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TITLE OF PROJECT: Sustainable Desiccation Crack Mitigation in Expansive Soils with Natural Fibres

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ABSTRACT (150-300 words):
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Expansive soils are utilized in many civil engineering infrastructures such as levees, the core of earthen dams, canals, compacted clay liners, etc. The critical problems related to expansive soils are associated with desiccation cracking and induced deformations during the process of water reduction within the soil mass. It resulted in an increase in soil weathering, a reduction in water retention capabilities and the obliteration of the local ecology of the site. The network of amalgamated desiccation cracks promotes contaminant transport, reduction in soil shear strength, increases compressibility and promotes rainfall-induced landslides. The conventional stabilization techniques used to treat desiccation cracks include the addition of lime, cement, bitumen, and polymer additives. However, these treatment techniques have severe sustainability considerations, such as increased alkalinity and stiffness, energy consumption for their production, increased carbon footprint, and leaching of harmful chemicals. Hence, the present research explored an environment-friendly sustainable way for desiccation crack mitigation by utilising natural fibres. A series of shrinkage drying tests were conducted to examine the desiccation crack response of expansive soil mixed with the different percentages (0%,0.25%,0.5%,0.75%,1%) of coir fibres and banana fibres. Sequential images were clicked, and specimen weights were measured to understand the crack propagation response and its relation to water content loss. Digital Image Analysis (DIA) was used to calculate the Crack Intensity Factor (CIF) and other crack parameters. The results show that the addition of natural fibres significantly reduced the potential of crack formation and propagation. The coir fibre content of just 0.25% was determined to be sufficient to completely mitigate the desiccation cracks. Conversely, 1.00% of banana fibres are needed to significantly reduce the CIF. Coir fibre's rough surface texture and higher tensile strength as compared to banana fibre were responsible for their better performance. The current study concludes that the addition of natural fibre is an effective sustainable solution for desiccation crack mitigation in expansive soils.

KEYWORDS: Expansive soils, Desiccation cracks, Natural fibres, Sustainability, Digital image analysis

CATEGORY: Geotechnical Engineering