

ANNOTATION

**on the dissertation of Ibzhanova Ainur Alimbayevna on the topic:
«Development of scientific and technical foundations of the production
technology of biodegradable packaging and standardization of new products
in accordance with TR CU 005/2011» for the degree of Doctor of philosophy
PhD in specialty 6D073200 – «Standardization and Certification»**

Relevance of the work

Today, the problem of environmental pollution from household waste is one of the most pressing. Wherever you look, we see plastic and polyethylene bags scattered. In nature, there is a process called the biological cycle. That is, as a result of microorganisms, all residual substances rot. They then decompose and turn into soil. According to scientists, plastic bags used for just 20 minutes do not decompose underground for up to 1000 years, so these bags harm the environment and release toxic compounds into the air during a fire, leaving heavy metals in the ash. Heavy metals remain in its ash. The cause of cancer is considered to be heavy metals entering the grass, from grass to animals, from animals to the human body.

Today, more than 40 countries around the world ban the production and use of plastic bags. To prevent the above disadvantages, it is advisable to use disposable paper packaging made from rapidly decomposing raw materials (agricultural waste, wood waste, etc.). For this purpose, in many countries, waste from various types of plants, such as wood and various plant leaves, wood chips, wheat and rice straw, has been widely used for making paper.

According to analytical reviews, the world produces over 400 million tons of paper and cardboard per year, of which packaging materials and packaging make up 57% of cardboard and paper products, 25% of printed paper and 8% of tissue paper. The most intensive growth in the production and consumption of paper, cardboard, and cellulose composite materials is observed primarily in China, India, South America, Eastern Europe, and also in Russia. In Japan, packaging consumption per capita is \$550, in North America and Canada - \$350-400, in Eastern Europe - \$130, in Turkey - \$120. Kazakhstan's accession to the Customs Union and the WTO is a positive tool in the development of the packaging paper economy and the promotion of domestic goods in the domestic and foreign markets.

Pulp and paper manufacturing is the most advanced demand-side manufacturing industry in the world and plays an important role in the social, economic and environmental development of any country. Total global paper consumption is projected to increase by up to 25% annually. When analyzing the market for pulp and paper products, the most common types over the past 10-15 years are printing paper and the use of pulp-composite materials as packaging.

Mineral-based packaging materials containing agricultural waste are currently in greatest demand. Scientific research and practical work in this area are very relevant. The use of new technologies proposed based on the study of physical and chemical properties reduces the labor intensity and cost of packaging materials. In

accordance with the Concept for the development of the agro-industrial complex of the Republic of Kazakhstan for 2021-2030, the use of new materials will improve the quality of the materials used and reduce costs.

The main problems of the Kazakhstan packaging industry:

- ineffective and insufficient use of the local raw material base;
- lack of highly qualified specialists;
- insufficient government support.

In the pulp and paper industry of Kazakhstan, 90% of the main raw material is waste paper. There are no trees in Kazakhstan; the forest area is only 3.8% of the total area. For the production of cardboard and paper packaging, materials of sufficient strength must be used to ensure the safety of the packaged products. The strength properties of cardboard and paper depend, foremost, on the semifinished products intended for their production. The main semifinished products are cellulose, wood pulp and waste paper. Cellulose is a major component in the production of paper and cardboard. Therefore, new cellulose materials obtained from agricultural wastes solve the problems of cellulose deficiency in most cases. Currently, an urgent problem is to obtain paper packaging with low environmental risk by extracting cellulose from a non-wood source of raw materials.

The purpose of the study is to develop regulatory and technical documentation for biodegradable paper packaging based on studying the properties of new materials made from wheat and rice straw in accordance with the requirements of TR CU 005/2011.

Research objectives:

- formation of a raw material base and research methods by analyzing the current state and future of packaging and composite compounds;
- conduct a study of the characteristics of raw materials for the manufacture of paper packaging;
- study of technological indicators of the composition;
- study of the performance properties of the composition;
- development of modes and compositions for preparing suspensions for the production of packaging from wheat and rice straw;
- development of regulatory and technical documentation.

Object of the study: paper for biodegradable packaging made from agro-industrial waste, in particular based on wheat and rice straw, with the addition of unenriched wollastonite and cardboard.

Subject of the study. Quality indicators of new material from agricultural waste, in particular wheat and rice straw with the addition of wollastonite and cardboard.

Research methods. Experimental studies were carried out in accordance with standardized methods using modern research equipment and measuring instruments: electron microscopy, X-ray phase analysis, X-ray fluorescence analysis, infrared spectroscopy, study of the mechanical properties of paper castings, and the

thermogravimetric method. The study of the biological decomposition of paper using non-standard methods was carried out in laboratory conditions. Processing of the research results was carried out using modern computing tools and the Excel 2010 program, using methods of probability theory and mathematical statistics. The reliability of the main provisions of the work is confirmed by the convergence of theoretical and experimental research, the use of high-tech equipment, and modern software systems in research.

Scientific results within the framework of the requirements for the dissertation:

The introduction sets out the purpose and objectives of the study, substantiates the relevance of the study, and outlines the main provisions for scientific novelty and protection.

The first section examines the analysis of scientific and practical material in the field of examination and testing of packaging, as well as the current state and prospects for the development of packaging. An analysis of regulatory and technical documents was carried out.

