

Analysis of the possibility of using water absorbing geocomposites in slope protection of earth structures

M.Sc., Eng. Michał Śpitalniak

Streszczenie (English)

Due to their specificity, earth structures should be protected against harmful atmospheric and physical phenomena, as well as human activities. In the era of progressing climate changes, the innovative water absorbing geocomposite (WAG) has become an interesting alternative for the existing methods of protecting earthwork slopes. This doctoral dissertation presents the effects of the application of water absorbing geocomposite with the aim to determine the reasonability and possibility of its use in the protection of slopes of soil structures.

Field and laboratory experiments were planned to analyse the effects of the application of WAG. The field tests involved the verification of the influence of WAG on the state of biotechnological cover of a slope in a completely exploited mine of mineral resources. Laboratory analyses were conducted to determine the interactions between the WAG and the environment of their application, among others, to demonstrate how the WAG modified the water movement in the soil profile. Apart from that, to provide a comprehensive analysis of the reasonability of the application of WAG, it was necessary to assess other commercially available soil amendments, which might provide an alternative for WAG in terms of retaining water in soil. Due to that, tests were also conducted to verify the effectiveness of the commonly used method of mixing superabsorbent polymers (which are an element of the WAG) directly with the soil.

The obtained results allowed to confirm the correctness of the research hypotheses, i.e. to demonstrate that WAG is an effective technology that enables to protect the slopes of earthwork structures by strengthening their anti-erosion protection. Apart from that, it was proven that WAG retains large amounts of water and modifies the water movement in soil, among others, by creating a capillary barrier (for mats). WAGs are currently the best soil amendments that enhance water retention in soil. The author also proposed some necessary modifications to optimise the application of WAG. The conducted research was presented and discussed in a series of four academic publications related by topic.

Keywords: water absorbing geocomposite, erosion control, soil moisture content, superabsorbent polymer, plant growth stimulation, soil amendments