

ANNOTATION

For PhD dissertation of **Zharylkasyn Perizat Muratovna** on the topic of: «*Development of environmentally sound technology for technical rubber with Tengiz waste oil refining and oil industry*» presented for the degree of Doctor of Philosophy (PhD) in the speciality 6D073100 – «Life Safety and Environmental Protection»

Relevance of the research topic. One of the main complex problems associated with oil production in Kazakhstan is the disposal of hydrogen sulfide and sulfur compounds.

As a result of the extraction and processing of oil and associated gases in the fields, about 20% of sulfur waste is formed, consisting of hydrogen sulfide and sulfur compounds.

As a result of strict environmental requirements to minimize emissions of sulfur and its derivatives into the environment, the situation with sulfur has changed dramatically. Many chemical elements in the Universe have cycles, but the most active of the natural and anthropogenic sources is sulfur. In recent years, anthropogenic sulfur emissions have increased so much that they have exceeded the natural background.

The "storage" technology used by the world's leading oil companies is as follows: purified sulfur solidifies into blocks when cooled and is stored in open-type "sulfur pads". Sulfur storage facilities in the form of large blocks at open deposits are currently located in Canada (7.3 million tons), France (1 million tons), Russia (1.5 million tons), and also in Kazakhstan at the Tengiz field (1.3 million tons). At the same time, the annual production and open storage of sulfur at the Kashagan field in Kazakhstan is expected to be about 4.2 million tons.

Due to the proximity of groundwater in the upper layers of rocks in sulfur storage areas, the method of underground sulfur storage used in Canada and a number of other oil-producing countries turned out to be unacceptable for Kazakhstan.

In this regard, scientific research in Kazakhstan is focused on methods of open storage of sulfur on "sulfur pads".

At the same time, the lack of relevant research and methods for calculating the formulations of rubbers based on polymer sulfur hinders the possibility of using this technology on an industrial scale.

In this regard, it is important to conduct research on obtaining polymeric sulfur by preliminary purification of Tengiz sulfur, which contains many impurities, and accelerated cooling of the sulfur melt in a quenching environment and obtaining tread rubber on its basis.

Correlation with the research and development plan. The topic of the dissertation corresponds to the priority areas of scientific development. The dissertation work was completed at the Department of Life Safety and

Environmental Protection in accordance with the plan of state budget research works of the South Kazakhstan University named after M. Auezov. The work was completed in the direction of B-TF-06-04-01 - "Development of technologies for obtaining target products from substandard raw materials and waste from chemical industries".

The aim and objectives of the research. Reducing the environmental impact of sulfur waste generated at the Tengiz oil field and stored in the open on sulfur pads. Development of a technology for producing a heat-stable vulcanizing composite material from sulfur waste.

In accordance with the stated goal, the following tasks were solved:

- a comprehensive analysis of the environmental impact of toxic components of oil production and refining waste during man-made impact on the environment (pollution of the air basin, water and soil);
- a sanitary and hygienic analysis of the storage condition of sulfur waste stored in open areas, called the "sulfur pad";
- an experimental study of the possibility of using Tengiz sulfur in rubber mixtures;
- an experimental study of the technological and physical-mechanical properties of technical rubber - a composite material containing Tengiz sulfur.

Research Objects.

The object of the study is the technology of using waste from oil production and processing industries, lump sulfur as a vulcanizing agent in the production of technical rubbers.

The subject of the study is the polymerization patterns of lump sulfur, the physico-chemical properties of the vulcanizing agent and the physico-mechanical properties of technical tread rubber.

The methodological basis of the research is physicommechanical studies of the wear resistance of technical rubbers and effective formulations of vulcanizates based on polymer sulfur.

