-day incubation time period, the proportion of P that was adsorbed on amorphous Fe(OH)3 increased substantially from 8 to 46% and Ba6IP6 increased steadily from 30 to 50%, while the proportion of Cu(IP6)6 decreased significantly from 53 to 5%. The amorphous Fe(OH)3-adsorbed P and Ba6IP6 formed the dominant P chemical components in the mixture of biosolids and DWTRs.