

Brief information about the project

Name of the project	AP26194161 «Development of methods of directed chemical modification of lignite humic acids in order to increase antioxidant and biological activity and expand the areas of application».
Relevance	Currently, humic acids are recognized as one of the promising areas of "green" chemistry as an accessible and cheap source of raw materials for obtaining chemically important products. The use of natural and modified humic substances such as surfactants, polymers with regulated redox properties (redox polymers), the bases for obtaining new medical drugs, plant protection agents, new sorbents, preparations as plant growth stimulators, preparations for the reclamation of areas contaminated with radionuclides, petroleum products, etc. is considered promising. The search for new raw material resources of biologically active substances of natural origin and development of new preparations of humic series on their basis is an urgent task. Besides, it is also important for technical purposes in terms of development of antioxidants for liquid fuels, technical oils and lubricants, as well as for food products.
Purpose	The purpose of this project is to develop scientific and technical solutions for obtaining and using humic products with high antioxidant, biological and ecological and economic efficiency from native and modified forms of Kazakhstan coals.
Objectives	To develop methods for ultrasonic coal treatment and select optimal conditions. To determine the elemental composition, functional group content, and structural characteristics of the raw and sonicated coals using FTIR, NMR, and EPR spectroscopy. To perform the extraction of humic acids from raw and sonicated coals. To develop methods for the chemical modification of humic acids. To determine the technical characteristics, elemental composition, functional group content, and structural components of the initial and modified humic acids. To evaluate the antioxidant and biological activities of chemically modified brown coal humic acids obtained from native and sonicated coal forms.
Expected and achieved results	Methods for ultrasonic treatment of coal will be developed, and their optimal conditions will be selected. Elemental composition, content of functional groups and structural characteristics of initial and voiced coals will be determined by IRS, NMR and EPR methods. Extraction of humic acids from the initial and voiced coals will be carried out. The biological activity of humic acids in the form of sodium humates obtained from native and voiced coals will be determined. Methods for the targeted chemical modification of humic acids will be

	developed. The technical characteristics, elemental composition, functional group content, and structural components of the initial and modified humic acids will be determined. The antioxidant and biological activities of chemically modified humic acids obtained from native and sonicated forms of coal will be evaluated.
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Usage	The target consumers of the obtained results are enterprises of the chemical, agricultural, pharmaceutical and medical industries.
Priority compared to real-world alternatives	Technological priority: Intensification (Ultrasound). Scientific priority: Directional modification. Environmental priority: "Green chemistry". Economic priority: Import substitution and raw material base. Analytical priority: Depth of research
List of publications with links to them	Kairbekov Zh., Esenalieva M.Z., Suimbaeva S.M., Dzheldybaeva I.M., Kairbekov A.A. Study of the physical and chemical properties, antioxidant and biological activity of humic acids of coal from Kazakhstan deposits of the republic of Kazakhstan // The 6 th International scientific and practical conference "Modern Pharmaceutics: Actual problems and prospects" Tashkent, October 17, 2025, P. 509-510.
Patents	-