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Evaluation of Technosols Potential for Carbon Accumulation: Impact of Mixtures of Iron Mining Tailings and Construction Waste on Carbon Sequestration

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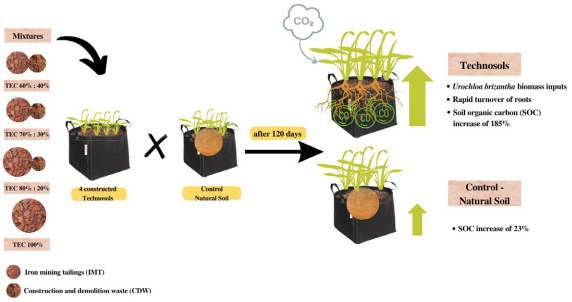

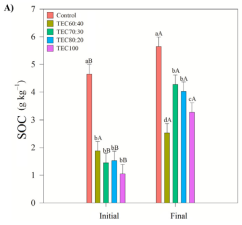

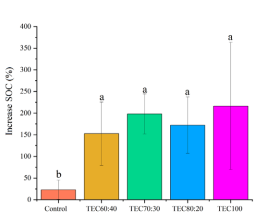

Brazil is grappling with severe environmental challenges stemming from the large-scale generation of mining tailings and construction waste, which are frequently mismanaged and inadequately disposed of in the environment, causing significant ecological impacts such as loss of biodiversity, degradation of ecosystems, and a reduction in soil organic matter (SOM), which leads to decreased carbon stocks and increased greenhouse gas emissions. Technosols, as tailor-made artificial soils, emerge as a promising solution to minimize SOM loss, promote carbon sequestration, restore ecosystem services, and mitigate climate change. To evaluate their effectiveness as plant substrates and carbon storage systems, four Technosols were developed using different mixtures of iron mining tailings (IMT) and demolition and construction waste (CDW) in varying proportions ($TEC_{60:40}$, $TEC_{70:30}$, $TEC_{80:20}$, and TEC_{100}). A tropical grass species, *Urochloa Brizantha* cv. Marandu, was cultivated in these artificial soils to assess carbon accumulation. A Haplic Ferralsol (natural soil) served as the Control treatment. After 120 days, the Technosols exhibited a substantial increase in soil organic carbon (SOC) compared to the Control, with an average rise of 185±28% (2±1 g kg^{-1}) relative to the initial levels. In contrast, the natural soil showed a more modest SOC increase of 23±22% (1±0.6 g kg^{-1}). This increase was primarily concentrated in the particulate organic matter (POM) fraction, where the Control averaged 2±0.7 g kg^{-1}, while the Technosols reached a mean of 2.2±0.5 g kg^{-1}. These results highlight the significant contribution of *Urochloa brizantha* biomass inputs, along with the rapid cycling of its roots, in enriching the POM carbon fraction, reinforcing the role of Technosols in short-term carbon accumulation. Additionally, under favorable conditions, a portion of this carbon stored in POM may gradually transition into the organic matter associated with minerals (MAOM) fraction, improving long-term stabilization and strengthening its viability as a climate change mitigation strategy.