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Co-application of biochars and zeolite to reduce Cd and Pb leaching to drinking water

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Co-application of two biochar types and natural zeolite was investigated to reduce cadmium (Cd) and lead (Pb) leaching from downhill of municipal waste disposal soils. The study region is located above Sarab Ghanbar, one of the most important water resources in Kermanshah city, Iran. The biochars (BCs) were produced from apple tree wood chips (BC1 at 700°C) and sawdust (BC2, 400°C) through slow pyrolysis. Total Cd and Pb amounts were 8 and 141 mg kg⁻¹ and 27 and 63 mg kg⁻¹ for soil 1 and 2, respectively. According to National Standards of Iran, soil samples were Cd-polluted (total Cd > 5 mg kg⁻¹) while not Pb-polluted (total Pb < 75 mg kg⁻¹). Therefore, soil 1 was polluted by Pb (500 mg kg⁻¹ of soil) as Pb (NO₃)₂ as an extremely polluted condition of a soil with both pollutants. The results showed different amounts (i.e. 10% or 20% BCs) and different treatments reduced significantly (Tukey's HSD $P < 0.001$) the leached Cd and Pb concentrations in comparison with untreated soils. For Cd, there were also significant differences between soils ($P < 0.001$) as well as the interaction effect of soil × treatments was significant ($P < 0.001$). For Pb, there was also significant difference between soils ($P < 0.01$). However, the interaction effect of soil × treatments was not significant. Treatments with BCs addition resulted in significant change in Cd and Pb leaching. However, for Cd, 20% BCs and co-application of zeolite and biochars (10% zeolite + 10% BCs) were similar. This study revealed that application of 20% BCs is more efficient than zeolite applications whether solely or co-application with BCs to reduce Cd leaching from Cd-Pb-polluted soils to drinking water resource. Although, Pb concentration was significantly reduced by addition of 20% zeolite, there were no significant differences between 20% BCs and 10% zeolite + 10% BCs with 10% BC1.

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