Scientific novelty of the research:

The scientific novelty of the work is as follows: based on theoretical and experimental studies of the patterns of transformation of sulfur and hydrogen sulfide waste into polymer sulfur, a scientifically substantiated method for calculating the formulation of a vulcanizing agent for a heat-stable composite material has been developed. In this case:

- the environmental impacts of sulfur waste and its toxic components generated during oil production and refining have been determined, based on sanitary and hygienic storage conditions on open maps, as well as the possibility of eliminating the technogenic and environmental load, based on the need to process them into a polymer state;
- a new effective composition (rational formulation) of a rubber mixture has been developed using oil production and refining waste - sulfur in the production of technical rubbers;

- based on the effective formulation determined by experimental studies, the patterns of the effect of sulfur amount on the physical and mechanical properties of tread rubber have been established;

- taking into account the dependence of sulfur amount on the quality of composite materials, the indicators of vulcanization time and rubber properties of a heat-resistant polymer sulfur composite material have been determined;

- it has been established that the compositions of the proposed filler cords preserve a long service life of the outer rubber of vehicle wheels.

Practical significance of the work

A "Rubber mixture for a filling cord" protected by the patent of the Republic of Kazakhstan No. 2980 has been created.

A method has been developed to reduce the anthropogenic load on the environment from storing waste from oil production and oil refining. Comprehensive technological tests of the rubber mixture have been conducted and the practical possibility of using sulfur in the production of tire rubber has been determined.

Applied recommendations for the rational choice of the composition of the composite material - rubber have been given, and design and disciplinary indicators of the new technology, which can be used in the production of tire rubber, have been established.

The research results, calculation methods, practical recommendations for the rational choice of rubber formulations can be used by teachers of educational institutions, engineering and technical and scientific workers of production, design organizations, research institutes.

The results of the dissertation work have been introduced into the educational process of M. Auezov South Caucasian University in the discipline «Waste of Kazakhstan and issues of their processing» and «Safety of technological processes and productions in the oil and gas complex».

Based on the results of the conducted research, a technology was developed for obtaining a rubber mixture used in the production of rubber products from sulfur waste from oil refining plants and approved by production test certificates at JSC Elastopolimet.

The following are the main points defended in this dissertation:

- results of studies to determine the technogenic impact on the environment of sulfur waste and its toxic components formed during oil production and processing, their utilization by polymerization;

- dependencies of calculating a new rational formulation of a rubber mixture using sulfur in the production of technical rubbers;

- patterns of sulfur influence on the physical and mechanical properties of rubber obtained on the basis of an effective formulation established by research work;

- indicators of the influence of polymer sulfur on the vulcanization time and properties of rubber of heat-resistant composite material.

The doctoral candidate's personal contribution lies in directly participating in summarizing and analyzing literary and patent materials related to the dissertation topic, choosing analysis methods, conducting theoretical and experimental research, and field tests. The main results and hypotheses of the dissertation were presented and discussed at the following international and national scientific conferences: M.Auezov South Kazakhstan University. International scientific and practical conference "One Hundred Concrete Steps. A Modern State for All" - a strategic path of industrial and innovative development of the country (Shymkent, 2015); "European research: innovation in science, education and technology" XV International scientific and practical conference. European research (London. United Kingdom, 2016); Izvestia National Academy of Sciences of the Republic of Kazakhstan. Series "chemistry and technology" (Almaty, 2016); News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technical sciences (Almaty, 2016); News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technical sciences (Almaty, 2017); International Journal of Engineering Research and Technology (India, 2020); Ecological Engineering & Environmental Technology (Poland, 2021); Republican scientific journal "Bulletin of General Science and education "(Astana, 2022); Republican scientific journal "Bulletin of General Science and education " (Astana, 2023).

During a scientific internship at the Saint Petersburg State Technological Institute (Technical University), the work was carried out at the Department of Environmental Engineering and received a positive assessment.

Publications on the Research Topic. The obtained scientific results of the dissertation work resulted in 9 scientific publications, including: 1 articles in publications included in the list recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Education and Science of the Republic of Kazakhstan. 4 article in journals included in the international Scopus database. 4 articles in international and national conferences and collections of foreign conferences.

Structure and Volume of the Dissertation

The dissertation consists of 116 pages and includes 15 figures, 35 tables. The list of references used includes 112 entries. The content of the dissertation consists of: introduction, literature review, materials and methods of research, research results, their discussion and a conclusion.