Name of the project, IRN	**AP14972645** Creation of composite materials based on mixtures of poly(2-ethyl-2-polyoxazolines) with the addition of nanofillers,
Terms of implementation	01.09.2022-31.12.2024
Project manager	Akhmetova Marzhan Kushkinbayevna, Master's degree, lecturer of the Department of Physics
Report	The most effective way to reduce polymer waste is the development of biodegradable polymers, i.e. polymers that retain operational characteristics only during the consumption period, and then undergo physico-chemical and biological transformations under the influence of environmental factors (light, temperature, moisture, water) and are easily incorporated into the metabolic processes of natural biosystems (bacteria, yeast, mushrooms, algae). In this case, high-molecular substances decompose into low-molecular (water and carbon dioxide), humic substances and biomass. In this way, a natural cycle of substances is carried out, capable of maintaining ecological balance in nature. Currently, the demand for composite polymers has sharply increased due to their biodegradation ability and the complex of properties inherent only to them. Polyoxazolines, which have a wide range of biological activity, have found wide application in a number of industrial fields. Their use formed the basis for the creation of water treatment technology, processing of various types of man-made waste, etc. A promising direction is the development of biodegradable composite packaging materials based on Poly(2-ethyl-2-oxazoline). The disadvantage of the polymer polyoxazoline is the high cost, it is also important to note that the high price of the material is a temporary phenomenon until the production of biopolymers has become widespread and the process of their release is not fully debugged. Over time, the cost of bioplastics will decrease, and they will become available to a wide range of enterprises. Due to the annual increase in polymer-household waste, only part of which is recycled, and mostly they accumulate in landfills, the question of the use of biodegradable composite materials in many industries and the development of green technologies is acute. Therefore, one of the urgent problems is the development of technology and the creation of decomposable composite materials based on hydrophilic polymers with improved physicochemical properties. The resulting composites, depending on the filler, can be used both for mulching soils, for thermally protective coatings, biodegradable packages, and for obtaining antibacterial films, etc. Polymer-based solid particle systems have found wide application in various fields of research, as well as in everyday life, including paints, photovoltaics, catalysis, drug delivery and geranostics. Depending on the intended application, it can be precisely designed by adjusting parameters such as size, surface chemistry, shape and type of polymer, chemical composition and their physico-chemical properties. Size has been one of the main parameters studied in recent decades, and a large number of manufacturing methods have been developed to manipulate particle diameters ranging from nanometers to micrometers. Along with the size, the type of polymer used, as well as the surface morphology and chemical

	composition of the manufactured particles mainly determine the characteristics of the composite material. To date, numerous classes of biodegradable and biocompatible polymers are used to give particle systems the desired properties. The main idea of the project is to create new polymer nanocomposites with improved physicochemical, mechanical properties and increased biodegradability. As well as the accumulation of deep fundamental knowledge in the field of the influence of nature, the morphology of filler nanoparticles, and the mechanisms of composite structure formation
Goal	The aim of the project is to develop scientific and technological bases for modifying polymer nanocomposites with improved physicochemical (thermal, electrical, optical properties and decomposability) and mechanical properties
Expected results	The effect of the additive and the percentage of reinforcing additives on the tensile strength of composites, bending, compression, decomposability and heat resistance will be investigated. The developed approaches to improve the physical and mechanical properties and decomposability can be used in conjunction with modern methods and methods for improving the physical and mechanical properties of composite materials, which may be in demand in various industries (in everyday life, for milling in agriculture, in the field of medicine, etc.) Fundamental knowledge will be accumulated in the field of the influence of nature, the morphology of the surface of nanofillers particles, the processes of chemical interaction between the components of the polymer matrix on the processes of structure formation, structure, physico-chemical, thermal and optical properties of polymer nanocomposites
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