

Brief information about the project AP26101951 (Nechipurenko S.V.)

Name of the project	AP26101951 Study of the mechanisms of new functional technological additives from renewable plant raw materials impact on the characteristics of rubber-metal molded products.
Relevance	Nowadays, biocomposites are applied to a large extent in industries such as the automotive, construction, and rubber industries. Biocomposites are environmentally friendly materials in which the polymer matrix is reinforced with natural fibres. The reasons for rapid growth are low cost, biodegradability, environmental friendliness, low density, non-abrasive nature, and wide variety of fibre types. The application of natural fibres in the formulation of elastomer compositions makes the resulting vulcanizates competitive both in terms of properties and in terms of the environment.
Purpose	The goal of the project is to develop new FTA through the thermochemical transformation of sunflower husks and the influence of FTA on the interaction with the rubber matrix and ingredients of elastomer compositions intended for the manufacture of rubber-metal molded products that dampen or isolate radial, axial, torsional and cardan vibrations.
Objectives	– determining optimal temperature-time parameters of heat treatment of sunflower husks for obtaining new FTA for elastomer composites; – studying morphological, structural and physicochemical characteristics of new functional technological additives obtained at different temperature-time parameters of heat treatment of sunflower husks; – studying interphase and interaggregate mechanisms of interaction of new FTA obtained at different temperature-time parameters of heat treatment of sunflower husks, in the volume of elastomer matrices based on rubbers for various purposes; – determining dependencies of changes in rheological, kinetic, physicomachanical, structural and operational characteristics of rubbers for rubber products on temperature-time parameters of obtaining new FTA from sunflower husks; – modelling the properties of experimental rubbers using tensile tests. – approbation of research results taking into account determined patterns and test models with specified rheological properties in production conditions.
Expected and achieved results	Expected results: 1. Functional processing aids will be developed through the thermochemical transformation of sunflower husks during heat treatment under various temperature-time conditions for use in elastomer composites. 2. The characteristics and dependencies of changes in the morphological, physicochemical, and structural surface characteristics of new functional processing aids obtained

	under various temperature-time conditions will be established. 3. The influence of new functional processing aids obtained under various temperature-time conditions on interfacial interactions (the amount of bound rubber) in the rubber-filler system will be studied to determine the reinforcing capacity of the obtained additives. 4. The mechanisms of interaggregate interactions (Payne effect) of new functional processing aids obtained under various temperature-time conditions in the filler-filler system will be established to subsequently improve the dispersion of components in the rubber matrix. 5. The properties of experimental rubbers will be modeled using tensile tests. 6. Rubber compound formulations will be developed for the manufacture of rubber-metal products containing new functional processing additives with various temperature-time production parameters. Their key technological (rheology, vulcanization kinetics), physical and mechanical (strength properties, abrasion, Shore A hardness), and performance (resistance to various aggressive environments) characteristics will be determined in order to determine the optimal manufacturing conditions for the new functional processing additive for rubbers, which imparts a number of specific properties to elastomeric composites. 7. Formulations for rubber products with the new functional processing additive, obtained under specific temperature-time conditions, will be developed for further testing under industrial conditions. 8. Based on the experimental data obtained, recommendations will be developed for the implementation of the developed rubber product manufacturing technologies in the mechanical engineering industry. Results achieved: 1. Based on a comprehensive study of patent and scientific-technical literature from Kazakhstan, neighboring and non-CIS countries, and patent literature, a technology for producing new functional processing aids based on renewable plant materials for elastomeric composites for various purposes was developed. 2. Functional processing aids were developed through the thermochemical transformation of sunflower husks during heat treatment under various temperature-time conditions for use in elastomeric composites. 3. Based on a study of the morphological, physicochemical, and structural characteristics of the surface of the new functional processing aids, optimal parameters for the successful implementation of the new technology for producing additives based on renewable plant materials were determined.
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	4. Formulations for rubber compounds for various purposes are being developed, containing new functional processing aids with various temperature-time parameters for production. This will allow us to determine the mechanism of interaction between the additives and the rubber matrix and the ingredients included in the compound. 5. Modeling of the properties of experimental rubbers is carried out using tensile tests.
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Usage	Rubber engineering
Priority compared to real-world alternatives	The project demonstrates the potential of using functional technological additives in rubber formulations
List of publications with links to them	-
Patents	-