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Aggregate stability in mine residues after reclamation with biochar

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This study aims to assess how the addition of biochar and marble waste to acidic mine residues affected aggregate stability (AS) and contributed to the improvement of soil texture. For this purpose, 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, with the aim of increasing pH from 3 to 8 (pH of the native soils of the area). Biochars and MW were applied independently and combined. A control treatment was used without application of amendments. The evolution of AS was periodically monitored at 2, 4, 7, 15, 30 and 90 days by the method of artificial rainfall. Results showed, at the end of the incubation, that the addition of MW alone did not significantly increased AS with comparison to CT (30%). However, the biochar, alone or together with MW, significantly increased AS, the treatment receiving CR derived biochar being the one with the highest values (46%). Increments in AS were significant from the day 30 of incubation. AS showed a significant correlation with the total organic carbon content, but was not correlated with organic carbon fractions (soluble, labile, recalcitrant), inorganic carbon, microbial biomass carbon, enzyme activities, exchangeable fraction of heavy metals (As, Cd, Cu, Pb, Zn), pH, electrical conductivity nor greenhouse gas emissions (NO_2, CH_4). Thus, the application of biochar (alone or in combination with MW as a source of calcium carbonate) significantly increased the formation of stable aggregates in former acidic mine residues, favoring the development of soil structure, essential to create a soil from residues. It seems that the total content of organic carbon is directly controlling aggregation, rather than other labile organic sources. Moreover, pH, salinity or the presence of exchangeable metals did not seem to affect soil aggregation.

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