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Reclamation of acidic mine residues by creation of technosoils with the addition of biochar and marble waste

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This study reports the short-term effect of biochar and marble waste addition for the reclamation of acidic mine residues. A lab incubation was carried out for 90 days. Biochars derived from pig manure (PM), crop residues (CR) and municipal solid waste (MSW) were added to the soil at a rate of 20 g kg-1. The marble waste (MW) was added at a rate of 200 g kg-1. Bochars and MW were applied independently and combined. A control soil was used without application of amendments. The evolution of different physical, chemical and biochemical properties and availability of heavy metals was periodically monitored. Results showed that original pH (2.8) was increased with all amendments, those samples containing MW being the ones with the highest pH (∼8.0). The electrical conductivity (EC) decreased from 6.6 to 3.0-4.5 mS cm-1 in all the treatments receiving MW. Soil organic C (SOC) increased in all samples receiving biochar up to 18-20 g kg-1, with no shifts during the 90 d incubation, indicating the high stability of the C supplied. Recalcitrant organic C accounted for ∼90-98% of the SOC. No significant effect of amendment addition was observed for carbohydrates, soluble C, microbial biomass C and β–glucosidase activity. However, arylesterase activity increased with amendments, highly related to pH. The availability of heavy metals decreased up to 90-95% owing to the addition of amendments, mainly in samples containing MW. The MW provided conditions to increase pH and decrease EC and metals mobility. Biochar was an effective strategy to increase SOC, recalcitrant C and AS, essential to create soil structure. However, a labile source of organic matter should be added together with the proposed amendments to promote the activation of microbial communities.

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