

## Postprint: Physicochemical and Compressive Deformation Characteristics of Dispersive Clay under Freeze-Thaw and Immersion

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### Abstract

To investigate the effects of freeze-thaw cycles and soaking on the physicochemical properties, deformation characteristics, and state of dispersive clay, laboratory physical, chemical, and compression tests were conducted on dispersive clay, and a compression deformation formula for dispersive clay under freeze-thaw cycle and soaking conditions was proposed based on the test results. The results indicate that after undergoing freeze-thaw cycles and soaking, the sodium and potassium ions in the clay decreased by 91%~95%, and the pH value decreased from 9.24 to 7.47; the particle size (0.075~0.005 mm and <0.005 mm) increased, the liquid limit and specific gravity increased, while the plastic limit remained unchanged; soaking led to the exchange and loss of sodium ions in dispersive clay, and its compressibility was higher than that of non-dispersive clay; freeze-thaw cycles and soaking deteriorated the dispersive clay body, accelerated the ion loss process, changed the compression curve, and resulted in a significantly deeper flocculent structure depth; after approximately 10 h of freeze-thaw cycles and soaking, the dispersive clay exhibited a completely flocculent structure.

### Full Text

## Study on the Physicochemical and Compressive Deformation Characteristics of Dispersive Clay Under the Coupling Effect of Freezing-Thawing Cycles and Immersion

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## Abstract

To investigate the effects of freeze-thaw cycles and immersion on the physicochemical properties, deformation characteristics, and state of dispersive clay, laboratory physical, chemical, and compression tests were conducted on dispersive clay samples. Based on the experimental results, a compression deformation formula for dispersive clay under freeze-thaw and immersion conditions was proposed.

The results demonstrate that after undergoing freeze-thaw cycles and immersion, sodium and potassium ions in the clay decreased by 91%–95%, while the pH value dropped from 9.24 to 7.47. Particle sizes in the ranges of 0.075–0.005 mm and <0.005 mm increased, accompanied by increases in liquid limit and specific gravity, whereas the plastic limit remained unchanged. Immersion caused exchangeable sodium in dispersive clay to leach out, resulting in higher compressibility compared to non-dispersive clay. Furthermore, freeze-thaw cycles and immersion deteriorated the clay mass, accelerating the ion loss process and altering the compression curve, with a noticeable deepening of the flocculent structure. After approximately 10 hours of freeze-thaw cycling and immersion, the dispersive clay exhibited a completely flocculent structure.

**Keywords:** dispersive clay; freeze-thaw cycles; exchangeable sodium; physicochemical characteristics; compressibility

*Note: Figure translations are in progress. See original paper for figures.*

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