Brief information about the project

Name of the project	AP19679683 «Development of technology for production of hydrogels based on modified polysaccharides with protective-stimulating compositions for seed coating»
Relevance	Humanity is currently facing environmental issues due to the lack of water in arid areas and the increase in the consumption of synthetic products. More than half of the planet's land is in arid regions, and the lack of water has a negative impact on agriculture in countries in these regions. In order to solve these problems, there are increasing interest in ways of covering and coating the seeds sown in the field. Seed coating is the process of applying specially studied exogenous materials to the natural seed surface. This practice is used to modify the physical properties of the seed and deliver the active ingredients. Physical seed modification aims to improve seed handling by standardizing seed mass and size. In some cases, changing seed morphology is not important when the goal is to reduce friction and improve flowability, but for small (e.g. plants like begonia or tobacco), expensive, or irregularly shaped seeds, thick coating is often used. Artificial coating is widely used as a carrier for various active ingredients. The usage of environmentally friendly plant protection agents and growth stimulants in agricultural production is becoming more and more relevant today. One of the most effective methods of protecting plants is the method of inducing their resistance to adverse external conditions and diseases. In this context, chitosan (X), starch (Kr) and its derivatives, which belong to the group of natural polysaccharides, are a particularly promising group as biogenic stimulators. In agriculture, they are used as a natural seed treatment and plant growth accelerator, and as an environmentally friendly biopesticide that increases the protective properties of plants against fungal infections. Since rapeseed and sugar beet are small-seeded crops, they cause significant difficulties during sowing. Therefore, it is promising to cover seeds with polymer hydrogels that retain a certain amount of water in order to protect plant growth, especially before the appearance of its leaves, from various “stress conditions” such as undecomposed plant residues in the soil, moisture stagnation, drought and other negative conditions.
Purpose	*The projrct goal* is development of technology for obtaining biodegradable hydrogels with protective-stimulating components based on modified polysaccharides to cover sugar beet, tomato and rape in technical and vegetable crops.
Objectives	Radiation irradiation of starch to obtain polymer hydrogel using electron accelerator ELV 4; production of polymer hydrogels with protective-stimulating components based on derivatives of modified starch and chitosan, polyvinyl alcohol, acrylic monomers; study of their physico-chemical and physico-mechanical properties with modern methods; in laboratory conditions, various factors, i.e. degree of hydrogel swelling, thickness of seed layer covered with polymer composite, etc. to study the influence of seed microflora suppression, seed quality, seed germination, ease of sowing, viability and productivity of

	seedlings, and to create optimal favorable conditions for seed coating technology; conducting field tests for pelleted seeds in the experimental fields of Almaty region, evaluating the growth trend; Obtaining the act of introduction and patent of the technology developed for the granulation seeds coated with hydrogels with protective-stimulating components.
Expected and achieved results	1. The optimal starch processing conditions on an electronic accelerator will be determined; *Achieved results:* *In the presented work, potato starch was taken as the object of research, and the modification of the polysaccharide was carried out at the ELV-4 (or ULU-10) installation at the Institute of Nuclear Physics located in the Almaty region. To modify starch, it was subjected to radiation treatment in the range of 10-70 kg. As a result of the research, it was found that starch irradiated at a dose of 70 kg has a higher solubility in distilled water.* 2. On the basis of modified starch and hydrophilic polymers, hydrogels of a mesh structure will be obtained and the patterns of their formation will be investigated. *Results achieved:* *In the work, polymers of a mesh structure, i.e. hydrogels, based on modified starch (MCr) and: carboxymethylcellulose (CMC); chitosan; acrylamide (AA); acrylic acid (AK) were obtained. The patterns of hydrogel formation have been studied with varying initial polymer ratios, polymer concentration, and crosslinking agent concentration; sol-gel analysis of synthesized crosslinking samples has been performed.* 3. The physico-chemical and physico-mechanical properties of the obtained hydrogels will be characterized. 4. Optimal technologies for grazing various seeds will be developed to obtain optimal coatings with protective and growth-stimulating properties. 5. Seed growth in laboratory and field conditions will be studied.
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	1. **Rakhmetullaeva Raikhan Kulymbetovna** Hirsch Index h=4 Scopus ID: 55903710100 ORCID: 0000-0003-1002-2046 Researcher ID: ABB-8540-2020 2**. Irmukhametova Galiya Serikbaevna** Hirsch Index h=7 Scopus ID: 22979722000 ORCID: 0000-0002-1264-7974 3. **Urkimbayeva Perizat Ibragimovna** Hirsch Index h=3 Scopus ID: 6508358809 ORCID: 0000-0001-7775-0238 4. **Toktabayeva Asel Kyrgyzbayevna** Hirsch Index h=2 Scopus ID: 57195074504 ORCID: 0000-0002-1313-8696

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List of publications with links to them	
Patents	

Rakhmatullayeva Raykhan Kalymbetova

Urkimbayeva Perizat Ibragimovna

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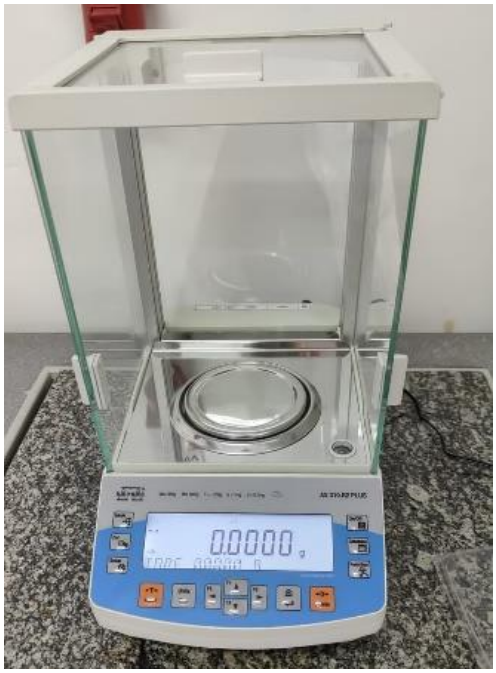
Kenesova Zarina Anvarovna



Laboratory analytical scales AS 310.R2 RADWAG

Melting Point Meter M5000

Discussion of the device operation

Business trip and conference in Astana

Rakhmetullayeva R.K. during the international symposium "Green Energy Materials Science" (Astana)

Havilkhairat Botagoz during a business trip to Nazarbayev University (Astana)