The effects of a sulphur oxidising bacterial inoculum and elemental sulphur amendment on alkaline iron ore tailings pH stabilisation

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Direct phytostabilisation of tailings is impossible, due to its poor physicochemical properties and limited biological functions, in other words, it is not a soil-like substrate and inhospitable for the colonisation of plants and some microorganisms [1-4]. The pH of tailings, one of the most significant constraints on iron ore tailings rehabilitation, plays a significant role in improving tailings chemical properties, accelerating natural mineral weathering processes, and colonisation by microorganisms and pioneer plants. This study investigates the use of elemental sulphur to neutralise the alkalinity of iron ore tailings through sulphur oxidation by a lithoautotrophic sulphur-oxidising bacterium, *Acidithiobacillus ferrooxidans* (DSM 14882).

The pH of tailings decreased from alkaline to circumneutral pH to acidic conditions with increasing elemental sulphur amendments and bacterial inoculation. This indicates that the biological oxidation of elemental sulphur occurring in microenvironments at the sulphur surface decreased the bulk pH of the alkaline iron ore tailings. The amount of elemental sulphur oxidation is directly related to the pH effect – acid production.

The niches on iron-rich mineral surface and the increase of soluble iron demonstrate mineral bio-weathering process changes the physicochemical properties of tailings minerals, potentially forming secondary iron oxides, which can improve the technosol environment by providing the physicochemical properties and biogeochemical process necessary for colonisation by key pioneer plant species and soil microorganisms.

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