

ABSTRACT

on the thesis of Serekpayeva Mira Amangeldinovna on the topic "Improving the quality indicators of protective coatings of three-layer panels and the development of technical documentation in accordance with international requirements ", submitted for Doctor of Philosophy degree (PhD) in the specialty 6D073200 – " Standardization and certification".

Relevance of the research. In accordance with "Kazakhstan-2050" Strategy one of the main objectives of the main branches of the economy of the Republic of Kazakhstan is to increase the production of construction materials and structures, increase their competitiveness. One of the priority areas of sustainable development is the production of high-tech energy-saving materials, safe for human health and the environment, with improved technical characteristics that increase the economic efficiency and quality of construction, reducing energy costs during operation, as well as stimulating domestic production by maximizing the use of domestic building materials in the construction and reconstruction of facilities.

According to the Concept of development of the agro-industrial complex of the Republic of Kazakhstan for 2021-2030, the development of agricultural industries requires the construction of new production facilities, reconstruction of production buildings and structures for the processing of products, storage facilities, elevators. One of the measures to improve the reliability and durability of building structures is to improve the quality of protective coatings. Anticorrosive materials used in various industries do not provide reliable protection of building structures. In this regard, the relevant objective is the development, research and improvement of materials capable of protecting metal structures from corrosion, aggressive media and other unfavorable effects. A special place is occupied by the state of metal structures, in particular three-layer panels, for the erection of structures, hangars, vegetable storages, livestock complexes in agriculture.

The use of three-layer (sandwich) panels with effective insulators and protective coatings is a promising direction of development of the construction industry, allowing to increase the volume of erected objects in industry and agriculture.

Steel structures in agricultural construction are subject to severe corrosion damage due to exposure to high concentrations of animal waste, high humidity, ammonia-phosphate fertilizers used in agriculture. To increase the term of anticorrosion protection of three-layer panels it is necessary to improve the quality of the corresponding protective coatings, so the search for a new solution and approach aimed at developing new coatings characterized by increased resistance to aggressive media, standardization of new materials is an issue of acute relevance.

At present, mainly paint and mastic coatings based on polymers, epoxy resin and polypropylene are used. The use of these coatings is associated with certain problems - low strength under impact loads, cracking, spalling, the possibility of easy violation of the integrity of the coating film at high humidity and aggressive

impact, which ultimately leads to rapid aging of the coating or complete loss of its properties.

The application of new materials, their production also revealed the problem of standardization of new products, the testing of which is impossible without solving the main problems of materials science – the study of the influence of raw materials on technological and operational quality indicators.

Modern economic conditions require obtaining materials not only with high characteristics, but also available, with a fairly low cost.

The concept of sustainable development implies efficient use of resources and minimization of negative impact on the environment. Industrial waste is a serious problem for many industries, as it can cause environmental pollution and pose a risk to public health. However, some types of industrial waste can be used as raw materials and fillers for the production of construction materials, which can reduce waste generation and minimize the use of primary resources. Industrial wastes contain calcium and silicate components necessary for the production of binders and composite materials and are both single and multi-component raw materials.

Protective coatings based on industrial waste are currently in the greatest demand. Scientific research and practical work in this field are very relevant.

Purpose of the research is to improve the quality of protective coatings of three-layer panels and to develop regulatory and technical documentation for new materials with improved chemical stability and strength properties.

In accordance with the set goal, the following **objectives** were defined:

- development of optimal compositions of polymer composite coatings with improved operational properties;
- investigation of the influence of industrial wastes (microspheres, microsilica) on the chemical stability of polymer composite coatings;
- evaluation of the quality level of new polymer coatings with nano-micro dispersions;
- development of normative and technical documentation for new anticorrosion coatings;
- study of properties of enamels based on industrial wastes;

Object of the research. Protective coatings of three-layer panels.

Subject of the research. Quality indicators of coatings with additives of industrial waste nanodispersions.

Scientific results within the requirements for the thesis.

The introduction substantiates the relevance of the research, outlines the purpose and objectives of the research. The academic novelty and the main provisions for defense are outlined.

The first section describes information about the planned scientific and technical level of development, about patent studies and conclusions from them determined by the completeness of the conducted literature review on the problem of improving the protective coatings of three-layer panels. The normative and technical literature has been analyzed.

The second section presents methods of research to fulfill the goal of the thesis work - improving the quality of protective coatings of three-layer panels and

the development of regulatory and technical documentation for new materials with improved chemical stability and strength properties. The choice of necessary instruments and equipment for research is made. Methods of determining the elemental, chemical, granulometric composition of raw materials; methods of determining the quality indicators of coatings; study of the structure of materials by electron microscopy method.

In the third section methods of experimental research of polymer composite coatings with additives of micro- and nano dispersions of industrial wastes are outlined. The results of studies of polymer composite coatings, structure and properties, optimal compositions of the obtained coatings are presented, the standard of organization is developed.