The second section describes materials, equipment, research methods, regulatory documents for their conduct, as well as methods for manufacturing the materials and samples used, the results of chemical and morphological processes of raw materials and the technology for producing cellulose from rice and wheat straw.

The third section presents methods for structural analysis of paper samples and the results of studying phase transformations, and also studies the technological and operational properties of the resulting paper.

The fourth section provides information on standardizing the parameters of raw materials for the production of biodegradable packaging based on agricultural waste, presents optimal modes and compositions, and provides recommendations for the development of regulatory and technical documentation for paper packaging.

The fifth section calculates the economic and environmental effects expected from the production of environmental paper packaging.

Scientific novelty:

Standardization of new materials, e.g. study of materials and raw materials of biodegradable paper from wheat and rice straw and unenriched wollastonite using chemical and physical-mechanical methods, optimization of suspension quality indicators, optimal suspension structure and modes for obtaining technological indicators and optimal performance indicators. For the first time in the Republic of Kazakhstan, paper for packaging a new material with biodegradable properties, made on the basis of straw with a mineral additive that ensures strength, was produced. A normative document has been developed - an organization standard.

The fundamental tenets put to the defense:

- composition of environmentally friendly biodegradable composites for the production of packaging paper;
- results of chemical studies of degradable paper for straw-based packaging;

- results of physical and mechanical studies of degradable paper for straw-based packaging;
- regulatory and technical documentation for new products.

Practical significance of the work:

- a composition of environmentally friendly biodegradable paper for packaging was obtained;
- a technological process for the production of packaging paper from straw has been developed;
- standardization of new materials based on wheat and rice straw was carried out.

Based on the results of the dissertation at the National Center for State Scientific and Technical Expertise, as a result of submitting a report on the initiative topic based on the results of scientific and scientific-technical activities, the state registration number RNTD22RKI007 was assigned on the topic “Multifunctional material from wheat straw.” A patent “Method for producing cellulose from wheat straw” was obtained, which is an important stage in preparation for commercialization. The dissertation presents a raw material base that can significantly reduce material costs in the production of packaging.

The connection of the work with other research works. The dissertation was carried out within the framework of budget program 226 “Stimulating productive innovations” under project No. AAR-PHD-A-18/020P “Development of scientific and technical foundations of the technology of biodegradable packaging materials for food products in accordance with TR CU 005/2011” funded by the Ministry of Education and Science of the Republic of Kazakhstan and the World Bank for Reconstruction and Development; within the framework of program-targeted financing for 2022-2024, scientific and technical program BR12967830 “Development of technical regulation tools in order to increase the efficiency, safety, resource saving of food production and environmental packaging”; As a result of submitting a report on the initiative topic to the National Center for State Scientific and Technical Expertise, work was carried out on the topic: “Multifunctional material from wheat straw” with the assignment of the state registration number RNTD22RKI007, based on the results of scientific and scientific-technical activities.

Personal contribution of the author. The author designed and planned the course of scientific and experimental activities within the framework of the dissertation topic, implemented the intended tasks and obtained reliable results using standardization methods, high-precision physico-chemical methods and obtained the results of operational indicators using standard test methods. The author independently analyzed the obtained research results and formed reasonable conclusions based on the results of each stage and the overall result of the dissertation. The objectivity, reliability, reliability and correctness of the obtained results have been repeatedly verified, errors and uncertainties have been determined. In the course of scientific work, the author studied and analyzed a significant number

of theoretical and practical sources necessary for conducting research, collected samples of raw materials, studied raw materials (chemical and mineralogical analysis, grinding), conducted experimental work on obtaining polymer coatings, enamels, generalization of research results, developed a standard organization, writing and registration of scientific articles.

Approbation of work results. The main provisions of the work were reported and discussed at international scientific and practical conferences: Collection of materials of the IScPC dedicated to the 100th anniversary of the Federal State Budgetary Educational Institution of Higher Education Omsk State Agrarian University «Scientific and technical support of the agro-industrial complex, state and development prospects», Omsk, 2018 April 19, 2018; VIII International Scientific and Practical Conference: «Current problems of transport and energy: ways to solve them innovatively» (March 20, 2020, Nur-Sultan); Materially XVP IScPC, «Dynamika naukowych badan – 2021», Volume 6 Przemysl: Nauka i studia, - Prague, July 07-15, 2021; International scientific and theoretical conference «Seifullin Readings – 17: Modern Agrarian Science: Digital Transformation», dedicated to the 30th anniversary of independence of the Republic of Kazakhstan (April 24, 2021, Nur-Sultan); International scientific and practical conference «Seifullin readings – 18(2): Science of the 21st century - the era of transformation» (October 6, 2022, Astana); International scientific and practical conference «Seifullin Readings-19, dedicated to the 110th anniversary of M. A. Gendelman» (March 17, 2023, Astana).

Publications. The main provisions of the dissertation were published in 17 printed works, including 1 article in journals included in the Scopus database, 3 articles in publications recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Education and Science of the Republic of Kazakhstan, 1 patent for a utility model, a positive decision 1 application for the PCT International Patent, 1 recommendation, 6 articles in the MRPC, 6 works in the MRPC of the Republic of Kazakhstan.

The structure and scope of work. The text of the dissertation is printed on a computer in A4 format on 189 pages and contains 16 tables, 52 figures, an introduction, a literature review, five sections, a conclusion, appendices, and 303 literary sources.