

Green technologies in natural and synthetic surfaces use for dumps reclamation

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Last 50 years coal dumps reclamation in Ukraine was based on two- or three-layer models. These models use a fertile substratum underneath a black soil (chernozem) layer 0.5 m thick (Model 1) or 0.70-1 m thick (Model 2). Model 3 has 3 layers. The deepest layer is a substrate which is phytotoxic or unfavourable for crop growth (coal-bearing substrates with a high content of pyrite, saline substrates). The second layers acts as a protective shield and consist of loess (0.5 m). The third is the layer of fertile chernozem (0.3-0.8 m).

However, due to the situation of a shortage of fertile soils, a lack of nutrient elements in the waste rock, and a moisture deficit with strong rock acidification, it is considered important to develop new non-traditional reclamation methods based on the geo-synthetic materials used in conjunction with sowing lawn grasses or grass seeds inside. The geogrids and biogeotextiles made from natural materials such as hemp, flax, jute, coconut and other plant biopolymer fibers are recommended for bioremediation. The biodegradable carcass of reclamation covering materials stabilises the slopes, effectively restrains the soil particles from leaching and blowing, and prevents wash-out of the plant seeds, as well as protecting them from being eaten by animals.

The research object of the presented work was the coal dumps of sulfide rocks in Western Donbass (Ukraine). These rocks are characterized by low level of the maximum hygroscopic moisture (4.3%) and moisture content not available for plant growth (5-6%). Also the rock has an average level of salinity, mainly of the sulphate type.

The main goal of the study was to justify the use of some non-traditional materials such as burlap (jute cloth), agricultural fibers (light non-woven material from polypropylene fiber of spun-bond type) and a padding of polyester in the capacity of a geosynthetic substrate as a basis for the mixed grass crop that enable a reduction in the bioremediation costs (in comparison with traditional methods of covering by fertile soil layer) and the arrangement of lawn roll. A mixture of grass crops was used that included three types of grass seeds which were sown in the condition of hydroponics with settled tap water in a floating poly-foam frame on the one- and two-layer (with grass seeds inside) substrates of the above-mentioned materials.

The best results, in terms of seed germination, root and above-ground parts of the plants length, were obtained with a single layer of jute burlap on which practically all germinated seeds reached a high degree of seedlings mass and root productivity similar to indices of growth mixtures in greenhouses.

As a mulch of organic ingredients a wide range of crop residues, namely wheat straw, corn stalks, sunflower stalks and husks, and others, can be used.