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Study of Mechanism of the W-OH Sand Fixation

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ABSTRACT

A novel hydrophilic polyurethane (abbreviated as W-OH) was developed and applied as a sustainable sand-fixing material. This paper on the chemical sand fixation mechanism of W-OH discusses the adhesive force between the W-OH solid and sand particles. The solidification mechanism was investigated and the solidifying time was tested. And then the thickness and porosity of the W-OH sand-fixing layer were investigated. By scanning electron microscopy (SEM), the microstructure of the W-OH sand-fixing layer was examined. The hardness and compressive stress of the sand-fixing specimens were studied at W-OH different concentrations. Finally, the resistance to wind erosion of the W-OH sand-fixing layer was investigated by a wind tunnel test. The results demonstrated that the W-OH aqueous solution had an excellent affinity for water on the surface of the sand particles, and the adhesive force between the W-OH solid and sand was primarily hydrogen bonding, covalent bonds and physical absorption, such as Van Der Waals forces. W-OH is a prepolymer of hydrophilic polyurethane containing groups of -NCO that can quickly react with water and other groups containing active H. The W-OH aqueous solution solidified in the range of 2 min to 15 min. The solidifying time decreased with increasing temperature and concentration. Before solidifying it had a good permeability of sand and the formed sand-fixing layer had a thickness of 8 - 35 mm and a porosity of 25% - 8% at a spraying concentration of 2 - 10 L/m^2. The hardness index of the sand-fixing layer was in the range of 21 mm to 28 mm and compressive stress was in the range from 0.21 MPa mm to 1.27 MPa, both of which increased linearly with W-OH concentration. Sand treated by over 3% W-OH concentrations showed excellent resistance to wind/sand erosion of more than 25 m/s.

KEYWORDS

W-OH Sand Fixation; Adhesive Force; Porosity; Solidifying Time; Wind Tunnel Test

Cite this paper

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