Contribution ID: **723** Type: **Poster Presentation**

Transformative Effects of Nano-MgO Integration in Electrokinetic Soil Conditioning: A Systematic Analysis of Expansive Clay Stabilization

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Expansive soils are widely known for their high shrink-swell behavior, which can lead to substantial structural damage and maintenance challenges in civil infrastructure. Traditional stabilization methods often face limitations in achieving uniform treatment and long-term effectiveness. In recent years, nanoparticles have emerged as a promising alternative for soil stabilization due to their high surface area, reactivity, and ability to alter soil fabric at the microstructural level. This study first evaluated the effectiveness of MgO and SiO2 nanoparticles through physical mixing tests. Among the two, MgO demonstrated superior performance, showing significant improvements in plasticity characteristics, including an increase in the plastic limit, a 22.78% reduction in the plasticity index, and a near elimination of swell potential at a 3% concentration. Based on these results, MgO was selected as the optimal nanoparticle for further enhancement using electrokinetic conditioning. The electrokinetic technique was employed to facilitate uniform distribution of MgO throughout the soil matrix. The integrated electrokinetic-MgO approach yielded substantial improvements, including a 28.26% reduction in swell strain and a 221.39% increase in compressive strength near the cathode at a MgO-to-water ratio of 1:10. X-ray fluorescence confirmed effective MgO distribution throughout the soil matrix.

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References

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