The fourth section presents the results of experimental studies for obtaining glass-crystalline materials (enamels) based on industrial wastes (steelmaking, iron slag and electrostatic precipitator dust).

Section five summarizes the expected cost-effectiveness.

Academic novelty.

1. Standardization of new products - polymer compositions with micro- and nano-additives of industrial wastes, including the study of raw materials and materials with the help of physicochemical methods, optimization of technological and operational indicators of products, study of their structure.

2. New compositions of obtaining polymer composite coatings with improved physical and mechanical properties containing industrial wastes (microsilica and microspheres) have been scientifically substantiated and experimentally confirmed);

3. Improved coating formulations resistant to various chemical aggressive environments have been developed;

4. A normative document - standard of the organization was developed.

5. New compositions of enamels on the basis of cast iron slags possessing anticorrosive properties have been experimentally confirmed.

The main points to be defended:

- new compositions of composite protective coatings, based on epoxy resin and industrial wastes, containing nanodispersions with improved performance indicators;

- new compositions of composite protective coatings, based on epoxy resin and industrial wastes, containing nanodispersions with improved chemical stability;

- normative document - standard of the organization for protective coatings with microsilica additives.

- new compositions of silicate enamel coatings with industrial waste fillers containing nanodispersions.

Practical value.

Practical significance of the obtained results is conditioned by a significant potential market for new products - protective coatings of metal structures, as well as by the solution of ecological problems due to the use of industrial wastes as fillers of composite materials. The proposed protective coatings can be used by agricultural enterprises, industrial facilities of rural settlements (livestock complexes, vegetable storages, granaries, etc.), as well as in other industries for the protection of metal

surfaces. The new materials will be in demand at small and medium-sized enterprises for the production of paint and varnish materials, commodity producers. The results of the thesis work are implemented in the educational process of S. Seifullin Kazakh Agrotechnical University NCJSC, in the training of specialists in the specialty "Standardization, certification and metrology" of higher educational institutions. Scientific-Ecological Organization LLP is interested in commercialization of research results.

Relation of the thesis to other research works. The thesis was carried out under the budget program within the framework of grant financing of projects of young scientists for 2021-2023 of the Ministry of Education and Science of the Republic of Kazakhstan on the topic: AP09058166 "Improving the quality of restoration of agricultural machinery parts by developing compositions of repair composite mixtures based on polymers, mineral substances and nano-additives" and scientific and technical program within the framework of program-targeted financing for 2022-2024 of the Republican State Enterprise "KazStandard" of the Committee for Technical Regulation and Metrology of the Ministry of Trade and Integration of the Republic of Kazakhstan on the topic BR12967699 "Creation of normative base, scientific and technical foundations of effective composite and smart materials using industrial wastes". This fact indicates that the topic of the thesis under consideration corresponds to the priority directions of science development realized in the Republic of Kazakhstan.

Author's personal contribution. The author designed and planned the course of scientific and experimental activities within the framework of the thesis topic, realized the planned objectives and obtained reliable results using standardization methods, high-precision physical and chemical methods and obtained the results of performance indicators using standard test methods. The author independently analyzed the obtained research results and formed reasonable conclusions on the results of each stage and the overall outcome of the thesis. Objectivity, validity, reliability and correctness of the obtained results were repeatedly checked, errors and uncertainties were determined. The author in the course of scientific work studied and analyzed a significant number of theoretical and practical sources necessary for research, conducted the collection of samples of raw materials, research of initial raw materials (chemical and mineralogical analysis, grinding), conducted experimental work on obtaining polymer coatings, enamels, generalization of research results, developed a standard of organization, writing and design of scientific articles.

Approbation of the research results. The main provisions of the thesis were reported and discussed at the International Scientific and Practical Conferences: XVII International Scientific and Practical Conference "Topical Issues of Modern Science» (December 19, 2018, Tomsk city); LI international scientific conference "Relevant scientific studies in the modern world". – Pereyaslav-Khmel'nitskiy, July 26-27, 2019; International scientific conference «Modern scientific challenges and trends» (20th October, 2019, Warsaw); International scientific-theoretical conference "S. Seifullin's readings 15", "Standardization-tool for improving competitiveness and integration of Kazakhstani products into the world economy",

Nur-Sultan city, October 24, 2019; International Scientific Conference “Technical and Natural Sciences” “National development” National research institute (Saint Petersburg, October 27, 2019).

Publications. The main results of the thesis are published in 12 printed works, including 3 works in editions recommended by the Committee on quality assurance in the sphere of science and higher education of the Ministry of Higher Education of the Republic of Kazakhstan, 3 articles in international scientific editions included in Scopus database, 5 articles in international scientific-practical conferences, 1 article in other editions. 1 patent for utility model of the Republic of Kazakhstan was received.

Structure and scope of the thesis. The thesis consists of an introduction, five sections, a conclusion, a list of used sources of 158 titles and 5 appendices. The work is outlined on 107 pages, includes 54 figures and 29 tables.