

Experimental study on water and salt migration of solidified sulphate saline soil

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The special natural environment makes a great amount of sulfuric saline soil in the northwest of China. Sulfate soil is a porous media material and contains a large number of anions and cations. Under the strong evaporation, the groundwater under the saline soil will move up through the voids in the soil and the salt migrates in the soil, so the salt would accumulate in the upper part of the soil and destroy the buildings and facilities. In this paper, the saline soil of Yumen in Gansu Province was selected as the object of the research. The compacted saline soil and the saline soil reinforced by geopolymer are made into specimens. The distilled water and compound salt solution simulated the groundwater of Yumen were used as the migration solution. At normal temperature and pressure, the water and salt migration test was carried out for compaction and solidification of salted soil column ($h = 10\text{cm}$) with an open top. The changes of water content, salt content and electrical conductivity of soil samples at the different time gradients and heights were compared and the effects of curing agents on different ion transport were revealed. The article gets conclusions as follows.

(1) When the transport solution is distilled water, the capillary water migration rate of the compacted soil is the maximum. The capillary water migration rate of the solidified soil is the minimum and the different migration solutions have little effect on migration rate, which indicates that the solidified saline soil has the effect of slowing the rising of the capillary water. When the capillary water is stable, the water content of the upper part of the compacted soil is less than that of the lower part, which shows the approximate linear distribution along the height. While the water content of the solidified soil column in the upper part is larger than that of the lower part which increases at first and then keeps constant along the height, which indicates that the solidified saline soil has significantly stable water holding effect.

(2) The migration rate of Cl^- , SO_4^{2-} and Na^+ in the solidified soil is significantly smaller than that in the compacted soil, which indicates that the solidified saline soil has a significant hindrance effect on the salt migration.

(3) Due to the salt migration and surface evaporation, the concentration of ions in the lower part of the soil column decreases and the ion concentration increases at the top of the soil column. When the transfer of water and salt is stable and the ion accumulates at the top, the ion content in the top of solidified soil column was significantly smaller than that of the compacted soil.

(4) The distribution of the conductivity is highly correlated with the distribution of the ion content, and finally it shows that the lower conductivity in the lower part of the soil sample and the higher conductivity in the upper part of the soil sample.

Keywords: sulphate saline soil, geopolymer cementitious material, capillary transport mechanism, water and salt migration, salt expansion

