

Experimental study on the Ecological Slope Protection with Aqueous Polymer Soil Stabilizers

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1. Introduction

The weak stability, strength and anti-erosion ability of soil frequently leaves the slope surface on highways, railways and other engineering structures easy to soil erosion during rainfall conditions, this will damage the plant growth in many cases. Currently, the chemical modification of the soil with soil stabilizer has received recent attention. In this study, a type of soil stabilizer, namely STW, is developed and introduced. Field test of slope surface ecologically protected with STW soil stabilizer is presented and the modification mechanism of soil stabilizer is discussed.

2. Soil stabilizer

STW soil stabilizer was prepared using emulsion polymerization of acetic–ethylene–ester. It contains a large number of functional group ($-\text{OOH}$, $-\text{OH}$) and has a milky surface. The solution has a pH of 6–7 and 1.05–1.07 g/cm³ of specific gravity. It has viscosity of about 3,000 mPa·s.

3. field test

A clayey soil slope locating in Jiangsu province, china was selected as field test spot to study the effect of ecological slope protection with aqueous polymer

soil stabilizers (Fig.1). The clayey soil of slope surface has a liquid limit of 52.6%, a plasticity index of 19.7, and a specific gravity of 2.62. The slope angle is 35°. The spraying concentration and content of STW soil stabilizer are 20%, 3 L/m², respectively. The results indicate that the STW soil stabilizers can improve the anti-erosion ability of soil, reduce erosion on the topsoil and promote the vegetation growth (Figs. 2-3).

4. Mechanism analysis

When STW soil stabilizer is applied to soil, it creates physicochemical bonds between polymer molecules and soil aggregates through ionic, hydrogen, or Van der Waals bonds, which vary in soil characteristics and polymer solution dynamics. Through these bonds, long-chain macromolecules of polymers enwrap the aggregate's surface and fill up the pore to form an elastic and viscous membrane structure on the slope surface, and then elevate the resistance to erosion.

5. Conclusions

The ecological slope protection with soil stabilizer is an effective method to reduce soil loss and improve the stability of the soil slope.



Fig.1 The slope before modification



Fig.2 Modified by vegetation



Fig.3 Modified by STW and vegetation