Key parameters affecting the compaction properties of filtered tailings

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# ABSTRACT

As an alternative to conventional tailings disposal, filtered tailings are becoming more common in the mining industry. This type of tailings is commonly disposed of in stacks, usually designed to be compacted. The compaction properties of mining tailings are critical for ensuring the stability, safety, and environmental sustainability of tailings storage facilities. This study investigates the key parameters influencing the compaction behavior of iron ore tailings, focusing on particle size distribution, moisture content, compaction energy, and mineralogical composition. Particle size distribution plays a significant role, as finer particles tend to fill voids between coarser particles, enhancing density but potentially reducing permeability. Conversely, a well-graded particle distribution can improve compaction efficiency by optimizing interparticle contact. Moisture content is another crucial factor, as it directly affects the soil's workability and compaction characteristics. Optimal moisture content, corresponding to the maximum dry density, is essential for achieving effective compaction, while deviations can lead to either insufficient compaction or excessive pore water pressure. Additionally, the mineralogical composition of tailings, including the presence of clay minerals, can affect compaction due to their water-absorbing and swelling properties. Tailings with a high percentage of fine particles often exhibit lower permeability and higher compressibility, complicating compaction efforts. Understanding these parameters is vital for designing efficient tailings management systems that minimize environmental risks, such as liquefaction or slope failure, while maximizing storage capacity. This research highlights the interplay between these factors and provides deeper discussions on the behavior of the materials, which can lead to future compaction strategies contributing to safer and more sustainable mining practices. The findings underscore the importance of tailored compaction approaches based on the specific characteristics of the tailings material.