

ABSTRACT

Ph.D. thesis on specialty 6D073100-Life safety and environmental protection

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The development of technology of the compositional materials production with using of industrial waste for constructions making on inhabitants protection from ES of the natural character in high-mountain regions of the Republic of Kazakhstan

Relevance of research. In the Republic of Kazakhstan, to date, about 80 various protective shelters have been built and are in operation, including 24 mud dams, 58 line structures (stop banks, channel ways, cost reclamation, field gates, storage dams, etc.).

The main part of the constructed protective structures plays a positive role in reducing damage during the passage of debris flows and is ready to perform its functions in the future. A number of structures were destroyed as a result of natural disasters, such as mudflows, avalanches, soil slips and are visible examples of the inefficient usage of structural design. Part of it fell into disrepair due to the insufficiency of the repair and recovery and maintenance works carried out on them. The imperfection of protective structures and the fragility of their functioning is largely determined by the lack of the necessary regulatory framework for their design, construction and operation (SNIPOV).

Preventive measures through controlled emptying of break-through mountain lakes and preventive triggering avalanches have been actively worked out in the Republic of Kazakhstan in addition to the construction of protective shelters provided by the schemes for protection against mudflows and avalanche phenomena. Thanks to which in some cases they were eliminated, while in others the risk of mudflows and snow avalanches was significantly reduced; thirdly, the effectiveness of preventive work was not high. At the same time, preventive measures were haphazard and do not have a developed scientific and methodological basis.

Protective shelters are designed to reduce the destructive effects of mudflows in the mountain and foothill areas of the Republic of Kazakhstan in order to protect the population and reduce economic damage.

In addition, millions of tons of solid man-made wastes accumulated on the territory of the Republic of Kazakhstan, such as wastes of the phosphor sub-sector in the form of granulated electrothermophosphor and steel-smelting slag, waste of mineral wool and slate-pipe production. These industrial wastes disrupt the ecological situation in the region, the landscape of the area and the rational use of industrial waste, using as building materials, are an urgent task and a practical solution for the disposal of the above wastes.

Therefore, the development of a new design of protective shelters against mudflows, with the use of industrial wastes in the mountainous regions of Kazakhstan of current concern today.

Object and subject of research:

The objects of the research were constructions of mudflow structures, developed from wastes of phosphoric, steel-smelting, mineral wool and slate-pipe industry.

The subject of the study was the strength characteristics of the construction of mudflow structures.

Scientific originality of the work:

- experimentally determined the optimized composition of the raw mix for the production of reinforced composite material for the manufacture of mud protection structures;

- the optimized composition of the raw mix of composite materials was determined and installed using mathematical planning of experiments, which increases the strength of mudguards for bending and the duration of the operational period.

- Strength characteristics of mud protection structures were revealed in the laboratory.

The practical value of the results of theoretical and experimental studies is to establish the optimized composition and representation of calculated values for composite materials in order to manufacture the construction of strong deflecting mudguards.

The aim of the work is the development of the optimal composition of composite materials using waste phosphoric, steelmelting, mineral wool and slate-tube industry, characterized by high bending strength, for the manufacture of structures of mud protection facilities to protect the population of highland areas of the Republic of Kazakhstan in emergency situations of natural character.

To achieve this goal, the author formulated and solved the following scientific problems:

- development of composite material technologies using portland cement, steel-smelting and granulated electrothermophosphor slag waste, mineral wool and slate-pipe production;

- Calculation and determination of the optimal composition of the raw mix of composite materials, increasing the strength of the mudguards for bending, the duration of the operational life, using the mathematical planning of experiments.

Implementation of the work. The results of the research have been tested in the construction organization LLP "Tassay temirbeton", in the preparation and testing of composite materials, flexural strength, based on waste steelmaking, granulated electrothermophosphoric, mineral wool and slate-pipe production. The constructed mud protection constructions from wastes of various industries can be used in the construction of protective structures against mudflows not only in the mountainous regions of Southern Kazakhstan, but throughout the Republic.

Study validity is confirmed by the use of modern methods for determining the physico-chemical properties of composite materials and methods for

conducting experimental studies on the strength characteristics of mudflow structures.

Propositions:

- physical and chemical substantiation of the technology for obtaining composite materials containing waste steel-smelting and granulated electrical thermophosphor slag, waste of mineral wool and slate-tube production for the preparation of a mixture of mud protection structures;
- mechanism of hardening of concrete matrix by natural fibers;
- test results and the principle possibility of introducing technologies for the production of composite materials that increase the strength of mud protection structures for bending and the duration of the operational period.

Connection with the plan of research works. The work was carried out in accordance with the research plan of the Auezov South Kazakhstan State University B-11-04-01 "Improving the industrial and environmental safety of the region with the development of technology for processing substandard raw materials and man-made waste"

Evaluation of results.

The results of the research were reported and discussed at the International Scientific Conferences "Auezov Readings-14" (Shymkent, Republic of Kazakhstan), "Materiły xiii międzynarodowej naukowo-praktycznej konferencji wykształcenie i nauka bez granic - 2017" (Prague, Czech Republic), "III International Conference of Industrial Technologies and Engineering »(Shymkent, Republic of Kazakhstan).

The personal contribution of the author is:

- development of new compositions and technologies for composite materials using phosphorus waste, steelmaking waste, mineral wool waste and slate-pipe production;
- calculation and determination of the strength characteristics of a mudguard structure with production waste for bending, the duration of the operational period, using the mathematical planning of experiments.

Publications. The main results of this dissertation were published in 10 scientific papers, including 2 articles in the Scopus / Web of Science database (Thomson Reuters), 3 articles in journals recommended by the Education and Science Control Committee of the Ministry of Education and Science RK (VAK), 4 theses of the materials of international conferences, including 1 in a foreign conference, as well as 1 patent for an invention.

Structure and scope of the dissertation. The total volume of the dissertation is 115 pages, including 45 figures, 16 tables and a bibliographic list of 116 titles.